

Public Works and Government Services Canada

Requisition Number: EZ899-201012/A

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SPECIFICATIONS for:

SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE ELEVATOR REPLACEMENT

Project No: R.099799.001

ISSUED FOR TENDER

March 29, 2019

APPROVED BY:



Regional Manager, AES

2018-05-28.
Date



Construction Safety Coordinator

2019-05-22
Date

TENDER:



Project Manager

2019-07-24
Date

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CONSULTANTS – SEAL & SIGNATURE

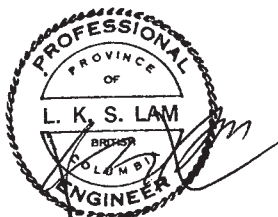
Discipline

Seal/Signature/Date

Architectural
Chernoff Thompson Architects



Structural
CWMM Consulting Engineers Ltd.



2019-03-27

Mechanical
Falcon Engineering



2019-03-27

Electrical
Falcon Engineering



2019-03-27

SUMMARY OF WORK

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 General Instructions Section 01 11 55

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this contract comprises of the replacement of one (1) service and one (1) passenger elevator at Summerland Research and Development Centre at 4200 97 Highway, South Summerland B.C. Work is comprised of tasks listed in Section 01 11 55 item 1.2.

1.3 CONTRACT METHOD

- .1 Construct work under lump sum contract.

1.4 WORK BY OTHERS

- .1 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.

1.5 WORK PLAN

- .1 Construct work to accommodate continued use of premises in immediate surrounding areas. Contractor to ensure at least one elevator must be operation during the full duration of the construction period.
- .2 Do not close off usage of facilities such as roadways, walkways and building access unless alternate usage has been provided with prior approval by Departmental Representative

1.6 CONTRACTOR USE OF PREMISES

- .1 Co-ordinate use of premises under direction of Departmental Representative.
- .2 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .3 At completion of operations the condition of existing work which is specified to remain must be equal to or better than that which existed before new work started.
- .4 Obtain and pay for use of additional storage or work areas needed for work under this contract.
- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

1.7 OWNER OCCUPANCY

- .1 During the entire construction period, the owner will occupy the entire building for normal operations.
- .2 Co-operate with Departmental Representative in scheduling operations to minimize conflict and to facilitate Owner usage of adjacent areas. In the event of a conflict the contractor will accommodate changes to their operations to minimize interference with owner operations.

1.8 EXISTING SERVICES

- .1 Notify Departmental Representative of intended interruption of building 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 2 weeks prior to the event. The contractor will not proceed until approval has been granted. Departmental

SUMMARY OF WORK

- Representative will make all reasonable efforts to accommodate the request; however PSPC will not accept delay charges should the request not be accepted.
- .2 Minimize duration of interruptions, and where required, provide temporary services to maintain critical systems.
 - .3 Establish location and extent of service lines in area of work before starting work. Notify Departmental Representative of findings.
 - .4 Submit schedule to and obtain approval from Departmental Representative for any shut- down or closure of all active building services, Adhere to approved schedule and provide notice to affected parties.
 - .5 Provide temporary services, when directed by Departmental Representative to maintain critical systems.
 - .6 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
 - .7 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by authorities having jurisdiction.
 - .8 Record locations of maintained, re-routed and abandoned service lines.
 - .9 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

END OF SECTION 01 11 00

GENERAL INSTRUCTIONS

1.0 GENERAL

1.1 CODES

- .1 Perform work in accordance with National Building Code for Canada 2015, Workers' Compensation Board of BC, B.C. Building Code 2018 and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Meet or exceed requirements of specified standards, codes and referenced documents.

1.2 DESCRIPTION OF WORK

- .1 Work under this Contract comprises, but is not limited to, the provision of all labour, materials, services and equipment necessary for the replacement of one (1) service elevator and one (1) passenger elevator of Summerland Research and Development Centre, Summerland, BC, as fully described in the Tender Documents. Work will be done in 2 phases.

1.3 CONTRACT DOCUMENTS

- .1 The Contract documents, drawings and specifications are intended to complement each other.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.4 TIME OF COMPLETION

- .1 Commence work immediately upon official notification of acceptance of offer and complete the project within forty-five (45) weeks after contract award. Work will be carried out in 2 phases:
 - .1 Replacement of Service Elevator: 25 weeks
 - .2 Replacement of Passenger Elevator: 20 weeks

1.5 HOURS OF WORK

- .1 All work which generates excessive noise and vibration, including cutting and coring, removal of Masonry wall shall be executed outside of the normal operating hours, except Saturday and Sunday.
- .2 All other work, except for that noted in Clause 1.5.1 shall be executed during the normal operating hours:
Monday through Friday – 07:00 to 17:00 hours.
- .3 All work conducted during or outside of normal operating hours will be subject to restrictions outlined in sections 01 14 00 and 01 51 00, including security arrangements.

1.6 WORK SCHEDULE

- .1 Carry out work as follows:
 - .1 Within 10 working days after Contract award, provide a "phasing bar chart" and a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
 - .1 Submission of shop drawings, product data, MSDS sheets and samples.
 - .2 Commencement and completion of work of each section of the specifications or trades for each phase as outlined.

GENERAL INSTRUCTIONS

- .3 Final completion date within the time period required by the Contract documents.
- .2 Do not change approved Schedule without notifying Departmental Representative.
- .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

1.7 COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the Contract price in detail as directed by the Departmental Representative and aggregating Contract price. After approval, the cost breakdown will form the basis of progress payments.
- .2 General Contractor, Mechanical and Electrical Sub-Contractor should attend meetings with Departmental Representative as required to finalize the breakdown.

1.8 CODE, BYLAWS, STANDARDS

- .1 Perform work in accordance with the National Building Code of Canada (NBC) 2015, and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

1.9 DOCUMENTS REQUIRED

- .1 Maintain one copy each of the following at the job site:
 - .1 Contract drawings.
 - .2 Contract specifications.
 - .3 Addenda to Contract documents.
 - .4 Copy of work schedule.
 - .5 Reviewed shop drawings.
 - .6 Change orders.
 - .7 Other modifications to Contract.
 - .8 Field test reports.
 - .9 Reviewed samples.
 - .10 Manufacturer's installation and application instructions.
 - .11 One set of record drawings and specifications for "as-built" purposes.
 - .12 National Building Code of Canada 2015.
 - .13 Current construction standards of workmanship listed in technical Sections.
 - .14 Building Safety Plan.

1.10 REGULATORY REQUIREMENTS

- .1 Building Permit
 - .1 Contractor to pay and apply for building permit and obtain building permit from District of Summerland. Departmental Representative will provide all required signed sealed drawings and letter of Assurance from the Engineers.
 - .2 Other permit such as occupancy permit, certificates or licenses required by District of Summerland and/or Provincial Authority to complete work will be the responsibility of the contractor.

GENERAL INSTRUCTIONS

- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the specification.

1.11 CONTRACTOR'S USE OF SITE

- .1 Use of site:
 - .1 Exclusive and complete for execution of work.
 - .2 Assume responsibility for assigned premises for performance of this work.
 - .3 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
 - .4 Coordinate with Departmental Representative for use of storage or work areas needed for operations under this Contract.
- .2 Perform work in accordance with Contract documents. Ensure work is carried out in accordance with approved schedules.
- .3 Do not unreasonably encumber site with material or equipment.

1.12 EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work.

1.13 EXISTING SERVICES

- .1 Where Work involves breaking into or connecting to existing services, carry out work as directed in Section 01 14 00 – Work Restrictions.
- .2 Record locations of maintained, re-routed and abandoned service lines.
- .3 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.14 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 his approval for actual location.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

1.15 CUTTING AND PATCHING

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove items so shown or specified.
- .3 Do not cut, bore, or sleeve load-bearing members.

GENERAL INSTRUCTIONS

- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Fit work airtight to pipes, sleeves, ducts and conduits.
- .6 Conceal pipes, ducts and wiring in raised floors, wall and ceiling construction of finished areas except where indicated otherwise.
- .7 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.
- .8 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.

1.16 SETTING OUT OF WORK

- 1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

1.17 ACCEPTANCE OF SUBTRADES

- 1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.18 QUALITY OF WORK

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 The workmanship, erection methods and procedures to meet minimum standards set out in the National Building Code of Canada 2015 and Construction Standards as specified herein.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

1.19 WORKS COORDINATION

- .1 Coordinate work of sub-trades:
 - .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
 - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
 - .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
 - .1 Pay particularly close attention to overhead work above ceilings and within or near to building structural elements.

GENERAL INSTRUCTIONS

- .2 Identify on coordination drawings, building elements, services lines, rough-in points and indicate location services entrance to site.
- .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
- .4 Publish minutes of each meeting.
- .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
- .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
- .4 Work cooperation:
 - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
 - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
 - .3 Ensure disputes between subcontractors are resolved.
- .5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
- .6 Maintain efficient and continuous supervision.

1.20 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 In accordance with Section 01 33 00, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.
- .2 Allow sufficient time for the following:
 - .1 Review of product data.
 - .2 Approval of shop drawings.
 - .3 Review of re-submission.
 - .4 Ordering of approved material and/or products. Refer to individual technical sections of specifications.

1.21 PROJECT MEETINGS

- .1 Contractor shall arrange project meetings and assume responsibility for setting times and distributing minutes.
- .2 The contractor shall provide the meeting facilities, record the meeting minutes and issue a meeting agenda 3 days prior to the meeting to Departmental Representative for review.

1.22 TESTING AND INSPECTION

- .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified in Sections 01 45 00.
- .2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.

GENERAL INSTRUCTIONS

- .3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.
 - .1 Mill tests and certificates of compliance.
 - .2 Tests specified in the contract documents to be carried out by Contractor which may be under the Departmental Representative's supervision.
- .3 Within 15 working days after Contract award provide a list of proposed testing services or testing laboratories for Departmental Representative's approval.
- .4 The Departmental Representative may require, and pay for, additional inspection and testing services not included in paragraph 1.22.2.
- .5 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
- .6 Contractor shall furnish labour and facilities to:
 - .1 Notify Departmental Representative in advance of planned testing.
- .7 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .8 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .9 Provide Departmental Representative with 2 copies of testing laboratory reports as soon as they are available.

1.23 AS-BUILT DOCUMENTS

- .1 Keep one set of current white prints of all contract drawings and all addenda, revisions, clarifications, change orders, and reviewed shop drawings in the site office; and have them available at all times for inspection by Departmental Representative.
- .2 As the Work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.
- .3 At completion of the Work, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings and change order, to a set of Issued for Construction drawings. Submit the 'red-marked' as-built set to the Departmental Representative, in hard copy and in PDF.
- .4 Refer to Section 01 78 00 – Close-out Submittals.

1.24 CLEANING

- .1 Refer to Section 01 74 11 - Cleaning.

1.25 DUST CONTROL

- .1 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public.
- .2 Protect furnishings and equipment within work area with 0.102 mm thick polyethylene film during construction. Remove film during non- construction hours and leave premises in clean, unencumbered and safe manner for normal daytime function.

GENERAL INSTRUCTIONS

- .3 Maintain and relocate protection until such work is complete.

1.26 ENVIRONMENTAL PROTECTION

- .1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.
- .2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .3 Ensure proper disposal procedures in accordance with all applicable territorial regulations.

1.27 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

- .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual technical sections of specifications.

1.28 ADDITIONAL DRAWINGS

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with drawings referred to in the Contract Documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of ten (10) sets of Contract Documents for use by the Contractor at no additional cost. Should more than ten (10) sets of documents be required, the Departmental Representative will provide them at additional cost.

1.29 BUILDING SMOKING ENVIRONMENT

- .1 Smoking within the building and within 7.5m of all air intakes is not permitted.
- .2 A 'No Smoking' sign to be put up by Contactor.

1.30 SYSTEM OF MEASUREMENT

- .1 The metric system of measurement (SI) will be employed on this Contract.

1.31 FAMILIARIZATION WITH SITE

- .1 Before submitting tender, visit site as indicated in tender documents and become familiar with all conditions likely to affect the cost of the work.

1.32 SECURITY REQUIREMENTS

- .1 Refer to Section 01 14 00.

1.33 SUBMISSION OF TENDER

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

1.34 SUBSTANTIAL COMPLETION

- .1 Substantial Completion of work and release of holdback will only apply after completion of Phase 2. 1 year warranty period for Phase 1 work will start from complete commissioning of Service Elevator and turn over to Departmental Representative.

WORK RESTRICTIONS

1.0 GENERAL

1.1 FACILITY OPERATIONS AND SECURITY PROCEDURES

- .1 All construction staff shall become thoroughly familiar with and abide by all provisions and requirements of Summerland Research and Development Centre: Operations, Safety and Security Procedures and Restrictions.

1.2 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.
- .2 Provide hoarding plan that close off the project construction area and scaffolding plan, if any, for Departmental Representative to review 5 business days prior to installation.
- .3 All access to the building will require daily sign- in at the Level 3 security desk.

1.3 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security as per Departmental Representatives direction and as specified in 1.7 Security.
- .4 Closures: protect work temporarily until permanent enclosures are completed.
- .5 Portions of the existing complex will be occupied by the public and government staff during entire construction period.
- .6 Coordinate with Departmental Representative in scheduling operations to minimize conflict and to facilitate use of space.

1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.5 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 10 working days of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends. The maximum number of shut downs is limited to 4 for the duration of the project.
 - .1 Optimize and plan shut-downs so that services are restored in time for normal facility operation hours. Coordinate all shut-downs with utility providers, facility users and the property management firm.
 - .2 Contractor shall be held responsible for damages to facility equipment as the result of service shut-downs.

WORK RESTRICTIONS

- .3 Contractor shall be held responsible for any and all unscheduled shut-downs of building utilities and services.
- .4 Contractor will not be allowed to connect to Departmental Representative's existing data and communication services.
- .5 Submit a "Fire Alarm Bypass" request to Departmental Representative 72 hours in advance for approval.
- .6 Obtain permission from Departmental Representative for access to restricted areas outside the construction zones 24 hours in advance.
- .3 Provide for personnel and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 SPECIAL REQUIREMENTS

- .1 Carry out noise and vibration generating Work outside the normal operating hours the facility.
 - .1 Means and procedures of controlling and isolating construction noise affecting occupied areas shall be responsibility of the Contractor and approved by the Departmental Representative.
- .2 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.
- .3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .4 Keep within limits of work and avenues of ingress and egress.

1.7 SECURITY

- .1 All work within the facility will require full-attendance in respect of working hours. The Contractor shall make minimum 48 hours advance arrangements commissionaires directly with commissionaires.
- .2 All security costs will be paid for by the Contractor directly.
- .3 Commissionaire Contact Information is provided below

Commissionaire BC
Phone: 604-646-3330

1.8 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted within the facility.

1.9 NOISE CONTROL

- .1 Refer to section 01 11 55 clause 1.5 for policy for excessive noise and vibration generation.
- .2 Means and procedures of controlling and isolating construction noise affecting occupied areas shall be responsibility of the contractor and approval of Departmental Representative.
- .3 Level of work noise must be maintained at a level no greater than 87 dBA, over an eight-hour period.
- .4 If work noise level exceeds 87 dBA, reduce noise either by using engineering devices to reduce or

WORK RESTRICTIONS

by shortening the duration of exposure.

- .1 Refer to Table of maximum duration of exposure to sound levels higher than 87dBA permitted by Canada Occupational Health and Safety Regulations:

Sound Level in dBA	Maximum Duration of Exposure in Hours per Employee per 24-Hour Period		Sound Level in dBA	Maximum Duration of Exposure in Hours per Employee per 24-Hour Period
87	8.0		104	0.16
88	6.4		105	0.13
89	5.0		106	0.10
90	4.0		107	0.080
91	3.2		108	0.064
92	2.5		109	0.050
93	2.0		110	0.040
94	1.6		111	0.032
95	1.3		112	0.025
96	1.0		113	0.020
97	0.80		114	0.016
98	0.64		115	0.013
99	0.50		116	0.010
100	0.40		117	0.008
101	0.32		118	0.006
102	0.25		119	0.005
103	0.20		120	0.004

END OF SECTION 01 14 00

PROJECT MANAGEMENT AND COORDINATION

1.0 GENERAL

- .1 This section includes the following:
 - .1 Coordination of Work under administration of Departmental Representative.
 - .2 Scheduled Pre-construction and Site meetings.
 - .3 Project planning and construction schedule.
 - .4 Site progress monitoring and control.

1.1 DESCRIPTION

- .1 Coordinate and manage construction schedule, submittals, use of site, temporary utilities, construction facilities, quality control program, and construction Work, with progress of Work of subcontractors, other contractors and Departmental Representative.

1.2 PRE-CONSTRUCTION MEETING

- .1 Pre-construction Meeting:
 - .1 Within 10 days after award of Contract, Departmental Representative will arrange pre-construction meeting.
 - .2 Departmental Representative, Contractor and representatives from Agriculture and Agri-Food Canada (AAFC) will be in attendance.
 - .3 Departmental Representative will establish time and location of meeting and notify parties concerned.
 - .4 The Contractor will chair the meeting, record minutes and issue minutes to all attendees.
 - .1 Agenda of meeting is generally as follows:
 - .1 Project team introductions including main construction personnel, PSPC personnel, AAFC representatives and other Departmental Representative Designate.
 - .2 Communication protocol for submittals.
 - .3 Start date on site.
 - .5 Construction Organization and Start-up:
 - .1 Comply with Departmental Representative's allocation of mobilization areas of site; for access, traffic, and parking facilities.
 - .2 During construction coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
 - .3 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
 - .4 Coordinate layout of construction barrier with Departmental Representative.

1.3 PROJECT PLANNING

- .1 Plan construction activities, submittals and field reviews ahead of time for efficient and effective management to ensure timely completion of project.
- .2 Contractor to provide 2 weeks look ahead schedule at every bi-weekly site meeting.

1.4 SCHEDULES

- .1 Submit preliminary construction schedule to Departmental Representative during Pre-Construction meeting.

PROJECT MANAGEMENT AND COORDINATION

- .2 After review, revise and resubmit schedule. Submit final full schedule within 10 days after Pre-Construction meeting.
- .3 During progress of Work revise and resubmit as directed by Departmental Representative.

1.5 CONSTRUCTION SITE MEETINGS

- .1 During course of Work and prior to project completion, Departmental Representative will request Construction Site Meetings as required.
- .2 Contractor will record minutes of meetings and circulate to attending parties and affected parties not in attendance.
- .3 Agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Review work to be carried out until the next meeting.
 - .4 Field observations, problems, conflicts.
 - .5 Review of Health and Safety including any incidents, near misses, and WorkSafe BC visits.
 - .6 Problems which impede construction schedule.
 - .7 Review of off-site fabrication delivery schedules.
 - .8 Corrective measures and procedures to regain projected schedule.
 - .9 Revision to construction schedule.
 - .10 Progress schedule, during succeeding work period.
 - .11 Review submittal schedules: expedite as required.
 - .12 Update of Red Line As-Built Drawings.
 - .13 Maintenance of quality standards.
 - .14 Review proposed changes for effect on construction schedule and on completion date.
 - .15 Other business.

1.6 WALK THROUGH FIELD REVIEW BY DEPARTMENTAL REPRESENTATIVE

- .1 Departmental Representative will carry out the following:
 - .1 Walk-through field review of the work with contractor's representatives.
 - .2 Preparation and distribution of the Walk-through field review Reports. Reports will be distributed within 5 days of field review.

1.7 SUBMITTALS

- .1 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
- .2 Process substitutions through Departmental Representative.
- .3 Deliver closeout submittals for review and inspections, for transmittal to Departmental Representative.

1.8 CLOSEOUT PROCEDURES

- .1 Notify Departmental Representative when Work is considered Substantially Complete. Contractor to prepare list of defects, deficiencies and incomplete work prior to inspection by Departmental Representative. Follow procedures as outlined in Section 01 78 00 – Closeout Submittals.
- .2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.

PROJECT MANAGEMENT AND COORDINATION

- .3 Comply with Departmental Representative's instructions for correction of items of Work listed in deficiency list.
- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

END OF SECTION 01 31 00

PROJECT MEETINGS

1.0 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 Meeting space can be held in the meeting room in PARC. Book meeting or room in advance through Departmental Representative.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within five (5) days after meetings and transmit to meeting participants and affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRE- CONSTRUCTION MEETING

- .1 Within 15 days after award of Contract: General Representative will request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Attendance will include, but is not limited to, the Departmental Representative, AAFC representatives, Elevator Sub-Contractor and Contractor.
- .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 EGD Security requirements.
 - .6 Site safety in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .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 -

PROJECT MEETINGS

- Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.

1.3 PROGRESS MEETINGS

- .1 During course of Work and two weeks prior to Project Completion, schedule progress meetings bi-weekly.
- .2 Attendance to include but is not limited to Departmental Representative, AAFC representatives, and Contractor.
- .3 Contractor responsible to record minutes of meetings and circulate to attending parties and affected parties not in attendance within five (5) days after meeting.
- .4 Record next meeting dates in the meeting minutes or notify parties minimum of seven (7) days in advance for other ad-hoc meetings.
- .5 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 Coordination discussions with AAFC
 - .5 Construction schedule review.
 - .6 Review of off-site fabrication delivery schedules.
 - .7 Corrective measures and procedures to regain projected schedule.
 - .8 Request for Information (RFI) log review.
 - .9 Engineering Disciplines Reviews.
 - .1 Architectural
 - .2 Mechanical
 - .3 Electrical
 - .4 Elevator
 - .10 Change order log review.
 - .11 Review submittal schedule.
 - .12 Review updated as built.
 - .13 Review and resolve site issues.
 - .14 New business.

END OF SECTION 01 31 19

**CONSTRUCTION PROGRESS SCHEDULE
BAR (GANTT) CHART**

1.0 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 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, 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.

**CONSTRUCTION PROGRESS SCHEDULE
BAR (GANTT) CHART**

- .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 10 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 measures to regain slippage.
 - .1 Corrective measures may 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.

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.

**CONSTRUCTION PROGRESS SCHEDULE
BAR (GANTT) CHART**

- .6 Procurement.
- .7 Construction.
- .8 Installation.
- .9 Site Works.
- .10 Training.

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 2 week look ahead schedule to Departmental Representative at each biweekly site meeting indicating the planned tasks of the next two week period.

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and

**CONSTRUCTION PROGRESS SCHEDULE
BAR (GANTT) CHART**

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

SUBMITTAL PROCEDURES

1.0 GENERAL

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .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 co-ordinated, 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.

SUBMITTAL PROCEDURES

- .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.

SUBMITTAL PROCEDURES

- .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 Electronic submissions will only be reviewed and returned electronically. No hardcopies will be returned to contractor.
- .23 All electronic submissions to be uploaded to Document Control System FTP site hosted by PSPC.

SUBMITTAL PROCEDURES

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.

1.6 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

HEALTH AND SAFETY REQUIREMENTS

PSPC Update on Asbestos Use

Effective April 1, 2016, all Public Service and Procurement Canada (PSPC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at <http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html>

1.0 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 2015):
 - .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 Structure
 - .4 CSA Z1006-10 – Management of Work In Confined Space
- .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 NMS Section 00 10 10 Specification Index (Appendix A thru Appendix E)

1.2 RELATED SECTIONS

- .1 Section 01 32 16.0 Construction Progress Schedule-Bar (GANTT) Chart:
- .2 Section 01 33 00 Submittal Procedures:
- .3 Section 01 51 00 Temporary utilities:
- .4 Section 01 52 00 Construction facilities:
- .5 Section 01 56 00 Temporary barriers and enclosures:

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.

HEALTH AND SAFETY REQUIREMENTS

1.4 COMPLIANCE WITH REGULATIONS

- .1 PSPC may terminate the Contract without liability to PSPC where the Contractor, in the opinion of PSPC, 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
- .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 Copy of Contractors' Construction Safety Manual
 - .6 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 5 (five) 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.

HEALTH AND SAFETY REQUIREMENTS

1.7 HEALTH AND SAFETY COORDINATOR

- .1 The contractor shall appoint a Health and Safety Coordinator who shall:
 - .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 the Contractor's Work Site (as required) and the Contractor Off-Site Offload Facility (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 sites.
 - .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 Utility Clearances

- .1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work.
- .2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

1.10 PROJECT/SITE CONDITIONS

- .1 Not Applicable

1.11 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.

1.12 WORK PERMITS

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

1.13 FILING OF NOTICE

- .1 The Prime 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.

1.14 HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment for the Contractor's Work Site and the Contractors' Off-Site Offload Facility (as required), based on a review of Contract documents, required work, and both project work sites. Identify any known and potential health risks and safety hazards.

HEALTH AND SAFETY REQUIREMENTS

- .2 Develop, implement, and enforce 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 Site Specific project health and Safety 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 Site Specific Project Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of the contractors' Site Specific Safety Project Health and Safety Plan by Public Services and Procurement Canada (PSPC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Project Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 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 other PSPC staff as required.
- .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 PSPC site staff.

HEALTH AND SAFETY REQUIREMENTS

- .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 At least once each year, emergency drills must be held to ensure awareness and effectiveness of emergency exit routes and procedures, and a record of the drills must be kept
- .6 Revise and update emergency procedures as required, and re-submit to the Departmental Representative

1.16 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 013300].
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
 - .3 Provide adequate means of ventilation in accordance with NMS Sections as indicated in Section 000110 Specification Index.

1.17 OFFSITE CONTINGENCY AND EMERGENCY RESPONSE PLAN

- .1 Prior to commencing Work involving handling of hazardous materials, develop off site Contingency and Emergency Response Plan.
 - .2 Plan must provide immediate response to serious site occurrence such as explosion, fire, or migration of significant quantities of toxic or hazardous material from Site.
 - .3 Notification of fire departments [4.17 – Worksafe BC Regulations Part 4 Buildings, Structures, Equipment, and Site Conditions]
 - (1) An employer having at a workplace hazardous products covered by WHMIS, explosives, pesticides, radioactive material, consumer products or hazardous wastes in quantities which may endanger firefighters, must ensure the local fire department is notified of the nature and location of the hazardous materials or substances and methods to be used in their safe handling.
 - (2) Subsection (1) does not apply to a workplace
 - (a) where materials are kept on site for less than 15 days if the employer ensures an alternative effective means for notification of fire departments is in place in the event of fire or other emergency, or
 - (b) which is not within the service area of a fire department.
- [Amended by B.C. Reg. 30/2015, effective August 4, 2015.]

HEALTH AND SAFETY REQUIREMENTS

1.18 PERSONNEL HEALTH, SAFETY, AND HYGIENE

- .1 Training: ensure personnel entering Site are trained in accordance with specified personnel training requirements. Training session must be completed by Health and Safety Officer.
- .2 Levels of Protection: establish levels of protection for each Work area based on planned activity and location of activity.
- .3 Personal Protective Equipment
- .4 Furnish site personnel with appropriate PPE as specified above. Ensure that safety equipment and protective clothing is kept clean and maintained
- .5 Develop protective equipment usage procedures and ensure that procedures are strictly followed by site personnel; include following procedures as minimum:
- .6 Ensure prescription eyeglasses worn are safety glasses and do not permit contact lenses on site within work zones.
- .7 Ensure footwear is steel-toed safety shoes or boots and is covered by rubber overshoes when entering or working in potentially contaminated work areas.
- .8 Dispose of or decontaminate PPE worn on site at end of each workday.
- .9 Decontaminate reusable PPE before reissuing.
- .10 Ensure site personnel have passed respirator fit test prior to entering potentially contaminated work areas.
- .11 Ensure facial hair does not interfere with proper respirator fit.

Respiratory Protection:

1. Provide site personnel with extensive training in usage and limitations of, and qualitative fit testing for, air purifying and supplied-air respirators in accordance with specified regulations.
2. Develop, implement, and maintain respirator program.
3. Monitor, evaluate, and provide respiratory protection for site personnel.
4. Ensure levels of protection as listed have been chosen consistent with site-specific potential airborne hazards associated with major contaminants identified on site.
5. In absence of additional air monitoring information or substance identification, retain an industrial hygiene specialist to determine minimum levels of respiratory protection required.
6. Immediately notify Departmental Representative when level of respiratory protection required increases.
7. Ensure appropriate respiratory protection during Work activities. As minimum requirement, ensure that persons entering potentially contaminated work areas are supplied with and use appropriate respiratory protection.

Heat Stress/Cold Stress:

Implement heat stress or cold stress monitoring program as applicable and include in site-specific Health and Safety Plan.

Personnel Hygiene and Personnel Decontamination Procedures.

Provide minimum as follows:

HEALTH AND SAFETY REQUIREMENTS

1. Suitable containers for storage and disposal of used disposable PPE.
2. Potable water and suitable sanitation facility.

Emergency and First-Aid Equipment:

1. Locate and maintain emergency and first-aid equipment in appropriate location on site including first-aid kit to accommodate number of site personnel; portable emergency eye wash; 9 kg ABC type dry chemical fire extinguishers as required.

1.19 ELECTRICAL SAFETY REQUIREMENTS

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
 - .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing 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.
 - .3 Develop, implement and enforce a communication plan with Departmental representative and EGD maintenance staff for all electrical work and lockout procedures.

1.20 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.

1.21 OVERLOADING

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

1.22 FALSEWORK

- .1 Design and construct falsework in accordance with CSA S269.1- 1975 (R2003).

1.23 SCAFFOLDING

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 and B.C. Occupational Health and Safety Regulations.

1.24 CONFINED SPACES

- .1 Carry out work in confined spaces in compliance with Worksafe B.C. Part 9 Confined Spaces and CSA Z1006-10 Management of Work in Confined Space.

1.25 RESTRICTED ACCESS

- .1 Contractor shall perform a hazard assessment and develop an appropriate restricted access entry plan in accordance with Worksafe B.C. regulations.

HEALTH AND SAFETY REQUIREMENTS

1.26 CONFINED SPACE AND RESTRICTED SPACE OUTSIDE OF DEFINED WORK SITE

- .1 Carry out work in confined spaces in compliance with Worksafe B.C. Part 9 Confined Spaces and CSA Z1006-10 Management of Work in Confined Space. Coordinate all confined space entry work with PSPC Departmental Representative through the contractor's confined space entry permit system.
- .2 Contractor shall perform a hazard assessment and develop an appropriate restricted access entry plan in accordance with Worksafe B.C. regulations. Coordinate all restricted access space entry work with the PSPC Departmental Representative prior to entry.
- .3 The Contractor is required to provide a reasonable amount of time to the Departmental Representative for making arrangements for entry and/or access to Confined Space or Restricted Access spaces located outside the designated work site.

1.27 POWDER-ACTUATED DEVICES

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

1.28 FIRE SAFETY AND HOT WORK

- .1 Coordinate all hot work with PSPC Departmental Representative through the contractors' hot work permit system
- .2 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .3 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.

1.29 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.

1.30 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.

1.31 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.

HEALTH AND SAFETY REQUIREMENTS

1.32 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 Qualified Health and Safety Coordinator, 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.

1.33 MEETINGS

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
- .2 All personnel employed by the contractor and its subcontractors shall attend the mandatory EGD Safety Orientation presentation prior to performing Work at the EGD Work Site.

1.34 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 Contractor will be responsible for any costs arising from such a "stop work order".

QUALITY CONTROL

1.0 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 will 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 Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and 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

QUALITY CONTROL

Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative 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.
- .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 commissioning reports for mechanical, electrical and elevator systems.
- .2 Refer to Divisions 14, 21, 23, 25, 26 and 28 for definitive requirements.

TEMPORARY UTILITIES

1.0 GENERAL

1.1 ACCESS AND DELIVERY

- .1 Only the designated entrance may be used for personnel access to the site. The designated entry and exit will be via the front entrance at Level 3. Delivery Access to L2 can be through the loading area on the east side of the building.
- .2 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 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.
- .4 Provide and maintain competent flag operators, traffic signals, barricades and flares, lights or lanterns as may be required to perform work and protect other users of the facility.

1.2 CONSTRUCTION PARKING

- .1 Construction staff are allowed to park in the designated stalls at the facility parking lot. Departmental Representative will have full discretion of the assignment of the number of stalls. Assigned stalls may not be sufficient to meet construction staff requirement.

1.3 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. Note that storage space is limited on site. Refer to site plan for location of Contractor's site storage and lay-down area.

1.4 POWER

- .1 Subject to Coordination with Departmental Representatives electrical power within the facility may be used at no extra cost. There is no guarantee of uninterrupted power supply. Contractor will use this power source at their own risk. Contractor will not be compensated for any incurred cost or time owing to any power failure. Contractor will be responsible for other power source as they consider to be required for completing the project. Contractor will be responsible for all the cost of connecting and disconnecting from this power source after completion of project to the satisfaction of the Departmental Representative.

1.5 AIR

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

1.6 WATER SUPPLY

- .1 Water supply is available for use by Contractor.

1.7 SANITARY FACILITIES

- .1 Contractor will provide their own portable sanitary facilities. Maintain in a safe and sanitary condition. Construction staff will not be allowed to use the facility washrooms.

TEMPORARY UTILITIES

1.8 HEATING AND VENTILIATION

- .1 Do not begin work until arrangements have been made with the Departmental Representative for protection of on-floor heating, ventilating and air conditioning.
- .2 If there is any dirt in the heating and ventilation system, at the completion of work, it will be the Contractor's responsibility to return system to its original state in accordance with the Departmental Representative's directions.
- .3 Prevent dust and odour migration to other occupied areas.
 - .1 Do not deactivate HVAC system to occupied floors. Purge air from construction floors only when directed by Departmental Representative, where dust and fumes will be generated.
 - .2 Change filters in existing HVAC system frequently.

1.9 SCAFFOLDING

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

1.10 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.

1.11 HOARDING

- .1 Prior to all demolition and construction, install dust proof hoarding or protective barrier to separate construction zone and the rest of the operating facility. Maintain in safe and clean condition throughout duration of project. Submit hoarding plan to Departmental Representative for approval.
- .2 Erect and maintain safety barricades around all openings and other danger areas as required by Building Code and WCB.
- .3 Make good all floor, ceiling and wall to their original condition after removal of hoarding at completion of project.

1.12 SITE OFFICE

- .1 Contractor to provide their own trailer as temporary site office. Coordinate with Departmental Representative for exact location.
- .2 Contractor should clear and demolish site office at end of project according to contract requirement.

1.13 REMOVAL OF TEMPORARY FACILITIES

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

1.14 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.

1.15 CLEAN-UP

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

TEMPORARY UTILITIES

- .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.

1.16 USE OF EXISTING UTILITIES

- .1 It is the intention of the Departmental Representative to supply temporary services where specified, however, in the event of any unforeseen occurrence, the Departmental Representative may discontinue such temporary service, without notice, and without acceptance of any liability, for damage or delay, caused by such withdrawal of temporary services.
- .2 Supply of temporary services by Department Representative is subject to the requirements of the facility and level of availability of existing services.
- .3 Contractor shall bear costs of all temporary services required for the project, subject to approval by Departmental Representative those available from existing services.

END OF SECTION 01 51 00

1.0 GENERAL

1.2 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.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.4 HOARDING

- .1 Refer to Section 01 51 00 Temporary Facilities Clause 1.11.

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 FIRE ROUTES

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

1.7 PROTECTION OF OFF-SITE AND PUBLIC PROPERTY

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

1.8 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Protect existing operating equipment within the project area
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

END OF SECTION 01 56 00

COMMON PRODUCT REQUIREMENTS

1.0 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 1 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

COMMON PRODUCT REQUIREMENTS

- 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.
- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in

COMMON PRODUCT REQUIREMENTS

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

EXAMINATION AND PREPARATION

1.0 GENERAL

1.1 REFERENCES

- .1 A set of construction drawings of existing research centre in pdf format are available for viewing and reference only upon request. The set of drawings may not be full completed set and do not necessarily represent as-built conditions. All existing conditions measurements need to be verified on site.

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 EXISTING SERVICES

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

1.4 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.5 RECORDS

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

1.6 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.

1.7 SUBSURFACE CONDITIONS

- .1 Promptly notify Departmental Representative 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.

EXAMINATION AND PREPARATION

- .2 After prompt investigation, should Departmental Representative 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

EXECUTION

1.0 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.

EXECUTION

- .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 in accordance with Section 07 84 00 - Firestopping, 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.
- .14 Provide GPR scan to concrete slab prior to demolition to defect any underslab services.

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

CLEANING

1.0 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 building 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.

CLEANING

- .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.

**WASTE MANAGEMENT &
DISPOSAL**

1.0 GENERAL

1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PSPC'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 demolition 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 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .4 Inert Fill: inert waste - exclusively asphalt and concrete.
- .5 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.
- .6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .8 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.
- .9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modeling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .11 Separate Condition: refers to waste sorted into individual types.
- .12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

**WASTE MANAGEMENT &
DISPOSAL**

- .14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .15 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 A, B, C, D, E 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 completed Demolition Waste Audit (DWA): Schedule C.
 - .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of final payment.
 - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
 - .3 For each material reused, sold or recycled from project, include amount quantities by number, type and size of items and the destination.
 - .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

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 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.

**WASTE MANAGEMENT &
DISPOSAL**

- .9 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 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule C.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.8 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.

1.9 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 Separate and store materials produced during dismantling of structures in designated areas.

**WASTE MANAGEMENT &
DISPOSAL**

- .5 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.

1.10 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.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.11 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.

1.12 SCHEDULING

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

2.0 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3.0 EXECUTION

3.1 APPLICATION

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

3.2 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.

**WASTE MANAGEMENT &
DISPOSAL**

3.3 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		

**WASTE MANAGEMENT &
DISPOSAL**

3.4 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						
Other						

**WASTE MANAGEMENT &
DISPOSAL**

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 Respon sible 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					

**WASTE MANAGEMENT &
DISPOSAL**

3.7 DEMOLITION WASTE AUDIT (DWA)

The following pertains to Schedule C - Demolition Waste Audit (DWA). Column-1 refers to the type of material salvaged. Column-2 refers to the material quantity shown in column-1. Several columns may be required to identify specific demolition areas. Column-3 refers to the unit of measurement used to describe Column-2. Column-4 refers to the total quantity of salvaged material. Column-5 refers to the cumulative volume of salvaged material. Column-6 refers to the total weight in kilograms. Column-7 refers to remarks and assumptions made about the specified material.

.1 Schedule C - Demolition Waste Audit (DWA):

(1) Material Description Assumptions	(2) Quantity	(3) Unity	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks & Assumptions
Wood						
Wood						
Stud						
Plywood						
Baseboard -wood						
Door						
Trim-Wood						
Cabinet						
Doors & Windows						
Panel						
Regular						
Slab Regular						
Wood						
Laminate						
Byfold-Closet						
Glazing						

3.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIROMENT

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

- .1 Ministry of Environment Lands and Parks
810 Blanshard Street, 4th 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

CLOSEOUT PROCEDURES

1.0 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 of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request 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 shall correct Work accordingly.
 - .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 Departmental Representative personnel.
 - .7 Work is complete and ready for Final Inspection.

END OF SECTION 01 77 00

CLOSEOUT SUBMITTALS

1.0 GENERAL

1.1 RELATED SECTIONS

.1	Quality Control	Section 01 45 00
.2	Examination & Preparation	Section 01 71 00
.3	Closeout Procedures	Section 01 77 00
.4	Demonstration and Training	Section 01 79 00
.5	General Commissioning CX Requirement	Section 01 91 31

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Completion of the Work, submit to the Departmental Representative, four final 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. Refer to individual specification sections.
- .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.

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.

CLOSEOUT SUBMITTALS

- .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 Data of each building shall be accessible by the input of either the building name or building number as defined by the Departmental Representative.
- .4 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:
 - .1 Architectural
 - .2 Mechanical
 - .3 Electrical
 - .4 Elevator
 - .5 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

CLOSEOUT SUBMITTALS

- .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.
- .5 The system shall be executed by Professional Engineers with a minimum of 10 years post qualification experience in the field of Building Services Engineering.
- .6 The Contractor shall provide a minimum of 3 past job references as proven record of similar undertakings.
- .7 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 215 x 280 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;

CLOSEOUT SUBMITTALS

- .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 Conditions, 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 reproduces, revising reproduces to show work as actually installed. Use different colour waterproof ink for each service.

CLOSEOUT SUBMITTALS

- .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:

CLOSEOUT SUBMITTALS

- .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 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 - Commissioning.
- .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.

CLOSEOUT SUBMITTALS

- .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 final payment.

1.11 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in the Operating and Maintenance Manuals.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.

CLOSEOUT SUBMITTALS

- .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 Departmental Representative 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

DEMONSTRATION AND TRAINING

1.0 GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative personnel two weeks prior to date of substantial performance.
- .2 Departmental Representative: 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 each Division.
 - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 23 05 93 – Testing, Adjusting and Balancing Testing for HVAC.
- .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: refer to Section 01 91 41

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 Departmental Representative personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

GENERAL COMMISSIONING (CX) REQUIREMENTS

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

General requirements relating to commissioning of project's components and systems, specifying general requirements to Performance Verification of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Sections:

Section 01 33 00	Submittal Procedures
Section 01 45 00	Quality Control.
Section 01 91 31	Commissioning (Cx) Plan
Section 01 91 33	Commissioning Forms
Section 01 91 41	Commissioning Training
Section 01 91 51	Building Management Manual (BMM)
Section 14 24 00.03	Hydraulic Elevations
Section 23 05 00	Common Work Results - Mechanical
Section 23 05 93.01	Testing
Section 23 34 00	HVAC Fans
Section 26 05 00	Common Work Results for Electrical.
Section 26 05 20	Wire and Box Connectors 0-1000 V
Section 26 05 28	Grounding – Secondary
Section 26 05 34	Conduits, Conduit Fastenings and Conduit Fittings
Section 26 28 21	Moulded Case Circuit Breakers

.3 Acronyms:

- .1 AFD - Alternate Forms of Delivery, service provider.
- .2 BMM - Building Management Manual.
- .3 Cx - Commissioning.
- .4 EMCS - Energy Monitoring and Control Systems.
- .5 O&M - Operation and Maintenance.
- .6 PV - Performance Verification.
- .7 TAB - Testing, Adjusting and Balancing.
- .8 CxA – Commissioning Authority.
- .9 DC – Design Consultant.
- .10 PSPC – Public Services and Procurement Canada.
- .11 ECxC – Electrical Commissioning Coordinator.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .12 MCxC – Mechanical Commissioning Coordinator.
- .13 QCM - .Quality control Manger.
- .14 ECA – Electrical Commissioning Agent.
- .15 MCA – Mechanical Commissioning Agent.
- .16 O&M – Operations and Maintenance.

1.2 REFERENCE

- .1 CSA Z 320-11

1.3 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.
Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Cx is to be performed by an independent third party professional Cx Agent(s) after work is completed and prior to energizing any equipment. The independent third party must have performed similar HV work for a minimum of 5 years. Qualifications of Cx Agent submitted by General Contractor shall be reviewed by Commissioning Authority and can only be hired after acceptance by Departmental Representative.
- .3 General Contractor to retain the services of an independent third party professional Cx Agent to carry out the tests and calibration as required herein. Testing Agency shall be familiar with NETA Standards as specified herein and shall have accreditation equivalent to a full NETA member company:
 - .1 This project shall only be undertaken by firms familiar with and having a long and demonstrable successful track record in the field of switchgear and transformer modification and installation, protection and control, and arc flash mitigation. The proponent shall be experienced in working with an industrial type primary voltage distribution system using parallel feeders. Provide documented experience on projects of this type.
 - .2 All protection settings must be reviewed by a Professional Engineer registered in British Columbia who is an employee of Cx Agency. Provide documentation naming this individual along with their credentials.
 - .3 All work must be performed by qualified technicians/electricians with applicable accreditation for the appropriate permitting required. Provide a list of all personnel and their qualifications.
 - .4 Provide three references, including contact information for completed projects similar to this in scope and technical content.
 - .5 Qualifications of the Cx Agency must be submitted and reviewed by Departmental Representative and only after acceptance will the Testing Agency be allowed to perform the work.
- .4 Furnish Independent Cx agency professional engineer's letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions. The letter is to be submitted stamped by a Professional Engineer, registered in BC, and provided to the Commissioning Authority.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .5 Employ only personnel who are qualified and experienced in high voltage work. Personnel must be familiar with the equipment and procedures necessary to complete the work as specified herein.
- .6 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems must interact with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments will be made to enhance performance to meet environmental or user requirements.
- .7 Design Criteria: as per client's requirements or determined by designer to meet Project functional and operational requirements.

1.4 COMMISSIONING OVERVIEW

- .1 Cx to be a line item of General Contractor's cost breakdown.
- .2 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .3 Cx is to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .4 Complete all start-up and verification of systems prior to review by Commissioning Agent.
 - .1 To bring mechanical, electrical and building architectural systems and components from a state of static completion to a state of dynamic operation.
 - .2 To verify conformance to contract requirements.
 - .3 To confirm installations meet requirements of Contract Documents.
 - .4 To provide all testing documents and records.
 - .5 To ensure completed facility meets contract requirements.
 - .6 To provide a documented operator training program.
 - .7 To verify accuracy of project record drawings and operating and maintenance manuals.
- .5 Departmental Representative will issue Certificate of Substantial Completion when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, Departmental Representative to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by General Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

GENERAL COMMISSIONING (CX) REQUIREMENTS

1.6 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .10 Submit factory testing report of Electrical Equipment to Departmental Representative for review and approval.
 - .11 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.7 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
- .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
- .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.
- .4 Provide additional documentation relating to Cx process required by Departmental Representative, specifically;
 - .1 Cx Plan and Schedule
 - .2 Accepted Shop drawings

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .3 Completed PI forms
- .4 Approved TAB report
- .5 Approved PV forms
- .6 Approved O&M manuals
- .7 Approved System and Integrated System Test Report
- .8 Approved Factory testing reports
- .9 Approved Training and Attendance forms
- .10 Accepted "As-built" Plans and Specifications
- .11 Final Cx Report

1.9 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 General Contractor to review and approve Cx documentation submitted by Cx Agent prior to submission to Cx Authority for review.
- .3 Provide completed and approved Cx documentation to Commissioning Authority.

1.10 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 17 Construction Progress Schedule.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.11 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: As per Construction Progress Schedule and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Section 01 32 16.07 Construction Progress Schedule Bar (GANTT Chart). General Contractor to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of General Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .6 Meeting will be chaired by General Contractor with their Commissioning Agent, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.12 STARTING AND TESTING

- .1 General Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days' notice prior to commencement.
- .2 Cx Authority and Departmental Representative to witness of start-up and testing.
- .3 General Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.
 - .1 Minimum of 5 years experience in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and general testing in following distinct phases
 - .1 Included in delivery and installation
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Prior to startup:
 - .1 Insulation resistance test and continuity test of all new cables and all cables with connections changed during construction
 - .2 All high voltage terminations tested with infrared imaging. Spot temperature readings are not acceptable
 - .3 Refer to the NETA Acceptance Testing specifications for detailed commissioning requirements for the following equipment:
 - .1 Cables, Low Voltage, 600 volt maximum.
 - .2 Switches, Air, Low Voltage
 - .3 Circuit Breakers, Air, Insulated/Molded Case
 - .4 Circuit Breakers, Air, Low-Voltage Power
 - .5 Instrument Transformers
 - .6 Metering Devices, Microprocessor-Based
 - .7 Motor Control, Motor Starters, Low-Voltage
 - .8 Emergency Systems, Uninterruptable Power Systems
 - .9 Emergency Systems, Automatic Transfer Switches
 - .10 Fiber-Optic Cables
 - .4 Startup: follow accepted start-up procedures.
 - .5 Operational testing: document equipment performance.
 - .6 System PV: include repetition of tests after correcting deficiencies.
 - .7 Post-substantial performance verification: to include fine-tuning.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .3 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system communications.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Megger 600-2.4kV circuits, feeder and equipment with a 5000V instrument.
 - .4 Check resistance to ground before energizing.
- .4 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .5 Document requires tests on approved PV forms.
- .6 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be removed from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .2 With assistance of manufacturer develop written maintenance program and submit to Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of Certificate of Substantial Performance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 4 weeks prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
- .3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Cx Authority and Departmental Representative to witness activities and Cx Authority to verify results.
- .2 Notify Cx Authority and Departmental Representative 1 week prior to tests, and confirm 48 hours before test.

1.22 AUTHORITIES HAVING JURISDICTION

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .1 Where start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Cx Authority within 5 days of test and with Cx report.
- .4 Authorities having jurisdiction in this project include Township of Esquimalt, BC, and BC Safety Authority.

1.23 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Cx Authority in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.24 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.25 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Cx Authority.
- .2 Report problems, faults or defects affecting Cx to Cx Authority in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative or Cx Authority.

1.26 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx, leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities, complete Cx prior to issuance of Certificate of Substantial Performance.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Cx Authority.

1.27 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.28 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts and special tools as specified in contract.

1.29 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.30 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .1 Accuracy complies with these specifications.
- .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.31 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 10% of recorded values for mechanical system and within +/- 2% of recorded values for electrical system.

1.32 DEPARTMENTAL REPRESENTATIVE PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

END OF SECTION 01 91 13

COMMISSIONING Cx PLAN

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.
 - .2 Related requirements:
 - .1 Section 01 91 13 General Cx Requirements
 - .2 Section 01 91 33 Cx Forms.
 - .3 Section 01 91 41 Cx Training.
 - .4 Section 01 91 51 Building Management Manual.

1.2 REFERENCES

- .1 CSA Z 320-11.

1.3 GENERAL

- .1 Provide fully functional facilities:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Substantial Performance.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Five Phases of Cx to be Used on This Project
 - .1 System readiness or Pre-functional Testing
 - .2 System start-up, testing, balancing, and adjustment
 - .3 Verification of integrated system performance
 - .4 Demonstration and training
 - .5 Seasonal or deferred testing and verification.
- .5 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems (aka DDC or BAS).
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.

COMMISSIONING Cx PLAN

- .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
 - .9 CxA – Commissioning Authority.
 - .10 DR – Departmental Representative
 - .11 PWGSC – Public Works and Government Services Canada.
 - .12 ECxC – Electrical Commissioning Coordinator.
 - .13 MCxC – Mechanical Commissioning Coordinator.
 - .14 QCM - .Quality control Manger.
 - .15 ECA – Electrical Commissioning Agent.
 - .16 MCA – Mechanical Commissioning Agent.
 - .17 O&M – Operations and Maintenance.
- .5 Commissioning terms used in this Section:
- .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Plan to be 100% completed within 12 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
- .2 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Submit each revised Cx Plan to Commissioning Authority for review every 3 months, and obtain written approval.

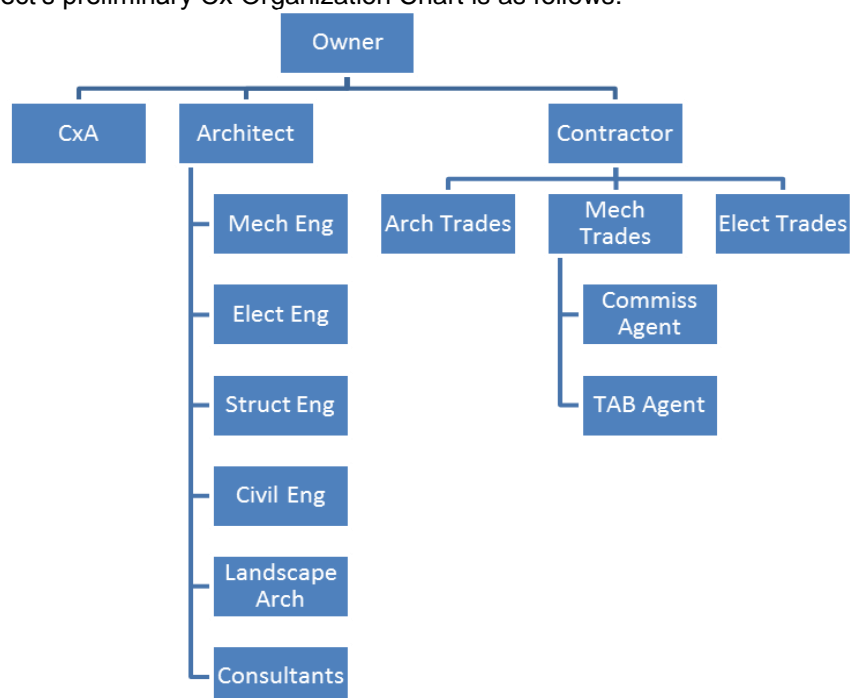
1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 General Contractor to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 The "Commissioning Team" consists of various participants involved in the Cx process. The table below lists team members, and shows some required tasks.

COMMISSIONING Cx PLAN

	Provide Design Intent	Review CxA's Design Review	Review Cx Plan	Respond to CxA Document Review	Attend Cx Meetings	Other Duties Described Herein
PWGSC, DR		✓	✓	✓	✓	✓
PWGSC Cx Manager		✓	✓	✓	✓	✓
Architect		✓	✓		✓	✓
General Contractor			✓			✓
Commissioning Authority:			✓		✓	✓
Contractor's Mechanical Commissioning Agent	✓	✓	✓	✓	✓	✓
Mechanical Engineer	✓	✓	✓	✓	✓	✓
Electrical Engineer	✓	✓	✓	✓		✓
Envelope	✓	✓	✓	✓		✓
Testing and Balancing Agent			✓		✓	✓
Controls Trade Contractor			✓		✓	✓
Electrical Contractor					✓	✓
Manufacturer's Representatives (as applicable)						✓
Inspectors and Testing Agencies						✓

.3 The project's preliminary Cx Organization Chart is as follows:



COMMISSIONING Cx PLAN

The team members' commissioning responsibilities are detailed in the specifications and this Commissioning Plan. The following is a summary table to assist team members in better understanding their roles:

LEGEND: "A" denotes ACCEPT; "L" denotes LEAD;
"P" denotes PARTICIPATE

TASK	Building rep.	Building op's and maint. staff	CxA	Cx provider	DR	Contractor & sub-contractors	Manufacturer's	Independent testing specialists
Concept Phase								
Define owner's project req's	L				P			
Select a Cx authority	L							
Form a Cx team		P	L		P	P	P	
Review OPRs			P		P			
Include Cx responsibilities		P	L		P	P	P	
Determine scope and initial Cx budget	A/L		P		P			
Develop basis of design (BOD)			P		L	P	P	
Develop initial Cx plan outline			L		P	P	P	
Acceptance	A							
Design Phase								
Hold design phase Cx meetings		P	L		P	P	P	P
Identify project-specific Cx responsibilities		P	L		P	P	P	P
Verify OPR and BOD for completeness and clarity			L		P			
Perform Cx-focused design reviews of drawings and specs		P	P		L			
Plan/prepare verification checklists and test procedures			L		P	P	P	P

COMMISSIONING Cx PLAN

Define requirements for systems manuals		P	P		L	P		
Determine operational training requirements		P	L/P		L/P			
Develop Cx specifications	A		P		L			
Prepare Cx report			L					
Update Cx plan			L					
Acceptance	A							
Construction Phase								
Integrate Cx activities into project schedule			P			L		
Hold construction Cx phase kickoff and progress meetings		P	L	P	P	P	P	P
Review contractor submissions and shop drawings			P		L	P		
Construct mock-ups	A	P	P	P	P	L	P	P
Update OPR and BOD	A		P		L			
Perform and document static verification			P	L/P		L/P	P	P
Perform and document start-up			P	P		L	P	P
Perform and document functional performance testing		P	P	L		P	P	P
Prepare and update issues logs			L		P	P		
Resolve issues resulting from all tests			P	P	L	P		
Verify, review, and conduct training		P	P	L	P	P	P	
Review maintenance and data manuals		P	P		L	P		
Review operations manuals		P	P		L	P		

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Prepare Cx report			P	L				
Update Cx plan			L					
Prepare Cx manual			L					
Acceptance	A							
Occupancy & operations phase								
Resolve outstanding Cx issues		P	P	L	P	P	P	P
Perform seasonal/deferred testing		P	P	L		P	P	P
Resolve issues resulting from seasonal/deferred tests		P	P	L	P	P	P	P
Update issues logs resulting from seasonal/deferred tests			L		P	P		
Complete final Cx report		P	L	P	P	P		
Acceptance	A							

General Contractor will select independent Commissioning Agent to ensure Cx activities are carried out to ensure delivery of a fully operational project including:

- .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Review of Cx documentation from operational perspective.
 - .4 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .5 Protection of health, safety and comfort of occupants and O&M personnel.
 - .6 Monitoring of Cx activities, training, development of Cx documentation.
 - .7 Work closely with members of Cx Team.
 - .8 Certifying accuracy of reported results
 - .9 Certifying tabs and other results
 - .10 Developing BMM.
 - .11 Ensuring implementation of final Cx Plan.
 - .12 Implementation of Training Plan
- .4 Departmental Representative is responsible for:
- .1 Witnessing reported results.
 - .2 Witnessing TAB and other tests.
 - .3 Provides basis of design data not included in the Contract Documents.
 - .5 Attends commissioning activities as required to certify the site adaptation and related work meet the design intent and the project requirements.
- .5 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:

COMMISSIONING Cx PLAN

- .1 Testing.
- .2 TAB.
- .3 Performance of Cx activities.
- .4 Delivery of training and Cx documentation.
- .5 Assigning one person as point of contact Departmental Representative for administrative and coordination purposes.
- .6 General Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
 - .5 Performing verification of performance of installed systems and equipment.
- .7 SRDC Facility Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.
- .8 Cx Authority is responsible for:
 - .1 Reviews commissioning checklists and test forms to ensure applicability to the project and provide comments to the Commissioning Agent.

1.7 EXTENT OF CX

- .1 The General Contractor shall provide commissioning services for the mechanical and electrical systems, cranes and process equipment provided under the contract.

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation, including BMM.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

- .1 Deliverables: provide:
 - .1 Cx Work Plans.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.

COMMISSIONING Cx PLAN

- .8 Description of Cx of integrated systems and documentation.
- .9 Tests witnessed by Departmental Representative and/or CxA.
- .10 Training Plans.
- .11 Cx Reports.
- .12 Prescribed activities during warranty period.

1.10 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative and/or CxA prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative and/or CxA will monitor some of these pre-start-up inspections.
 - .3 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and/or CxA.
 - .4 Include completed documentation in Cx report.
- .2 Pre-Cx Activities - MECHANICAL:
 - .1 Plumbing systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

1.11 START-UP

- .1 Once Pre-Start process is complete, start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor to start-up, as appropriate, under Contractor's direction.
- .3 Departmental Representative and/ or CxA to monitor some of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative and/or CxA.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative and/or CxA.
 - .2 Use procedures and modified generic procedures to suit project requirements.
 - .3 Departmental Representative and/or CxA to witness and certify reported results using approved PI and PV forms.
 - .4 Departmental Representative and/or CxA to approve completed PV reports and provide to Departmental Representative.
 - .5 Departmental Representative and/or CxA reserves right to will verify up to 30% of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx agency using procedures approved by Departmental Representative and/or CxA.
- .2 Departmental Representative and/or CxA to monitor Cx activities.

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- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative and/or CxA reserves right to verify a percentage of reported results at no cost to Contract.

1.13 MECHANICAL SYSTEMS TESTING, ADJUSTING AND BALANCING

- .1 Testing:
 - .1 Quality Assurance:
 - .1 Test equipment and material where specified or required by authority having jurisdiction to demonstrate its proper and safe operation.
 - .2 Test procedures shall be in accordance with applicable portions of ASME, ASHRAE, SMACNA, NFPA, CSA and other recognized test codes as far as field conditions permit.
 - .3 Provide notice to the Departmental Representative before tests.
 - .2 Liability: During tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration.
 - .3 Pressure Tests:
 - .1 Provide equipment, materials and labour for tests. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy. Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.
 - .2 Carry out hydraulic tests for 8 hours and maintain pressure. Where leakage occurs, repair and re-test.
 - .3 Refrigerant Piping: Test with nitrogen to 2070 kPa on high pressure side and 1035 kPa on low side and refrigerant halide torch test.
 - .4 Low Pressure Ducts: Test for tightness such that leakage is inaudible and not detectable by feel.
 - .5 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air or nitrogen test medium and halide torch for refrigerant medium.
 - .6 When using water as test medium for system not using water or steam, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.
 - .7 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

1.14 ELECTRICAL TESTING, ADJUSTING AND BALANCING

- .1 Conduct and pay for tests of the following:
 - .1 Distribution system including phasing, voltage, grounding, load balancing, panel 's' prior to energizing.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Carry out tests in presence of the Departmental Representative.

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- .4 Give advance notice of proposed time of tests so that the Departmental Representative can be represented at the tests.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results for review by the Departmental Representative.
- .7 Test all systems in accordance with details in appropriate sections.
- .8 Testing methods and test results: in accordance with CSA, CEC, NETA MTS, and regulations of the supply authority and other authorities having jurisdiction.
- .9 Liability: During tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration.
- .10 Remove and replace with new materials all conductors that are found to be shorted or grounded.
- .11 With the systems completely connected, conduct the following tests on the power system:
 - .1 Control and Switching: test all circuits for the correct operation of devices, switches and controls.
 - .2 Polarity Tests: test all circuits for correct operation of devices, switches and controls.
 - .3 Voltage Tests: make a voltage test at the last outlet of each circuit. Maximum drop in potential permitted will be 2% on 120V, and 208V branch circuits. 2% on 208V feeder circuits and 5% on 600V feeder circuits. Correct any deficiency in this respect.
 - .4 Phase Balance: measure the load on each phase at each switchboard, splitter, distribution panel board and lighting and power panel board. Report results in writing to the Departmental Representative. Re-arrange phase connections as necessary to balance the load on each phase as instructed by the Departmental Representative with the re-arrangement being restricted to the exchanging of connections at the distribution points mentioned in this paragraph. After marking any such changes, make available to the Departmental Representative, drawings or marked prints showing the modified connections.
 - .5 Supply Voltage: measure the line voltage of each phase at the load terminals of the main breakers and report the results in writing to the Departmental Representative. Perform this test with the majority of electrical equipment in use.
 - .6 Motor Loading: measure the line current of each phase of each motor with the motor operating under load and report the results in writing to the Departmental Representative. Upon indications of any imbalance or overload, thoroughly examine electrical connections and rectify any defective parts or wiring. If electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Departmental Representative. Verify motor full load amps and overload relays are properly sized and adjusted accordingly.
 - .7 General Operations: energize and put into operation each and every electrical circuit and item. Make repairs, alterations, replacements, tests and adjustments necessary for a complete and satisfactory operating electrical system.
- .12 Carry out tests covering "General Operation" at the time of acceptance of the work.
- .13 Test all systems installed under this contract and obtain written confirmation from the manufacturer of each system that all components have been installed correctly and that the system is functioning as intended. Present separate certification for all systems including: fire alarm, power distribution, to the Departmental Representative and/or CxA.

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- .14 Provide labour, instruments, apparatus and pay all expenses required for the tests. The Departmental Representative reserves the right to demand proof of the accuracy of all instruments used.
- .15 When tests are performed, the Departmental Representative and/or CxA may require that equipment be opened and removed from their housings to examine interior of equipment, terminations and connections. Provide all required labour and tools.
- .16 Co-ordinate the testing of motors with the trades providing the equipment driven by the motors so that they are carried out at the time the driven equipment is put on test. In addition to the motor loading tests, provide labour and instruments to take and record all motor load readings required to supplement the tests on the driven equipment through various load sequences, as required by the trades involved.
- .17 Test the entire electrical system installed under this contract by performing a loss and return of utility power test. Demonstrate the operation of:
 - .1 High and low voltage service equipment and metering.
 - .2 Exit and emergency lighting.
 - .3 Fire alarm operation during power outage, including remote monitoring system.
 - .4 EMCS system shut down and auto restart, including re-stabilization of systems after power return. Attach printouts as evidence of expected operation on all systems including all air handling systems and pump systems.
 - .5 User equipment shutdown and auto-restart.

1.15 ELEVATOR TESTING

- .1 Refer Specification Section 14 24 00 Elevator Modification Clause 4.1.

1.16 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.17 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.18 PERFORMAMNCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.19 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.20 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative and/or CxA for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.

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- .3 Cx agents' credentials: 60 days before start of Cx.
- .4 Cx procedures: 3 months after award of contract.
- .5 Cx Report format: 3 months after contract award.
- .6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
- .7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
- .8 Notification of intention to start TAB: 21 days before start of TAB.
- .9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
- .10 Notification of intention to start Cx: 14 days before start of Cx.
- .11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
- .12 Identification of deferred Cx.
- .13 Implementation of training plans.
- .14 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.
- .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.21 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative and/or CxA to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative and/or CxA.

1.22 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Full-scale emergency evacuation exercises.

1.23 TESTS TO BE PERFORMED BY DEPARTMENTAL REPRESENTATIVE

- .1 None is anticipated on this project.

1.24 TRAINING PLANS

- .1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.25 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

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2.0 PRODUCTS

NOT USED

3.0 EXECUTION

3.1 SYSTEMS TO BE CX'D

- .1 The proposed is generally comprised of the following systems to be Cx'd:
 - .1 Mechanical Equipment
 - .1 Elevator Mechanical Room Exhaust Fans
 - .2 Elevator Mechanical Room Cooling
 - .3 Elevator Mechanical Room Ventilation
 - .4 DDC Controls
 - .5 BMS (controls) Operator Workstation (software)
 - .2 List of Electrical Equipment and Acceptance Tests:
 - .1 Preventable Inspections - Box, Conduit & Cable Installations
 - .2 Ground system inspection/report
 - .3 Panel S
 - .4 Low Voltage lighting Control
 - .5 Motor Control Centre: Preventable Inspection
 - .6 Wiring Devices Checklist
 - .7 Fire Alarm System
 - .8 Consolidated Load Balance Report
 - .9 Certificates and/or Equipment Test Report
 - .10 Equipment Spare Parts Report
 - .11 Generic Acceptance Report
 - .12 Twelve Step Final Acceptance Report.
 - .3 Elevator:
 - .1 Service Elevator.
 - .2 Passenger Elevator.
- .2 The Contractor shall use the 5 phase Cx process and document the proper operation of the above systems, and the sub-systems they depend on, at least.
- .3 This plan, or any other commissioning document or correspondence, does not relieve contractors from other testing, verification and commissioning duties that may be described in the project specifications or other agreements.

3.2 CXA'S DUTIES

- .1 The Commissioning Authority (CXA) serves as an objective advocate for the Departmental Representative, oversees the commissioning process and presents final recommendations to the Departmental Representative regarding the performance of the commissioned building. Commissioning Authority will perform the following tasks:
 - .1 Support efforts to implement the Building Systems Commissioning requirements throughout the project.
 - .2 List all relevant systems included in the Commissioning scope. The contractors are to provide the detailed equipment lists, checklists, and schedules.
 - .3 Review the design requirements and basis of design.
 - .4 Help coordinate the commissioning-related activities of the "Commissioning Team".
 - .5 Review the Contract Documents to help verify inclusion of commissioning responsibilities.
 - .6 Review Contractor's testing plans and criteria for each of the 5 Cx Phases
 - .7 Organize and chair Cx meetings of the Commissioning Team; facilitate the process of

COMMISSIONING Cx PLAN

- distributing minutes to all Commissioning Team members as required.
- .8 Monitor construction for commissioning-related installation issues.
- .9 Review startup process by observing a sampling of measurements.
- .10 Verify commissioning process of automatic control systems by:
 - .1 Observing a sampling of commissioning
 - .2 Obtaining and reviewing a copy of installation end-to-end check sheets.
 - .3 Reviewing sample trend logs
 - .4 Verifying documentation of the testing of control sequences under all operating modes.
- .11 Verify the documentation of performance of all systems being commissioned and witness a sample of functional performance tests, and review whether the results meet test criteria.
- .12 Verify reported Testing and Balancing results by observing a sampling of measurements.
- .13 Review Operating and Maintenance Manuals for compliance with specified content.
- .14 Review seasonal testing by contractors, and carry out warranty year duties.
- .15 Compile a commissioning report in accordance with the requirements.

3.3 GENERAL CONTRACTOR'S DUTIES

- .1 The General Contractor shall ensure that the following Cx procedures and tests are within the scope of appropriate trades and sub-trades, and that they are performed and documented as required to meet the Owner's Project Requirements:

System	PRE-START	STARTUP	MANUF START RPT	ADJUST	FUNCTIONAL PERFORMANCE	VALIDATION & VERIFICATION
Space Heat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Space Cool	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Controls	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Power	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Power	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire Alarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cranes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- .2 General Contractor will select independent Commissioning Agents and/or Coordinators to ensure Cx activities are carried out to deliver a fully operational project including. Activities include:
 - .1 Planning, scheduling and organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Reviewing Cx documentation from operational perspective.
 - .4 Reviewing for performance, reliability, durability of operation, accessibility, maintainability,
 - .5 Verifying operational efficiency under conditions of operation.
 - .6 Supporting health, safety and comfort of occupants and O&M personnel.
 - .7 Monitoring of Cx activities, training, and development of Cx documentation.
 - .8 Working closely with other members of Cx Team.
 - .9 Certifying accuracy of reported results
 - .10 Certifying tabs and other results
 - .11 Developing BMM.
 - .12 Ensuring implementation of final Cx Plan.

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- .3 The General Contractor shall incorporate the mechanical and electrical Cx schedules into the project's construction schedule, and coordinate milestones with the CxA.
- .4 The General Contractor shall oversee or delegate the preparation for testing and Cx. The following are examples:

DYNAMIC TEST READINESS CHECKLIST

	YES	NO	N/A	DATE	INITIALS
GENERAL					
Applicable tests such as duct/pipe pressure tests submitted					
Construction, painting, millwork and flooring complete in areas served					
Building rooms clean and ready for fan start-up; "All Clean" declared					
AIRSIDE MECHANICAL					
TAB contractor has reviewed the system and completed job preparation					
Ductwork complete, terminals installed, dampers open					
Duct and fan plenum cleaning complete					
Correct filters installed					
Piping complete, gauges installed					
Piping filled, tested, treated and documented					
Valves positioned for testing					
Equipment mounts complete, shipping bolts removed, vibration isolation active					
Equipment lubricated					
Manufacturer's start-up reports received					
PLUMBING & WATERSIDE MECHANICAL					
Drainage connected					
Piping systems flushed out and treated					
Air removed from the system					
DHW systems activated					
CONTROLS					
Control wiring complete					
Control panels mounted and connected					
Thermostats, sensors, actuators, etc. installed					
End-to-end checks completed					
POWER					
Permanent electrical connections complete, including power to starters, rotation checks and overload sizes and settings checked					

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Fire alarm system as per ULC					
Other tests and checks cited herein					

VERIFICATION READINESS CHECKLIST

	YES	NO	N/A	DATE	INITIALS
MECHANICAL					
Balancing complete					
Drive changes complete (as required)					
Applicable inspections by authorities having jurisdiction received					
FIRE PROTECTION					
Fire alarm installed and tested					
CONTROLS					
Control program installed, and verification checklist or de-bugging documentation completed with changes noted. Major changes copied to Departmental Representative for review					

- .5 The General Contractor shall ensure that Training Plans are developed by the appropriate trades and sub-trades, and that they are submitted to Departmental Representative for review.
- .6 The General Contractor shall ensure that Seasonal and Deferred Testing is performed and documented by the appropriate trades and sub-trades, and that the reports are submitted to the CxA for review.

3.4 THE COMMISSIONING AGENT IS RESPONSIBLE FOR:

- .1 Witnessing reported results for tests done by others.
- .2 Witnessing TAB and other tests.
- .3 Providing basis of design data not included in the Contract Documents.
- .4 Preparing an equipment inventory and all functional testing criteria and checklists, as required by the specification and Commissioning Plan for all features and systems requiring commissioning.
- .5 Reviewing commissioning checklists and test forms to ensure applicability to the project and providing comments to the Commissioning Authority.
- .6 Attending commissioning activities as required to certify the site adaptation and related work meet the design intent and the project requirements.

3.5 FACILITY MANAGER: REPRESENTS LEAD ROLE IN OPERATION PHASE AND ONWARDS AND IS RESPONSIBLE FOR:

- .1 Receiving facility on completion.
- .2 Day-To-Day operation and maintenance of facility.

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3.6 GENERAL CONTRACTOR'S DUTIES

- .1 The Mechanical Commissioning Agent (MCA) shall be engaged by the Mechanical Trade Contractor to execute the requirements set out by the CaGBC's documentation, and the Contract Documents. The Commissioning Agent shall perform the following tasks:
 - .1 Prepare an MCA's Commissioning Plan outlining each of the following five phases involved in the Cx process:
 - .1 Phase 1 - System readiness.
 - .2 Phase 2 - System start-up, testing, balancing, and adjustment.
 - .3 Phase 3 - Verification of system performance.
 - .4 Phase 4 - Demonstration and instruction.
 - .5 Phase 5 – Seasonal testing and verification.
 - .2 Prepare an equipment inventory and all functional testing criteria as required by the specifications and Commissioning Plan for all features and systems requiring commissioning.
 - .3 Submit all required testing documentation to the Commissioning Authority and Departmental Representative for review.
 - .4 Attend all commissioning meetings as required by the Commissioning Authority or Departmental Representative.
 - .5 Execute or delegate all commissioning tasks as set out in the final functional testing criteria documents.
 - .6 Coordinate with Trade Contractors regarding sequencing of work. For example, before manufacturer site start-up of AHUs, safety features must be in place, ductwork must be ready, "All Clean" must be declared, power must be connected, hydronics must be cleaned, filled and free of air, controls must have been tested, etc.. Manufacturer start-up must be done prior to air balance, and so on.
 - .7 Record and document the verification of the specified Pre-Start checks, including but not limited to the following:

Compliant make and model,
CSA label,
no visible damage,
proper equipment installation as per specifications and manufacturer's recommendations,
mounting as specified,
seismic restraint as specified,
electrical connection safe and complete,
safety controls & interlocks functional,
operating controls connected and adequately functional,
pre-start safety checks (where applicable),
connection of other services complete,
supporting or related systems in place,
access for maintenance in place,
strainers/filters clean and firmly in place,
isolation valves, dampers or switches in place, set correctly and functional,
alignment of drives and components correct,
proper coil drain pan draining,
bypasses in place and appropriately positioned open or closed,
vibration isolation adjusted,

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- | | |
|--|--|
| | insulation as specified and full coverage, |
| | lubrication complete, |
| | penetrations through fire separations in place as specified, |
| | purges and pressure/leak tests complete and passed, |
| | environment (cleanliness, clearance, cooling, drainage, freeze protection, etc.) good, |
| | water tightness of mechanical service roof and exterior wall penetrations, |
| | air and water distribution cleaned degreased, |
| | charges & pressures correctly set; proper air and water pressure relief in place. |
- .8 Record and document the verification of the specified Startup checks, including but not limited to the following:
- | | |
|--|--|
| | pre-start test passed and conditions still in effect, |
| | qualified personnel present, |
| | confirmation of regulatory authorities' inspections, including reports, |
| | manufacturer or vendor representative present, |
| | factory technician test and start-up (where applicable), |
| | correct rotation, |
| | safety controls operate properly, |
| | operating controls function properly |
| | sequencing correct, |
| | desired temperature/pressure/humidity maintained, |
| | electrical characteristics conform to ratings, |
| | no leaks, |
| | noise as per ratings, |
| | obtain certificates of approval and for compliance with regulations from Authorities Having Jurisdiction; include copies of certificates with startup reports. |
- .9 Immediately after start-up, submit Pre-start checklists and Start-up checklists, signed by the person performing the start-up, to the CxA.
- .10 Prepare Functional performance test checklists containing the step-by-step procedures by which the functional requirements of a system, and its various components, will be confirmed. System's response is to be verified and clearly documented according to the respective manufacturer's written instructions, this plan, and the Contract Documents.
- .11 The MCA is to prepare Functional Performance Test Checklists, including but not limited to the following:
- .1 individual test procedures,
 - .2 the expected system response or acceptance criteria for each procedure,
 - .3 a place to record the actual response or findings,
 - .4 comments pertinent to the ongoing performance of the system and building.
- .12 Each control sequence and strategy shall be tested, verified and documented by the Contractor, including:
- .1 start-up, and shut down,
 - .2 modulation up and down over unit's range of capacity, and/or component staging,
 - .3 unoccupied and manual modes,
 - .4 power failure and backup/restart,
 - .5 abnormal or emergency modes,
 - .6 interlocks and alarms,

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- .7 sensor calibration.
- .13 The checklists are to confirm the Departmental Representative Project Requirements and design intent with respect to the following:
 - .1 electrical characteristics
 - .2 flows,
 - .3 pressures,
 - .4 temperatures
 - .5 overall system control programming and automatic performance and alarms.The goal is to determine whether the installation functions properly under all specified conditions, not that it can be shown to function under one condition. Functional Performance Checklists, signed by the person performing the tests, must be submitted to the CxA immediately after testing.
- .14 Participate in troubleshooting those systems that do not meet the functional testing criteria and provide all necessary follow-up testing and documentation.
- .15 Submit completed functional test documentation to the Commissioning Authority and Departmental Representative for inclusion into the final Commissioning Report.
- .16 Within 2 months of award, provide a preliminary Cx schedule for pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion to the Project Manager and the CxA. Update the schedule as appropriate. Submit information to the Project Manager on a monthly basis to refine the schedule for the commissioning phase of the work. Provide the following information:
 - .1 Building "All Clean"
 - .2 Equipment start-up schedule.
 - .3 Submission dates for the various documents required prior to substantial performance.
 - .4 Timing of the various phases of the commissioning, testing, balancing and training/demonstration process.
- .17 Provide a certificate of building cleanliness: An "All Clean" declaration is to be signed by Departmental Representative and General Contractor. It shall signify that the building and ductwork is adequately clean to allow air distribution start-up without contaminating coils, controls, fan chambers, etc.
- .18 Provide regular updates on project progress, of and witnessing of Cx. MCA to contact Cx Authority prior to Cx, and to provide 48 hours' notice of tests.
- .19 Provide a Commissioning Report as specified in the contract documents and herein.
- .20 Plan, coordinate and execute Departmental Representative and Building Operator training and demonstrations as set out in the specifications and Commissioning Plan.
- .21 Provide two follow-up site visits to re-test and verify occupancy and seasonal-sensitive systems after the facility has been fully occupied. Coordinate seasonal performance verification with CxA. Tests must be done during normal (high) occupancy working hours, and at near winter design conditions, and near summer design conditions. Cx Agent shall review equipment operation, status of energy saving strategies. Submit a report of findings to CxA for each visit. Report to contain the following:
 - .1 Verification of whether conditions meet the Departmental Representative Requirements (as documented by Cx Authority), and whether equipment performance meets the design intent.
 - .2 List of out-of-tolerance conditions, and malfunctioning equipment, components and systems.
Recommendations addressing each problem that was identified.

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Seasonal Test Report – **Mechanical Cx Agent** - Required Sections:

WINTER		SUMMER	
Date: Time of visit: Outdoor Temperature: Outdoor Cloud Cover: Areas too hot: Areas too cold: Areas Humidity: Areas With High Noise:		Date: Time of visit: Outdoor Temperature: Outdoor Cloud Cover: Areas too hot: Areas too cold: Areas Humidity: Areas With High Noise:	
Air distribution equipment operating properly: <div style="text-align: right;">Occupant Concerns</div> <div style="text-align: right;">Operator Concerns</div>		Air distribution equipment operating properly: <div style="text-align: right;">Occupant Concerns</div> <div style="text-align: right;">Operator Concerns</div>	
<i>Owner Requirements</i> being met for plumbing. List of Equipment Functioning Improperly Problems:		<i>Owner Requirements</i> being met for plumbing. List of Equipment Functioning Improperly Problems:	
1	Description: <div style="text-align: right;">Solution: Recommendation:</div>	1	Description: <div style="text-align: right;">Solution: Recommendation:</div>
2	Description: <div style="text-align: right;">Solution: Recommendation:</div>	2	Description: <div style="text-align: right;">Solution: Recommendation:</div>
3	Description: <div style="text-align: right;">Solution: Recommendation:</div>	3	Description: <div style="text-align: right;">Solution: Recommendation:</div>

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- .22 Depending on the details of the contractors' contracts among themselves, either the Mechanical Cx Agent, or the mechanical trade shall provide further Seasonal Testing as follows:

Seasonal Test Report – **Mechanical Contractor** Required Sections

Six Months After Occupancy					
	Date: Time of visit: Outdoor Temperature: Outdoor Cloud Cover: Areas too hot: Areas too cold: Areas Humidity: Areas With High Noise:				
	<table style="width: 100%;"> <tr> <td style="width: 70%; vertical-align: top;"> Air distribution equipment operating properly: </td> <td style="width: 30%; vertical-align: top; text-align: right;"> Filters not bypassing and clean Vibration/noise acceptable Leaks found and plugged Warranty Issues </td> </tr> </table>	Air distribution equipment operating properly:	Filters not bypassing and clean Vibration/noise acceptable Leaks found and plugged Warranty Issues		
Air distribution equipment operating properly:	Filters not bypassing and clean Vibration/noise acceptable Leaks found and plugged Warranty Issues				
	Owner Requirements being met (details) List of Equipment Functioning Improperly				
Problems:					
1	<table style="width: 100%;"> <tr> <td style="width: 60%;">Description:</td> <td style="width: 40%;">Solution:</td> </tr> <tr> <td></td> <td>Recommendation:</td> </tr> </table>	Description:	Solution:		Recommendation:
Description:	Solution:				
	Recommendation:				
2	<table style="width: 100%;"> <tr> <td style="width: 60%;">Description:</td> <td style="width: 40%;">Solution:</td> </tr> <tr> <td></td> <td>Recommendation:</td> </tr> </table>	Description:	Solution:		Recommendation:
Description:	Solution:				
	Recommendation:				
3	<table style="width: 100%;"> <tr> <td style="width: 60%;">Description:</td> <td style="width: 40%;">Solution:</td> </tr> <tr> <td></td> <td>Recommendation:</td> </tr> </table>	Description:	Solution:		Recommendation:
Description:	Solution:				
	Recommendation:				

Provide a report which describes problems, solutions, and suggested improvements revealed in the first months of operation (Word and Excel format).

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3.7 TESTING & BALANCING AGENT DUTIES

- .1 The Testing and Balancing Agent (TAB) shall be engaged by the Mechanical Trade Contractor to execute the contract requirements to meet the design intent and the Commissioning Authority. The TAB Agent must perform the following tasks:
- .1 Prepare functional testing criteria (including specific documentation) as required by the Commissioning Plan for all features and systems requiring testing or balancing.
 - .2 Submit all required testing documentation to the Commissioning Authority and Departmental Representative for review, including schedule, proposed procedures, and sample forms.
 - .3 Visit the site prior to TAB to review adequacy (quantities, locations and types) of balance-related devices. Provide a pre-TAB report of findings to the CxA.
 - .4 Attend all commissioning meetings as required by the Commissioning Authority.
 - .5 Provide Cx Authority with 7 days' notice of TAB testing periods.
 - .6 Execute or delegate all TAB tasks as set out in the final functional testing criteria documents.
 - .7 Coordinate with trade contractors regarding sequencing of work. For example, before balancing, ductwork must be ready, safeties must be functioning, power must be connected, hydronics to be filled and free of air, controls to have been tested, and, in the case of air distribution, the "All Clean" status must have been granted. Manufacturer start-up must be done prior to air balance, and so on.
 - .8 Provide the following TAB Process Quality Assurance Review to the CxA 2 months prior to commencement of balancing:

PROJECT: Summerland Elevator Upgrade
DATE: (Month)

	Test process	Test Equip	Equip Calibration	Test Staff	Staff Experience	Pass/Fail Criteria
AHU CFM			Certificate from X dated X	Mr John Doe	X yr; X projects; Qualifications	+/- X% from spec
Max/Min OAD Volumes			Certificate from X dated X	Ms Jane Doe	X yr; X projects; Qualifications	+/- X% from spec
Exhaust Fan Flows			Certificate from X dated X	Mr John Doe	X yr; X projects; Qualifications	+/- X% from spec
Diffuser Flows			Certificate from X dated X	Ms Jane Doe	X yr; X projects; Qualifications	+/- X% from spec
Pump Flows			Certificate from X dated X	Mr John Doe	X yr; X projects; Qualifications	+/- X% from spec
Heat Terminals			Certificate from X dated X	Ms Jane Doe	X yr; X projects; Qualifications	+/- X% from spec
DX AC			Certificate from X dated X	Mr John Doe	X yr; X projects; Qualifications	heat, cool, air change, OA CFM, controls

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- .9 At the completion of balancing, and following review of the TAB report, visit the site with the CxA and retest a sampling of balanced air. The CxA could require that up to 5% of terminals be verified, depending on the results of initial tests.
- .10 Participate in troubleshooting those systems that do not meet the functional testing criteria and provide all necessary follow-up testing and documentation.
- .11 Submit completed functional test documentation to the Commissioning Authority and Departmental Representative for inclusion into the final Commissioning Report.
- .12 Provide O&M Manuals as specified. Provide sections of O&M Manual for inclusion in Systems Recommissioning Manual to CxA, in Word and Excel file format, as required.
- .13 Plan and execute demonstrations and training as set out in the Commissioning Plan or specifications.
- .14 Provide deferred or seasonal functional performance testing and documentation of proper operation during warrantee period. Seasonal test to be done so that systems' performance is reviewed during both warm (summer) days and cold (winter) days. Correct deficiencies and make necessary adjustment to O&M manuals and as-built drawings.

Seasonal Test Report – TAB Agent- Required Sections:

Three, Six or Nine Months After Occupancy	
	Date: Time of visit: Outdoor Temperature: Outdoor Cloud Cover: Areas too hot: Areas too cold: Areas Humidity: Areas With High Noise:
	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> Air distribution equipment operating properly: Motor rotation Volumes still as per design intent Supply Air Temperatures appropriate and efficient Outdoor Air volumes minimal for heating, max for free cooling </div> Flow and ventilation Owner Requirements being met (details) List of Equipment Functioning Improperly
	Problems:
1	Description: Solution: Recommendation:
2	Description: Solution: Recommendation:
3	Description: Solution: Recommendation:

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3.8 CONTROLS CONTRACTOR DUTIES

- .1 The Controls Trade Contractor shall provide a Commissioning Agent (CCA) from their staff to:
- .2 Prepare a CCA's Commissioning Plan outlining each of the following five phases involved in the Cx process:
 - .1 Phase 1 - System readiness (clean, grounded, interlocked, mounted properly, accessible, etc.).
 - .2 Phase 2 - System start-up, testing, balancing, and adjustment.
 - .3 Phase 3 - Verification of system performance.
 - .4 Phase 4 - Demonstration and instruction.
 - .5 Phase 5 – Seasonal testing and verification.
- .3 Prepare Functional Performance Test Checklists as a record that all controls provided have been inspected, checked and verified for proper installation and performance. Prepare an equipment inventory and all functional testing criteria as required by the specifications and Commissioning Plan for all features and systems requiring commissioning. Example checklists are as follows:

CONTROLLERS	Controller	Card	Card
ITEM INSPECTED	1	Expansion Module 1	Expansion Module 2
	Y/N/na	Y/N/na	Y/N/na
Shop drawings approved			
Software licensing in place			
QC inspection report reviewed and deficiencies corrected			
Device matches specified products			
Devices mounted and restrained properly			
Number of control panels & system architecture correct			
Number of points monitored is correct			
Conduit, plenum-rated cable and flex connections selected and installed appropriately			
Wire shielding is correct			
Control device properly located and installed			
Devices and components tagged and identified at all terminations, splices, and junctions			
Point lists present inside panel			
Software and hardware alarms are in place			
Connection to EMCS Server DDC network is made			

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CONTROLLERS	Controller	Card	Card
ITEM INSPECTED	1	Expansion Module 1	Expansion Module 2
	Y/N/na	Y/N/na	Y/N/na
Graphics accepted by ME & Departmental Representative			
BACnet interface between proprietary controls and DDC system are functioning properly			
Trend-log in place for all necessary inputs, outputs, variables			
Operating software complete, including energy strategies (weekly and annual schedules, economizers, optimized water and air set points, optimized motor speeds, etc.).			
REMARKS/COMMENTS:			
ACKNOWLEDGED			
Controls Contractor:			
MCA:			

INPUT POINTS	Card	Inputs	
ITEM INSPECTED	1	1ip1	1ip2
		Y/N/na	Y/N/na
Shop drawings approved			
QC inspection report reviewed and deficiencies corrected			
Devices matches specified products			
Devices mounted and restrained properly			
Number of points monitored is correct			
Conduit, plenum-rated cable and flex connections selected and installed appropriately			
Wire shielding is correct			
Control device properly located and installed			
Sensors and devices calibrated and verified			
Devices and components tagged and identified at all terminations, splices, and junctions			
Trend-log in place for all necessary (inputs, outputs, variables)			
REMARKS/COMMENTS:			
ACKNOWLEDGED			
Controls Contractor:			
MCA:			

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OUTPUT POINTS	Card	Outputs	
ITEM INSPECTED	1	1OP1	1OP2
	Y/N/na	Y/N/na	Y/N/na
Shop drawings approved			
Sequences of operation are understood and make sense			
QC inspection report reviewed and deficiencies corrected			
Devices matches specified products			
Devices mounted and restrained properly			
Conduit, plenum-rated cable and flex connections selected and installed appropriately			
Wire shielding is correct			
Control device properly located and installed			
Sensors and devices calibrated and verified			
Devices and components tagged and identified at all terminations, splices, and junctions			
Software and hardware alarms are in place			
BACnet interface between proprietary controls and DDC system are functioning properly			
Trend-log in place for all necessary (inputs, outputs, variables)			
REMARKS/COMMENTS:			
ACKNOWLEDGED			
Controls Contractor:			
MCA:			

- .4 If a digital control, Building Automation System, or EMCS is not installed, then the requirements relating to servers, networks, graphics, BACnet, etc. are not applicable. However, other items listed above that are applicable to conventional controls shall be verified and documented.
- .5 Submit all required testing documentation to the Commissioning Authority and Departmental Representative for review.
- .6 Attend all commissioning meetings as required by the Commissioning Authority or Departmental Representative.
- .7 Execute or delegate all commissioning tasks as set out in the final functional testing criteria documents.
- .8 Verify that systems are functionally meeting the design intent, and produce a Cx Report documenting this, and identifying where design intent is not being met.

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- .9 Controls Contractor to provide O&M Manual, including sequences of operation, network diagrams, graphics, shop drawings, recommended post-occupancy calibration, test and maintenance procedures, etc. to CxA. Submit in Word and Excel file format, as required.
- .10 Controls Contractor to provide training and training materials for temperature controls, controls operation and reporting, energy conservation strategies, and other control items having an impact on building or system operation.
- .11 Provide deferred or seasonal functional performance testing and documentation of proper operation during warrantee period. Seasonal test to be done during normal working hours, and so that systems' performance is reviewed during both warm (summer) days and cold (winter) days. Correct deficiencies and make necessary adjustment to O&M manuals and as-built drawings.

Seasonal Test Report – **Controls Contractor** - Required Sections:

Three, Six or Nine Months After Occupancy	
Date: Time of visit: Outdoor Temperature: Outdoor Cloud Cover: Areas too hot: Areas too cold: Areas Humidity: Areas With High Noise:	
Control system operating properly:	Sequences in "auto" Minimal simultaneous heating and cooling Time Schedules correct
Owner Energy and Temp Control Requirements being met (details) List of Equipment Functioning Improperly Problems:	
1	Description: <div style="text-align: right; margin-top: 10px;"> Solution: Recommendation: </div>
2	Description: <div style="text-align: right; margin-top: 10px;"> Solution: Recommendation: </div>
3	Description: <div style="text-align: right; margin-top: 10px;"> Solution: Recommendation: </div>

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3.9 ELECTRICAL TRADE CONTRACTOR DUTIES

- .1 The Electrical Trade Contractor shall provide a Commissioning Agent or Coordinator (ECA) to
 - .1 Prepare an ECA's Commissioning Plan outlining each of the following five phases involved in the Cx process:
 - .1 Phase 1 - System readiness (clean, grounded, interlocked, mounted properly, accessible, etc.).
 - .2 Phase 2 - System start-up, testing, balancing, and adjustment.
 - .3 Phase 3 - Verification of system performance.
 - .4 Phase 4 - Demonstration and instruction.
 - .5 Phase 5 – Seasonal testing and verification.
 - .2 Conduct and pay for tests of the following:
 - .1 Low voltage breaker set-up, calibration, testing and reporting.
 - .2 Megger testing
 - .3 Voltage testing
 - .4 Phase rotation testing
 - .5 Motors heaters and controls.
 - .6 Polarization testing of receptacles and utilization devices
 - .7 Lighting systems and controls
 - .8 Illumination testing
 - .9 Testing and reporting and certification of fire alarm and emergency alarm systems.
 - .10 Such additional testing as required for completion of the test forms laid out in 01 91 31.
 - .3 Furnish manufacturer's certificate or letter confirming that entire installation relating to their product has been installed to manufacturer's instructions.
 - .4 Carry out tests in presence of the Commissioning Authority.
 - .5 Give advance notice of proposed time of tests so that the Commissioning Authority can be represented at the tests.
 - .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
 - .7 Submit test results for review by the Commissioning Authority.
 - .8 Test all systems in accordance with details in appropriate sections.
 - .9 Testing methods and test results: in accordance with CSA, CEC, NETA MTS, and regulations of the supply authority and other authorities having jurisdiction.
 - .10 Liability: During tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration.
 - .11 Remove and replace with new materials all conductors that are found to be shorted or grounded.
 - .12 With the systems completely connected, conduct and document the following tests on the power system:
 - .1 Control and Switching: test all circuits for the correct operation of devices, switches and controls.
 - .2 Polarity Tests: test all circuits for correct operation of devices, switches and controls.
 - .3 Voltage Tests: make a voltage test at the last outlet of each circuit. Maximum drop in potential permitted will be 2% on 120V, and 208V branch circuits. 2% on 208V feeder circuits, and 5% on 600V feeder circuits. Correct any deficiency in this respect.
 - .4 Phase Balance: measure the load on each phase at each switchboard, splitter, distribution panel board and lighting and power panel board. Report results in writing to the Commissioning Authority. Re-arrange phase connections as

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- necessary to balance the load on each phase as instructed by the Commissioning Authority with the re-arrangement being restricted to the exchanging of connections at the distribution points mentioned in this paragraph. After marking any such changes, make available to the Commissioning Authority, drawings or marked prints showing the modified connections.
- .5 Supply Voltage: measure the line voltage of each phase at the load terminals of the main breakers and report the results in writing to the Commissioning Authority. Perform this test with the majority of electrical equipment in use.
- .6 Motor Loading: measure the line current of each phase of each motor with the motor operating under load and report the results in writing to the Commissioning Authority. Upon indications of any imbalance or overload, thoroughly examine electrical connections and rectify any defective parts or wiring. If electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Departmental Representative. Verify motor full load amps and overload relays are properly sized and adjusted accordingly.
- .7 General Operations: energize and put into operation each and every electrical circuit and item. Make repairs, alterations, replacements, tests and adjustments necessary for a complete and satisfactory operating electrical system.
- .13 Carry out tests covering "General Operation" at the time of acceptance of the work.
- .14 Test all systems and obtain written confirmation from the manufacturer of each system that all components have been installed correctly and that the system is functioning as intended. Present separate certification for all systems including: fire alarm, power distribution, to the Commissioning Authority.
- .15 Provide labour, instruments, apparatus and pay all expenses required for the tests. The Departmental Representative reserves the right to demand proof of the accuracy of all instruments used.
- .16 When tests are performed, the Departmental Representative may require that equipment be opened and removed from their housings to examine interior of equipment, terminations and connections. Provide all required labour and tools.
- .17 Co-ordinate the testing of motors with the trades providing the equipment driven by the motors so that they are carried out at the time the driven equipment is put on test. In addition to the motor loading tests, provide labour and instruments to take and record all motor load readings required to supplement the tests on the driven equipment through various load sequences, as required by the trades involved.
- .18 Test the entire electrical system by performing a loss and return of utility power test. Demonstrate the operation of user equipment shutdown and auto-restart.
- .19 Prepare Functional Performance Test Checklists that will be a record that all electrical services provided have been inspected, checked and verified for proper installation and performance. Prepare an equipment inventory and all functional testing criteria as required by the specifications and Commissioning Plans for all features and systems requiring commissioning. The system list overview is; but not limited to the following:

COMMISSIONING Cx PLAN

CHECKLIST	Cx Plans			Cx Execution			
	Submitted	Reviewed	Updated	Complete	Reviewed	Notes	Comments
Molded Case Circuit Breakers							
Installation of Electrical Equipment: Conduits, trays Cables and Boxes							
Installation of Electrical Equipment: Utilization Devices – Outlets and Heating/Cooling							
Motor Control and Motor Starters							

Note: there may be Cx requirements in other sections of the specification.

- .20 Submit all required testing documentation to the Commissioning Authority and Departmental Representative for review. For example:
 - .1 Implementation of Coordination Study Settings
 - .2 Certificates and/or Equipment Test Report
 - .3 Equipment Spare Parts Report
 - .4 Generic Acceptance Report
 - .5 Final Acceptance Report.
- .21 Attend all commissioning meetings as required by the Commissioning Authority or Departmental Representative.
- .22 Execute or delegate all commissioning tasks as set out in the final functional testing criteria documents.
- .23 Verify that systems are functionally meeting the design intent, and produce a Cx Report documenting this, and identifying where design intent is not being met.
- .24 Electrical Trade Contractor to provide O&M Manual, sequences of operation, recommended post-occupancy calibration, test and maintenance procedures, etc. to CXA for inclusion in Systems Recommissioning Manual. Submit in Word and Excel file format, as required.
- .25 Electrical Trade Contractor to provide training and training materials
- .26 Provide deferred or seasonal functional performance testing and documentation of proper operation during warrantee period. Seasonal test to be done during normal working hours, and so that systems' performance is reviewed during both long (summer) days and short (winter) days. Correct deficiencies and make necessary adjustment to O&M manuals and as-built drawings.
- .27 Allow minimum 8 hours for each of two site visits for seasonal/deferred testing and reporting. 16 hours total.

COMMISSIONING Cx PLAN

Seasonal Test Report – **Electrical Contractor & Cx Agent** - Required Sections:

Three to Nine Months After Occupancy	
<p>Date: Time of visit: Outdoor Temperature: Outdoor Cloud Cover:</p> <p>Areas too dark: Areas too bright:</p>	
<p>Lighting</p> <p>Power equipment operating properly:</p> <p>Power quality still good; phase output, phase to phase output, power factor, etc. acceptable</p> <p>Line voltage controls by Elect operating properly</p> <p>List of Equipment Functioning Improperly</p> <p>Problems:</p>	
1	<p>Description:</p> <p>Solution: Recommendation:</p>
2	<p>Description:</p> <p>Solution: Recommendation:</p>
3	<p>Description:</p> <p>Solution: Recommendation:</p>

COMMISSIONING Cx PLAN

**3.10 REQUIRED WRITTEN WORK PRODUCTS – DEPARTMENTAL REPRESENTATIVE, AND TRADES
OTHER THAN CX AGENCIES, CONTROLS AND ELECTRICAL**

- .1 COMMISSIONING AUTHORITY
 - .1 Schematic design review.
 - .2 CxA'S Cx Plan (this document),
 - .3 Review of construction documents,
 - .4 Commissioning Binder, Systems Manual and 10 Month Warranty Report.
- .2 DEPARTMENTAL REPRESENTATIVE
 - .1 Contract Documents clearly require that features, equipment and systems are to be installed in such a way that TAB and commissioning are facilitated. The documents shall also identify Trade Contractors' responsibilities for execution and documentation of the Commissioning Process.
 - .2 Shop drawing process:
 - .1 The contractor is to forward the shop drawings to Departmental Representative for review
 - .2 The Departmental Representative will forward shop drawings to the CxA..
 - .3 All Change Orders and Site Instructions are to be copied to the CxA. Departmental Representative to verify that changes are in keeping with the Project Requirements.
 - .4 Reviews and approvals of insulation, air barrier, walls, windows, roof and skylights by Departmental Representative to document that envelope assemblies control water and air leakage, and condensation properly - so that negative impact on energy required is minimized, and negative impact on IAQ is eliminated. CxA to receive copies of all such Field Reviews and test reports.
 - .5 Training overview material is required from Departmental Representative, including how the building keeps air and water out; what kind of envelope maintenance may be required and when; unusual items, etc. Design intents are required from the contract document.
 - .6 Reviews and acceptance of electrical power and lighting components and of proper system installation and operation.
 - .7 Reviews and acceptance of mechanical components, and of proper system installation and operation.
 - .8 Building "All Clean" certification is required to allow fan operation. The Departmental Representative and General Contractor shall jointly sign a letter declaring that the building and systems are clean enough to run the fans.
 - .9 Reviews of TAB and commissioning submittals and documents by Departmental Representative, with written acceptance forwarded to the CxA for inclusion in the Commissioning Report.
- .3 TRADE CONTRACTORS
 - .1 Construction Schedule integrating all divisions of the work, and allowing adequate time for submittal reviews, commissioning of equipment, verification of systems' operation, and the demonstration to (and training of) the Departmental Representative, review of operating and maintenance and Cx manuals. The schedule shall include, but not be limited to, the following items:
 - .1 Installation and testing of piping systems and equipment, including protection of heat exchangers during cleaning.
 - .2 Installation and cleaning of air distribution systems and equipment.
 - .3 Connection of electrical services to equipment by electrical trade contractor.
 - .4 Chemical cleaning and treatment of water distribution systems.
 - .5 Control system installation.
 - .6 Pre-start checks.

COMMISSIONING Cx PLAN

- .7 Start-up of equipment and systems.
- .8 Air/Water balancing, including samples witnessed by CXA.
- .9 Check-out of control systems.
- .10 Commissioning of systems, including samples witnessed by CXA.
- .11 Correction of deficiencies and retests.
- .12 Demonstration of systems and equipment to Departmental Representative and other representatives of the project.
- .13 Preparation of maintenance manuals and as-built drawings.
- .14 Submission of the various documents required prior to substantial performance.
- .15 Project closeout documents.
- .2 Contractor Submittal Drawings and Equipment Data: Submittals will be reviewed by Departmental Representative and CXA to help verify that the systems and equipment being supplied are consistent with the required commissioning test procedures, and if not, that the variances are acceptable to the Team, and that commissioning checklists are revised accordingly.
- .3 Approved Pre-start checklists and Start-up checklists must be completed prior to start-up of each specific system or piece of equipment. Checklists, signed by the person performing the start-up, must be submitted to the CXA immediately after start-up.
- .4 Functional performance verifications for equipment and systems must be performed, and redone until proper system performance is verified.
- .5 As-built drawings forwarded by installing contractors. The various trades shall mark-up the contract drawings to indicate design or layout changes that took place during construction.
- .6 Training materials by sub-trades to meet the requirements of See Section 01 91 41.
- .7 Reports on seasonal testing and documentation of proper operation during warrantee period.
- .8 See other sections for specific MCA, ECA, CCA, and TAB Trade requirements and duties.
- .9 The following tables provides a partial checklist of submittals required by each sub-trade:

DESCRIPTION	FORMAT			FROM			
	PDF	.doc .xls	sign-off	Departmental Representative	Cx Agent	TAB	Mech Contractor
Cx Plan (5 Phases), Process, Inventories and Checklists		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cx Schedule (5 Phases)		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Preliminary O&M Manual from Cx Agents		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reviewed TAB Report	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			
<i>TAB Report Test Performance Sheets</i>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reviewed O&M Manual	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>			
<i>System Descriptions and all sections described in Contract Doc's</i>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	
<i>Validation Of Testing and Balancing</i>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Training Plans		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Validation of Fire Damper Operation			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Training Materials and Validation of Departmental Representative Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deferred & Seasonal System Tests, Adjustments and Reports	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

COMMISSIONING Cx PLAN

DESCRIPTION	FORMAT			Mech Contractor	Controls Contractor
	PDF	.doc .xls	sign-off		
Controls Cx Plan (5 Phases), Inventories and Checklists		<input type="checkbox"/>			<input type="checkbox"/>
Cx Schedule (5 Phases)		<input type="checkbox"/>			<input type="checkbox"/>
Preliminary O&M Manual from Cx Agents		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
<i>Signed Commissioning Checklists</i>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
<i>DDC & Other Controls Sequences of Operation</i>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>
<i>Controls Checkouts</i>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>
<i>Recommended Post-Occ Calib, Test & Maint Procedures</i>		<input type="checkbox"/>			<input type="checkbox"/>
Training Plan	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Training Materials and Validation of Departmental Representative Training		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Seasonal System Tests, Adjustments and Reports		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

DESCRIPTION	FORMAT			FROM
	pdf	.doc .xls	Sign off	Electrical Contractor
Cx Plan (5 Phases) Inventories and Checklists				<input type="checkbox"/>
Cx Schedule (5 Phases)				<input type="checkbox"/>
Preliminary O&M Manual from Cx Agents		<input type="checkbox"/>		<input type="checkbox"/>
Validation of Power Systems Operation			<input type="checkbox"/>	<input type="checkbox"/>
Reviewed Commissioning Report	<input type="checkbox"/>	<input type="checkbox"/>		
Start-up and Operation Requirements – Electrical Systems			<input type="checkbox"/>	<input type="checkbox"/>
Signed Commissioning Checklists	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
Reviewed O&M Manual	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
System Descriptions	<input type="checkbox"/>	<input type="checkbox"/>		
Reviewed Controls Manual	<input type="checkbox"/>	<input type="checkbox"/>		
Line Voltage Controls Checkouts	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
Electrical Training Plan				<input type="checkbox"/>
Validation of Penetrations Through Separations			<input type="checkbox"/>	<input type="checkbox"/>
Validation of Seismic Restraint Installation			<input type="checkbox"/>	<input type="checkbox"/>
Validation of Vibration Isolation			<input type="checkbox"/>	<input type="checkbox"/>
Validation of Electrical System Demonstration			<input type="checkbox"/>	<input type="checkbox"/>
Training Materials and Validation of Departmental Representative Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Problems & Suggestions in First Few Months		<input type="checkbox"/>		<input type="checkbox"/>
Seasonal System Tests, Adjustments and Reports	<input type="checkbox"/>			<input type="checkbox"/>

COMMISSIONING Cx PLAN

DESCRIPTION	FORMAT			FROM Electrical Trade
	PDF	.doc .xls	sign-off	
Cx Schedule (5 Phases)				<input type="checkbox"/>
Power Shop Drawings	<input type="checkbox"/>			<input type="checkbox"/>
Electrical Training Plan	<input type="checkbox"/>			<input type="checkbox"/>
Validation of Fire Stopping	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Letters of Assurance from Trades' Departmental Representative	<input type="checkbox"/>			<input type="checkbox"/>
Validation of Items To Be Handed Over To Departmental Representative	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Validation of Electrical System Demonstration	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Training Materials and Validation of Departmental Representative Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Record Drawings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

END OF SECTION 01 91 31

COMMISSIONING FORMS

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Cx Authority. Check lists will be required during Commissioning and will be included in Building Management Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative approval.

COMMISSIONING FORMS

1.5 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Contractor provides project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51 - Building Management Manual (BMM).

1.6 LANGUAGE

- .1 To suit the language profile of the awarded contract.

END OF SECTION 01 91 33

COMMISSIONING TRAINING

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Sections:
 - .1 General Commissioning (Cx) Requirements Section 01 91 13
 - .2 Commissioning (Cx) Plan Section 01 91 31

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Departmental Representative will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.

COMMISSIONING TRAINING

- .4 Management Manual.
- .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 8 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials.
- .2 Commissioning Agent will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Commissioning Agent.

1.8 MECHANICAL SYSTEM TRAINING

- .1 Organize and conduct training courses to instruct the Departmental Representative in the operation and preventative maintenance of equipment and systems provided at the completion of the project.
- .2 Provide services of qualified personnel, including each sub-trade, each major equipment supplier and Departmental Representative to and instruct on their equipment or systems.
- .3 One-person day shall be eight hours including one half hour for breaks, and one person week shall be five person days.
- .4 Submit sessions schedule and list of representatives to the Departmental Representative for approval 30 days prior to course starting date. Confirm attendance of course by written notification to all participants, followed by verbal confirmation just prior to course starting date.
- .5 Submit final copies of record drawings and operating and maintenance manuals to Departmental Representative.
- .6 Submit a written follow-up of all courses, complete with an attendants list to the Departmental Representative.

COMMISSIONING TRAINING

- .7 Systems Course: Allow a minimum of 8 hours of instruction to conduct systems training courses addressing the following topics:
 - .1 Air Systems:
 - .1 Review operation of systems and equipment:
 - .1 Propane gas systems
 - .2 All exhaust systems
 - .2 Review equipment maintenance.
 - .2 Site Services:
 - .1 Sanitary/storm/domestic water.

1.9 ELECTRICAL SYSTEM TRAINING

- .1 Organize and conduct training courses to instruct the Departmental Representative in the operation and preventative maintenance of equipment and systems provided at the completion of the project.
- .2 Provide services of qualified personnel, including each sub-trade, each major equipment supplier and design Departmental Representative to and instruct on their equipment or systems.
- .3 One-person day shall be eight hours including one half hour for breaks, and one person week shall be five person days.
- .4 Submit sessions schedule and list of representatives to the Departmental Representative for approval 30 days prior to course starting date. Confirm attendance of course by written notification to all participants, followed by verbal confirmation just prior to course starting date.
- .5 Submit final copies of record drawings and operating and maintenance manuals to Departmental Representative. Submit a written follow-up of all courses, complete with an attendants list to the Departmental Representative.
- .6 Systems Course: Allow a minimum of 4 hours of instruction to conduct systems training courses addressing the following topics:
 - .1 Standard Power Systems:
 - .1 Review operation of systems and equipment.

END OF SECTION 01 91 41

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.
- .2 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 HVAC - Heating, Ventilation and Air Conditioning.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.
 - .7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

- .1 Standard letter size paper 216 mm x 279 mm.
- .2 Methodology used to facilitate updating.
- .3 Drawings, diagrams and schematics to be professionally developed.
- .4 Electronic copy of data to be in a PDF with hyperlink from content page to individual sections.

1.3 APPROVALS

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

1.4 GENERAL INFORMATION

- .1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
 - .1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
- .2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
 - .1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
- .3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
- .4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.
- .5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

BUILDING MANAGEMENT MANUAL (BMM)

- .6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.
- .7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.
- .8 Operating and maintenance manual - Section 3.2 of BMM.
- .9 Final commissioning plan as actually implemented.
- .10 Completed commissioning checklists.
- .11 Commissioning test procedures employed.
- .12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.
- .13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

- .1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.
- .2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.
- .3 Include original manufacturer's brochures and written information on products and equipment installed on this project.
- .4 Record and organize for easy access and retrieval of information contained in BMM.
- .5 Include completed PI report forms, data and information from other sources as required.
- .6 Inventory directory relating to information on installed systems, equipment and components.
- .7 Approved project shop-drawings, product and maintenance data.
- .8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.
- .9 Inventory and location of spare parts, special tools and maintenance materials.
- .10 Warranty information.
- .11 Inspection certificates with expiration dates, which require on-going re-certification inspections.
- .12 Maintenance program supporting information including:
 - .1 Recommended maintenance procedures and schedule.
 - .2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Content of Manual:
 - .1 All possible Emergency situations modes including: presence of fire and smoke, power failure, loss of water or pressure, chemical spills and refrigerant release.
 - .2 HVAC emergencies and fuel supply failures.
 - .3 Intrusion and security breach.
 - .4 Emergency provisions for natural disasters, bomb threats and other disruptive situations.
 - .5 Dedicated emergency generators for high security projects, medical facilities and computer systems.
 - .6 Emergency control procedures for fire, power and major equipment failure.
 - .7 Emergency contacts and numbers.
 - .8 Manual to be readily available and comprehensible to non- technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

- .1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
 - .1 General:
 - .1 Finalized commissioning plan.
 - .2 WHMIS information manual.
 - .3 Approved "as-built" drawings and specifications.
 - .4 Procedures used during commissioning.
 - .5 Cross-Reference to specification sections.
 - .2 Architectural and structural:
 - .1 Inspection certificates, construction permits.
 - .2 PV reports.
 - .3 Fire prevention, suppression and protection:
 - .1 Test reports.
 - .2 Smoke test reports.
 - .3 PV reports.
 - .4 Mechanical:
 - .1 Installation permits, inspection certificates.
 - .2 Piping pressure test certificates.
 - .3 Ducting leakage test reports.
 - .4 TAB and PV reports.
 - .5 Charts of valves and steam traps.
 - .6 Copies of posted instructions.
 - .5 Electrical:
 - .1 Installation permits, inspection certificates.
 - .2 TAB and PV reports.
 - .3 Electrical work log book.
 - .4 Charts and schedules.
 - .5 Locations of cables and components.
 - .6 Copies of posted instructions.
 - .6 Elevator:
 - .1 Refer Specification Section 14 24 00 Elevator Modification item 4.6.3
- .2 Assist Departmental Representative with preparation of BMM.

1.8 LANGUAGE

- .1 Provide documentation in English only.

1.9 IDENTIFICATION OF FACILITY

- .1 When submitting information to Departmental Representative for incorporation into BMM, use following system for identification of documentation:
 - .1 As advised by Departmental Representative.

1.10 USE OF CURRENT TECHNOLOGY

- .1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.
- .2 Obtain Departmental Representative's approval before starting Work.

END OF SECTION 01 91 51

DEMOLITION FOR MINOR WORKS

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Division 1

1.2 REFERENCES

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

1.3 ACTION & INFORMATION SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and 01 74 19 - Waste Management and Disposal.
- .2 Submit hoarding layout plan for approval by Departmental Representative at each stage of work.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.4 SITE CONDITIONS

- .1 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous is encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Proceed only after receipt of written instructions have been received from Departmental c Representative.
- .2 Notify Departmental Representative before disrupting building access or services.

3.0 EXECUTION

3.1 EXAMINATION

- .1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Perform GPR scan prior to demolition of floor slab. Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect, cap, plug or divert, as required, existing utilities within the building where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative in case of damage to any utility or service designated to remain in place.
 - .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

DEMOLITION FOR MINOR WORKS

3.2 PREPARATION

- .1 Protection of In-Place Conditions:
 - .1 Prevent movement, settlement, or damage to adjacent structures, and utilities.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
 - .5 Do Work in accordance with Section 01 35 33 - Health and Safety Requirements.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION 02 41 99

HAZARDOUS MATERIALS ABATEMENT

Part 1 General

1.1 REFERENCES

- .1 Refer to the following reports (further referred to herein as the “Assessment Reports”), attached in the Appendix 4 and Appendix 5 of the Project Specifications, for information pertaining to hazardous building materials that have been identified and will require disturbance (removal and disposal) during the Work:
 - .1 “Pre-Hazardous Building Materials Assessment; 18 Buildings at the Summerland Research and Development Centre, Summerland, BC”, prepared by Stantec Consulting Ltd., dated December 14, 2016
 - .2 “Project Specific Pre-Renovation Hazmat Assessment Report, Admin/Laboratory Building Elevator Replacement” prepared by Stantec Consulting Ltd., dated July 10, 2019

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 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 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .4 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

1.3 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 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Research Council Canada Institute for Research in Construction (NRC-IRC)
 - .1 National Fire Code of Canada 2015.
- .4 Department of Justice Canada
 - .1 Transportation of Dangerous Goods Act (TDG Act) 1999, (c. 34).
 - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

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- .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)
 - .3 "Lead-Containing Paints and Coatings; Preventing Exposure in the Construction Industry" (2011)
 - .4 "Safe Work Practices for Handling Lead" (2017)
- .6 Government of Canada
 - .1 The Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations (COHSR)
 - .2 The Federal PCB Regulations (SOR/2008-273).
 - .3 The Federal Halocarbons Regulation (July 2003).
- .7 Government of British Columbia
 - .1 British Columbia Hazardous Waste Regulation (BC Reg. 63/88)
- .8 Canadian Construction Association
 - .1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2004 – further referred to herein as "CCA 82").

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit to Departmental Representative current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Co-ordinate storage of hazardous materials 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 current National Fire Code of Canada 2015 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.

HAZARDOUS MATERIALS ABATEMENT

- .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 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.
- .7 Do not use flammable liquids having flash point below 38 degrees C, such as naphtha or gasoline as solvents or cleaning agents.
- .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 not mixed.
 - .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 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .12 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.6 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If hazardous waste is generated on site:

HAZARDOUS MATERIALS ABATEMENT

- .1 Co-ordinate transportation and disposal with Departmental Representative.
- .2 Ensure compliance 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 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
- .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
- .6 Ensure that 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 a 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.

1.7 EXISTING CONDITIONS

- .1 Reports and information pertaining to hazardous building materials present within the building 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 suspected hazardous building material discovered during Work and not apparent from drawings, specifications, or reports pertaining to the Work. Do not disturb such material pending instructions from Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site quantity of hazardous materials 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.

Part 3 Execution

3.1 HAZARDOUS MATERIALS ABATEMENT

- .1 Abatement shall be conducted to handle, alter, remove and dispose of hazardous building materials as identified in the Assessment Reports in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such

HAZARDOUS MATERIALS ABATEMENT

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 building materials that will be impacted by the Work of this Contract.
- .3 The listing below is a summary of the identified hazardous building material categories that are anticipated to require disturbance (other than asbestos and lead, which are specified elsewhere), along with the associated removal and disposal regulations, guidelines and/or standards.
 - .1 Asbestos-Containing Materials (ACMs)
 - .1 Refer to the Assessment Reports for identities and locations of ACMs. Although the Contractor is responsible to review this information in light of their proposed methods for completing the Work, a preliminary review indicates that the following ACMs will require consideration:
 - .1 Eight switches located within the freight elevator shaft and six switches located in the passenger elevator.
 - .1 These switches were reported to potentially contain ACM.
 - .2 Contractor is responsible to appropriately remove and/or dismantle the switches to determine whether or not potential ACM layers/materials are present.
 - .2 Actions that will disturb identified ACMs (either in switches or due to other activities planned by the Contractor) are to be conducted in accordance with the requirements of the 2017 WorkSafe BC publication "Safe Work Practices for Handling Asbestos", by appropriately trained personnel.
 - .1 Contractor is to conduct a risk assessment and document work procedures for actions/tasks that will or may disturb identified ACMs.
 - .2 Contractor is to submit the documented work procedures to the Departmental Representative for review, at least 10 days prior to initiation of work.
 - .3 Contractor must not proceed with work that will impact identified ACMs without approval from Departmental Representative.
 - .4 If air monitoring is required as part of the Contractor's work procedures, the Departmental Representative will provide the required air monitoring and inspections.
 - .5 If, in the opinion of the Departmental Representative, the work procedures developed by the Contractor do not meet the intent of the 2017 WorkSafeBC publication "Safe Work Practices for Handling Asbestos", revisions will be required, at no cost to the Owner, and at no impact to the schedule.
 - .3 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

HAZARDOUS MATERIALS ABATEMENT

- .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 Department Representative
- .6 Lead and Lead-Containing Paints (LCPs)
 - .1 Refer to the Assessment Reports for identities and locations of identified lead-containing materials (including paints with varying concentrations of lead).
 - .2 Actions that will disturb lead-containing materials (including paints and materials coated with paints) are to be conducted in accordance with the requirements of the 2017 WorkSafe BC publication "Safe Work Practices for Handling Lead", keeping airborne exposure to lead dust to less than COHSR and BC Reg. 296/97 regulated 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre (mg/m³).
 - .1 Actual methods to maintain exposures within applicable limits are to be determined by the contractor through their own risk assessment, which will take into account the lead content of the paints as indicated in the Assessment Reports, along with their planned disturbance methods (and associated dust control), tools, PPE and the overall duration of the work.
 - .1 Although formal evaluation is ultimately the responsibility of the Contractor, limited hazards are expected associated with the lead content of paints to be disturbed, based on the information in the Assessment Reports.
 - .3 Although paints and items coated with paints may 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 paints from items or surfaces is not expected to be required during the Work.
 - .4 Refer to the provisions of the 2017 WorkSafeBC document "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.
 - .2 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.
 - .3 Waste disposal to be conducted in accordance with BC Reg. 63/88.
 - .2 Polychlorinated Biphenyls (PCBs)
 - .1 According to the Assessment Report, the approximately 10 florescent light fixtures observed may have ballasts that contain PCBs.

HAZARDOUS MATERIALS ABATEMENT

- .2 When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada 1991 publication "Identification of Lamp Ballasts Containing PCBs, Report EPS2/CC/2", or equivalent reference
 - .1 Separate PCB-containing ballasts from non-PCB ballasts.
- .3 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.
- .4 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)
- .3 Mould
 - .1 Removal, alteration and/or disposal of mould-impacted materials is not anticipated to be required during the Work.
- .4 Mercury
 - .1 According to the Assessment Report, mercury vapour is expected to be present in the light tubes within approximately 10 fluorescent light fixtures.
 - .2 When mercury-containing items are removed (fluorescent light tubes), 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.
 - .3 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/m³ as per the COHSR and BC Reg. 296/97. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.
- .5 Ozone-Depleting Substances (ODSs)
 - .1 Removal, alteration and/or disposal of ODS-containing equipment is not anticipated to be required during the Work
- .6 Silica
 - .1 According to the Assessment Report, silica is expected to be present in masonry blocks, asphalt roofing and concrete walls and floors.
 - .2 When silica-containing materials are to be disturbed and/or removed (e.g., demolition of concrete slabs, masonry or concrete units, removal of gypsum board/plaster walls, impacts to stucco-like wall or ceiling coatings, etc.), ensure dust control measures are employed such that

HAZARDOUS MATERIALS ABATEMENT

airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97. (Cristobalite and Quartz – each 0.025 mg/m³). This would include, but not be limited to, the following:

- .1 Providing workers with respiratory protection
- .2 Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
- .3 Providing workers with facilities to properly wash prior to exiting the work area.

3.2 DISPOSAL

- .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 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.

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.

END OF SECTION 02 81 01

HAZARDOUS MATERIALS ABATEMENT

Part 1 General

1.1 REFERENCES

- .1 Refer to the following reports (further referred to herein as the “Assessment Reports”), attached in the Appendix 4 and Appendix 5 of the Project Specifications, for information pertaining to hazardous building materials that have been identified and will require disturbance (removal and disposal) during the Work:
 - .1 “Pre-Hazardous Building Materials Assessment; 18 Buildings at the Summerland Research and Development Centre, Summerland, BC”, prepared by Stantec Consulting Ltd., dated December 14, 2016
 - .2 “Project Specific Pre-Renovation Hazmat Assessment Report, Admin/Laboratory Building Elevator Replacement” prepared by Stantec Consulting Ltd., dated July 10, 2019

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 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 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .4 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

1.3 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 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Research Council Canada Institute for Research in Construction (NRC-IRC)
 - .1 National Fire Code of Canada 2015.
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HAZARDOUS MATERIALS ABATEMENT

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 - .4 "Safe Work Practices for Handling Lead" (2017)
- .6 Government of Canada
 - .1 The Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations (COHSR)
 - .2 The Federal PCB Regulations (SOR/2008-273).
 - .3 The Federal Halocarbons Regulation (July 2003).
- .7 Government of British Columbia
 - .1 British Columbia Hazardous Waste Regulation (BC Reg. 63/88)
- .8 Canadian Construction Association
 - .1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2004 – further referred to herein as "CCA 82").

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit to Departmental Representative current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Co-ordinate storage of hazardous materials 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 current National Fire Code of Canada 2015 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.

HAZARDOUS MATERIALS ABATEMENT

- .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 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.
- .7 Do not use flammable liquids having flash point below 38 degrees C, such as naphtha or gasoline as solvents or cleaning agents.
- .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 not mixed.
 - .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 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .12 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.6 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If hazardous waste is generated on site:

HAZARDOUS MATERIALS ABATEMENT

- .1 Co-ordinate transportation and disposal with Departmental Representative.
- .2 Ensure compliance 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 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
- .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
- .6 Ensure that 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 a 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.

1.7 EXISTING CONDITIONS

- .1 Reports and information pertaining to hazardous building materials present within the building 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 suspected hazardous building material discovered during Work and not apparent from drawings, specifications, or reports pertaining to the Work. Do not disturb such material pending instructions from Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site quantity of hazardous materials 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.

Part 3 Execution

3.1 HAZARDOUS MATERIALS ABATEMENT

- .1 Abatement shall be conducted to handle, alter, remove and dispose of hazardous building materials as identified in the Assessment Reports in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such

HAZARDOUS MATERIALS ABATEMENT

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 building materials that will be impacted by the Work of this Contract.
- .3 The listing below is a summary of the identified hazardous building material categories that are anticipated to require disturbance (other than asbestos and lead, which are specified elsewhere), along with the associated removal and disposal regulations, guidelines and/or standards.
 - .1 Asbestos-Containing Materials (ACMs)
 - .1 Refer to the Assessment Reports for identities and locations of ACMs. Although the Contractor is responsible to review this information in light of their proposed methods for completing the Work, a preliminary review indicates that the following ACMs will require consideration:
 - .1 Eight switches located within the freight elevator shaft and six switches located in the passenger elevator.
 - .1 These switches were reported to potentially contain ACM.
 - .2 Contractor is responsible to appropriately remove and/or dismantle the switches to determine whether or not potential ACM layers/materials are present.
 - .2 Actions that will disturb identified ACMs (either in switches or due to other activities planned by the Contractor) are to be conducted in accordance with the requirements of the 2017 WorkSafe BC publication "Safe Work Practices for Handling Asbestos", by appropriately trained personnel.
 - .1 Contractor is to conduct a risk assessment and document work procedures for actions/tasks that will or may disturb identified ACMs.
 - .2 Contractor is to submit the documented work procedures to the Departmental Representative for review, at least 10 days prior to initiation of work.
 - .3 Contractor must not proceed with work that will impact identified ACMs without approval from Departmental Representative.
 - .4 If air monitoring is required as part of the Contractor's work procedures, the Departmental Representative will provide the required air monitoring and inspections.
 - .5 If, in the opinion of the Departmental Representative, the work procedures developed by the Contractor do not meet the intent of the 2017 WorkSafeBC publication "Safe Work Practices for Handling Asbestos", revisions will be required, at no cost to the Owner, and at no impact to the schedule.
 - .3 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

HAZARDOUS MATERIALS ABATEMENT

- .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 Department Representative
- .6 Lead and Lead-Containing Paints (LCPs)
 - .1 Refer to the Assessment Reports for identities and locations of identified lead-containing materials (including paints with varying concentrations of lead).
 - .2 Actions that will disturb lead-containing materials (including paints and materials coated with paints) are to be conducted in accordance with the requirements of the 2017 WorkSafe BC publication "Safe Work Practices for Handling Lead", keeping airborne exposure to lead dust to less than COHSR and BC Reg. 296/97 regulated 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre (mg/m³).
 - .1 Actual methods to maintain exposures within applicable limits are to be determined by the contractor through their own risk assessment, which will take into account the lead content of the paints as indicated in the Assessment Reports, along with their planned disturbance methods (and associated dust control), tools, PPE and the overall duration of the work.
 - .1 Although formal evaluation is ultimately the responsibility of the Contractor, limited hazards are expected associated with the lead content of paints to be disturbed, based on the information in the Assessment Reports.
 - .3 Although paints and items coated with paints may 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 paints from items or surfaces is not expected to be required during the Work.
 - .4 Refer to the provisions of the 2017 WorkSafeBC document "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.
 - .2 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.
 - .3 Waste disposal to be conducted in accordance with BC Reg. 63/88.
- .2 Polychlorinated Biphenyls (PCBs)
 - .1 According to the Assessment Report, the approximately 10 florescent light fixtures observed may have ballasts that contain PCBs.

HAZARDOUS MATERIALS ABATEMENT

- .2 When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada 1991 publication "Identification of Lamp Ballasts Containing PCBs, Report EPS2/CC/2", or equivalent reference
 - .1 Separate PCB-containing ballasts from non-PCB ballasts.
- .3 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.
- .4 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)
- .3 Mould
 - .1 Removal, alteration and/or disposal of mould-impacted materials is not anticipated to be required during the Work.
- .4 Mercury
 - .1 According to the Assessment Report, mercury vapour is expected to be present in the light tubes within approximately 10 fluorescent light fixtures.
 - .2 When mercury-containing items are removed (fluorescent light tubes), 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.
 - .3 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/m³ as per the COHSR and BC Reg. 296/97. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.
- .5 Ozone-Depleting Substances (ODSs)
 - .1 Removal, alteration and/or disposal of ODS-containing equipment is not anticipated to be required during the Work
- .6 Silica
 - .1 According to the Assessment Report, silica is expected to be present in masonry blocks, asphalt roofing and concrete walls and floors.
 - .2 When silica-containing materials are to be disturbed and/or removed (e.g., demolition of concrete slabs, masonry or concrete units, removal of gypsum board/plaster walls, impacts to stucco-like wall or ceiling coatings, etc.), ensure dust control measures are employed such that

HAZARDOUS MATERIALS ABATEMENT

airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97. (Cristobalite and Quartz – each 0.025 mg/m³). This would include, but not be limited to, the following:

- .1 Providing workers with respiratory protection
- .2 Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
- .3 Providing workers with facilities to properly wash prior to exiting the work area.

3.2 DISPOSAL

- .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 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.

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.

END OF SECTION 02 81 01

MASONRY SHORT FORM

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Gypsum Board Assemblies Section 09 21 16

1.2 REFERENCES

- .1 CSA A179- 14, Mortar and Grout for Unit Masonry
.2 CSA A370- 14, Connectors for Masonry
.3 CSA A371- 14, Masonry Construction for Buildings
.4 CSA A165-SERIES-14 Standards for Concrete Masonry Units
.5 CSA-S304.1-14, Design of Masonry Structures
.6 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes
.7 ASTM C144-18 Standard Specification for Aggregate for Masonry Mortar
.8 CSA G30.18-14, Carbon Steel Bars for Concrete Reinforcement

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Ensure that materials are delivered to job site in dry condition
.2 Keep materials dry until use.
.3 Store under waterproof cover on pallets of plank platforms held off ground by means of plank or timber skids.

1.4 SAMPLES

- .1 Submit samples of mortar and masonry unit in accordance with Section 01 33 00 – Submittal Procedures.

1.5 COLD WEATHER REQUIREMENTS

- .1 Comply with Clause 6.7 of CSA-A371.
.2 When air temperature is below 5°C take following precautions in preparing and using mortar:
.1 Heat sand slowly and evenly. Do not use scorched sand, having a reddish cast, in mortar.
.2 Heat water to 70°C maximum; 20°C minimum.
.3 After combining heated ingredients maintain temperature of mortar between 5°C and 50°C until used.
.4 Protect mortar from rain and snow
.3 Maintain dry beds for masonry and use dry masonry units only.

1.6 HOT WEATHER REQUIREMENTS

- .1 Comply with Clause 4 6.7 of CSA A371.

MASONRY SHORT FORM

- .2 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

1.7 PROTECTION

- .1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by permanent construction.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials 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 paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

2.0 PRODUCTS

2.1 MORTAR MATERIALS

- .1 Mortar and grout: to CSA A179

2.2 MORTAR TYPES

- .1 Mortar: to CSA A179.
 - .1 Concrete block masonry walls: Type S based on mortar proportion by volume

2.3 GROUT

- .1 Grout: to Table 5 of CSA A179, minimum compressive strength 20 Mpa, 10 mm maximum sized aggregate and minimum slump of 200 mm.
- .2 Concrete fill: minimum compressive strength 20 Mpa, 10 mm maximum sized aggregate and slump of 200 – 250 mm.

2.4 ACCESSORIES

- .1 Masonry flashing: 1.5 mm thickness reinforced modified SBS asphalt membrane conforming to section 07 62 00 – Sheet Metal Flashing and Trim.
- .2 Lap adhesive: recommended by manufacturer of flashing material.

2.5 REINFORCING AND TYING

- .1 Metal ties bar type reinforcement, bolts and anchors: to CSA-S304.

MASONRY SHORT FORM

- .2 Horizontal joint reinforcement: ladder type to CSA-A370. Ladder type with tab or eye extensions to accept 3.8 mm diameter wire ties at walls with exterior wythe. Extensions spaced at 400 mm
- .3 Corrosion protection: to Clause 5.2 and Table 5.1 of CSA-A370, for metal ties and horizontal reinforcing in exterior walls, walls in shower areas and wet areas.
- .4 Bar reinforcement to G30.18, Grade 400R.

2.6 MASONRY UNITS

- .1 Standard concrete masonry units to CAN3 A165-SERIES-M2014.
 - .1 Classification: H/20/A/M.
 - .2 Size: Modular.
 - .3 Special shapes: Provide purpose-made "H" shapes for lintels and bond beams. Provide additional special shapes as indicated.

3.0 EXECUTION

3.1 WORKMANSHIP

- .1 Build masonry plumb, level and true to line, with vertical joints in proper alignment.
- .2 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.2 TOLERANCES

- .1 Conform to Clause 6.2 of CSA-S371

3.3 MEASUREMENT MIXING OF MORTAR

- .1 Supplement Clause 6 of CSA A179 as follows:
 - .1 Mix grout to semi-fluid consistency.
 - .2 Prehydrate pointing mortar by mixing all ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of the proper consistency for pointing.

3.4 MASONRY FLASHING

- .1 Install flashings in masonry in accordance with Clause 12.4 of CSA-S371 and as follows:
 - .1 Under exterior masonry bearing on concrete foundation and over openings.
 - .2 Flashing material specified in section 07 62 00 – Sheet Metal Flashing and Trim.
- .2 Lap joints 150 mm and seal with adhesive.

3.5 REINFORCING

- .1 Horizontal Reinforcing:
 - .1 Install in all masonry walls continuous in every second course beginning at first course (200 mm above floor), horizontal truss or ladder type reinforcement comprising two 3.8 mm rods, each rod 25 mm from each face, and lapped 300 mm at each splice. Refer to structural drawings for ladder joint reinforcement spacing.

MASONRY SHORT FORM

.2 Refer to structural drawings for horizontal bond beam requirements.

.2 Vertical Reinforcing

.1 See structural drawings.

.2 "Prior to erecting any reinforced masonry blockwork, the location of all wall base dowels placed in the foundations shall be paint marked on the main floor slab, vertical block reinforcing shall be paint match up with these dowels."

.3 Refer to structural drawing for details and additional requirements for reinforcement in masonry walls.

3.6 ENGINEERED MASONRY

.1 Grout and reinforce engineered masonry in accordance with CSA-S304.1 and as indicated.

.2 Fill cores of masonry block walls with vertical reinforcing, full height where indicated.

3.7 REINFORCE BOND BEAMS

.1 Reinforce bond beams as indicated on drawing. Make joint in bond beams to match adjacent walls.

.2 Place grout and reinforcing in accordance with CSA-S304.

3.8 TEMPORARY BRACING

.1 Provide lateral support and anchorage in accordance with Clause 6.1.1 of CSA-A371.

3.9 BOLTS AND ANCHORS

.1 Embed bolts and anchors solidly in mortar or grout to develop maximum resistance to design forces.

3.10 EXPOSED MASONRY

.1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

3.11 LAYING UNITS

.1 Bond: running stretcher for concrete block units

.2 Coursing height: 200 mm for one block and one joint.

.3 Jointing: concave where exposed or where paint or other finish coating is specified.

3.12 JOINTING

.1 Tool with round jointer to provide smooth, compressed, uniformly concave joints where concave joints are indicated. All interior exposed masonry units with concave joint.

.2 Strike flush all joints concealed in walls and joints in walls to receive insulation, ceramic tile, or other applied material except paint or similar thin finish coating.

3.13 JOINING OF WORK

.1 Where necessary temporarily stop horizontal runs of masonry, and in building corners:

.1 Step-back masonry diagonally to lowest course previously laid.

.2 Do not "tooth" new masonry.

MASONRY SHORT FORM

- .3 Fill in adjacent courses before heights of stepped masonry reach 1200 mm.

3.14 CUTTING

- .1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in object.
- .2 Make cuts straight, clean and free from uneven edges. Use masonry saw where necessary to cut special shapes.

3.15 BUILDING-IN

- .1 Build in items required to be built into masonry
- .2 Prevent displacement of built-in items during construction. Check for plumb, alignment and correctness of position, as work progresses.
- .3 Brace jamb frames to maintain plumb. Fill spaces between jambs and masonry with mortar. Build in jamb anchors, cell door frames, as indicated.

3.16 SUPPORT OF LOADS

- .1 Refer to requirements on structural drawings.

3.17 CLEANING

- .1 Allow mortar droppings on concrete masonry to partially dry then remove by means to trowel, followed by rubbing lightly with small piece of block and finally brushing.

3.18 TESTING

- .1 Inspection and testing will be carried out by testing laboratory designated by Departmental Representative.
- .2 Contractor will pay for costs of tests as specified in Section 01 11 55 – General Instructions.

END OF SECTION 04 05 00

METAL FABRICATIONS

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Interior Painting Section 09 91 23

1.2 REFERENCES

- 1 ASTM International
- .1 ASTM A 53/A 53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A 269 08, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .3 ASTM A 307-07v, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM B 209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .5 ASTM B 221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
- .2 CSA International
- .1 CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA S16-09, Design of Steel Structures.
 - .4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .5 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) [Metric].
 - .1 GS-11-2008, 2nd Edition], Paints and Coatings.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).
- .4 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.
- .5 Green Seal Environmental Standard GS 03 (anti-corrosive primer).

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements
 - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.
- .3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada. Submit BCBC 2012 Schedule B and C-B and Federal letter of Assurance Schedule B1, B2 and C-B as per Appendix L.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

METAL FABRICATIONS

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE & 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, labeled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground 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 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 19 Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.
- .2 Exterior Steel, stair stringers and pipe rails: to ASTM A 53/A 53M standard weight galvanized finish.
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series.
- .5 Bolts and anchor bolts: to ASTM A 307.
- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.
- .7 Aluminum: to ASTM B209, clear anodized finish.
- .8 Unistrut: unistrut P1100 or similar profile embedded in concrete, 1.9mm (14ga) hot-dipped galvanized finish conforming to ASTM A123.
- .9 Grout: non-shrink, non-metallic flowable, 15MPC at 24 hours.
- .10 Stainless Steel Sheet: Conforming to ASTM A167, Type 304, #4 Satin Finish.
12 Gauge for use in seismic joint cover plate.
- .11 Security fasteners: screws and bolts with spanner type heads to prevent removal except with special tools; non-corrosive type.

METAL FABRICATIONS

- .12 Shop coat primer: to CAN/CGSB-1.40M.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 610 g/m² to CAN/CSA-G164.
- .2 Shop coat primer: CGSB 1GP 40M in accordance with chemical component limits and restrictions requirements and VOC limits of GC-03. Prepare surface to an abrasive blast specification SSPC-SP10.
- .3 Zinc primer: To CGSB 1GP 48, CISC/CPMA 1-73A, CISC/CPMA 2-75 in accordance with chemical component limits and restrictions requirements and VOC limits of GC-03. Prepare surface to an abrasive blast SSPC-SP10.

2.4 ISOLATION COATING

- .1 Isolate 2 different metals from following components, by means of bituminous paint:
- .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
- .2 Concrete, mortar and masonry.
- .3 Wood.

2.5 SHOP PAINTING

- .1 Primer: VOC limit 250 g/L maximum to GC-03.
- .2 Apply one shop coat of primer to metal items, with exception of aluminum, galvanized or concrete encased items.
- .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .4 Clean surfaces to be field welded; do not paint.

3.0 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.

METAL FABRICATIONS

- .4 Contractor shall verify field measurements are as shown on shop drawings prior to fabrication.

3.2 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Weld field connection.
- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
 - .1 Primer: maximum VOC limit 250 g/L to GC-03.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
 - .1 Primer: maximum VOC limit 250 g/L to GC-03.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION 05 50 00

ROUGH CARPENTRY FOR MINOR WORKS

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Finish Carpentry Section 06 20 00
- .2 Non-Structural Metal Framing Section 09 22 16

1.2 REFERENCES

- .1 CSA International
 - .1 CSA B111- 1974 (R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O121- 08, Douglas Fir Plywood.
 - .3 CAN/CSA-O141- 05, Softwood Lumber.
 - .4 CSA O151- 09, Canadian Softwood Plywood.
 - .5 CAN/CSA-O325.0- 07, Construction Sheathing.
- .2 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001- 2004, FSC Principle and Criteria for Forest Stewardship.
 - .2 FSC-STD-20-002- 2004, Structure and Content of Forest Stewardship Standards V2-1.
 - .3 FSC Accredited Certified Bodies.
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-11- 2008, 2nd Edition, Paints and Coatings.
- .4 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2000.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113- A2007, Architectural Coatings.

1.3 ACTION & INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for rough carpentry work and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Wood Certification: submit vendor's Chain-of-Custody Certificate number for FSC certified wood.
- .4 Low-Emitting Materials:
 - .1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.
 - .2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 QUALITY ASSURANCE

- .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.

ROUGH CARPENTRY FOR MINOR WORKS

- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.
- .4 Sustainable Standards Certification:
 - .1 Certified Wood: submit listing of wood products and materials used in accordance with FSC-STD-01-001.

1.5 DELIVERY, STORAGE & 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 Store and protect wood from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 19 Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 FSC certified.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.
- .3 Panel Materials:
 - .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .1 Urea-formaldehyde free.
 - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .1 Urea-formaldehyde free.
 - .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
 - .1 Urea-formaldehyde free.
- .4 Wood Preservative:
 - .1 Surface-applied wood preservative: clear coloured, or 5% pentachlorophenol solution, water repellent preservative.

ROUGH CARPENTRY FOR MINOR WORKS

- .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
- .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.
- .5 Primers: in accordance with manufacturer's recommendations for surface conditions:
 - .1 Interior Flat coating or Primer, Green Seal GS-11, VOC limit 50 g/l.
 - .2 Interior Non-Flat Coating or Primer, Green Seal GS-11, VOC limit 150 g/l.
 - .3 Sealers and undercoaters, SCAQMD Rule 1113, VOC limit 200 g/l.

2.2 ACCESSORIES

- .1 Fasteners: hot dipped galvanized to CAN/CSA-G164, for interior highly humid areas, pressure-preservative, fire-retardant treated lumber.
- .2 Nails, spikes and staples: to CSA B111.
- .3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs recommended for purpose by manufacturer.

3.0 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Treat surfaces of all exterior use timber or wood in contact with concrete, metal and masonry with wood preservative before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

3.3 INSTALLATION

- .1 Comply with requirements of NBC 2010, and BCBC 2012, supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.

ROUGH CARPENTRY FOR MINOR WORKS

- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.
- .9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .10 Countersink bolts where necessary to provide clearance for other work.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Waste Management and Disposal.

END OF SECTION 06 08 99

FINISH CARPENTRY

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Rough Carpentry for Minor Works Section 06 08 99
- .2 Door Hardware Section 08 71 00

1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
 - .1 Architectural Woodwork Quality Standards, 1st edition, 2009 (AWS).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .3 CSA International
 - .1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.
 - .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-08, Douglas Fir Plywood.
 - .4 CSA O141-05, Softwood Lumber.
 - .5 CSA O151-09, Canadian Softwood Plywood.
 - .6 CSA O153-13 Poplar Plywood.
- .4 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
 - .2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1.
 - .3 FSC Accredited Certified Bodies.
- .5 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2008.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168 2005, Adhesives and Sealants Applications.
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN4-S104-10 Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for plywood MDF and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Submit drawings in accordance with Section 01 33 00 Submittal Procedures.
 - .2 Indicate details of construction, profiles, jointing, fastening and other related details.

FINISH CARPENTRY

- .3 Indicate materials, thicknesses, finishes and hardware.
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
- .5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
- .6 Test and Evaluation Reports: submit certified test reports for composite wood from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

- .1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).
- .2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.
- .3 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada to CAN4-S104 and CAN/ULC-S105.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - 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 and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wood products from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section
- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal

2.0 PRODUCTS

2.1 MATERIALS

- .1 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber
 - .3 AWMAC custom or premium grade, where noted, moisture content as specified.
 - .4 Machine stress-rated lumber is acceptable.

FINISH CARPENTRY

- .2 Hardwood lumber: moisture content 10% or less in accordance:
 - .1 AWMAC custom grade, moisture content as specified.
- .3 Panel Material: Urea-formaldehyde free
 - .1 Recycled content: provide information indicating recycled content on a % (Post-Consumer + ½ Post-Industrial)
 - .2 FSC certified.
 - .3 Douglas fir plywood (DFP): to CSA O121, standard construction. 6.1.5 and 6.2.5 where both sides exposed to view.
 - .4 Hardwood plywood: to ANSI/HPVA HP-1.
 - .5 Medium density fibreboard (MDF): to ANSI A208.2, density 640-800 kg/m³.
 - .6 Decorative overlaid composite panels.
 - .1 Decorative overlay, heat and pressure laminated with suitable resin to thickness indicated MDF urea-formaldehyde free core.
 - .2 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain (buff) balancing sheet.
 - .3 Furniture finish: stain wood grain pattern selected by Departmental Representative.
 - .4 Edge finishing: edges dadoed or saw kerfed to take plastic "T" moulding in width and colour to match melamine finish.

2.2 ACCESSORIES

- .1 Nails and staples: to CSA B111; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood screws: plain, type and size to suit application.
- .3 Splines: wood
- .4 Adhesive and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

3.0 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Do finish carpentry to AWS Custom Grade.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Form joints to conceal shrinkage.

FINISH CARPENTRY

3.3 CONSTRUCTION

- .1 Fastening:
 - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION 06 20 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Gypsum Board Assemblies Section 09 21 16
- .2 Non-Structural Metal Framing Section 09 22 16

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 ASTM C 665-01e1, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - .3 ASTM C 1320-05, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CGA-B149.1-05, Natural Gas and Propane Installation Code Handbook.
 - .2 CAN/CGA-B149.2-05, Propane Storage and Handling Code.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S604-M1991, Type A Chimneys.
 - .2 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation

1.3 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 sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar GANTT Chart.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with other building sub-trades.

- .4 Review manufacturer's installation instructions and warranty requirements.

- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT & 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 for recycling in accordance with Waste Management Plan.

2.0 PRODUCTS

2.1 INSULATION

- .1 Acoustic Rock mineral wool: Comply Type 1 CAN/ULC-S702-09, Type 1 for ASTM C665, Comply ASTM C553.
- .1 Fire Performance:
- | | | |
|-------------------|---|---------------------|
| CAN4 S114 | Test for Non-Combustibility | Non-Combustible |
| ASTM E 136 | Behavior of Materials at 750°C (1382°F) | Non-Combustible |
| CAN/ULC S102 | Surface Burning Characteristics | Flame Spread = 0 |
| | | Smoke Developed = 0 |
| ASTM E84 (UL 723) | Surface Burning Characteristics | Flame Spread = 0 |
| | | Smoke Developed = 0 |
| CAN/ULC S129 | Smolder Resistance | 0.09% |
- .2 Acoustical Performance:
- | | | |
|-------------|--|--------|
| ASTM E 90 | Airborne Sound Transmission | Tested |
| ASTM # 413 | Rating Sound Insulation | Tested |
| ASTM C 423 | Sound Absorption coefficients | Tested |
| ASTM E 1050 | Impedance and Absorption of Acoustical Materials | Tested |
- .3 Density: 45 kg/m³ minimum

2.3 ACCESSORIES

- .1 Insulation clips:
- .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.
- .2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.
- .3 Staples: 12 mm minimum leg.
- .4 Tape: as recommended by manufacturer.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data

sheets.

3.2 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B and L vents.
- .5 Do not enclose insulation until it has been reviewed and approved by Departmental Representative.

3.4 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers. security devices.

END OF SECTION 07 21 16

FIRE STOPPING

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- | | | |
|----|--|------------------|
| .1 | Gypsum Board Assemblies | Section 09 21 16 |
| .3 | Non-Structural Metal Framing | Section 09 22 16 |
| .4 | Mechanical | Divisions 21-25 |
| .5 | Electrical Communications/Electronics/Security Divisions | 26-28 |

1.2 REFERENCES

- | | |
|----|--|
| .1 | Health Canada/Workplace Hazardous Materials Information System (WHMIS) |
| .1 | Material Safety Data Sheets (MSDS). |
| .2 | Underwriter's Laboratories of Canada (CAN/ULC) |
| .1 | CAN/ULC-S101 Fire Endurance Tests of Building Construction and Materials. |
| .2 | CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies. |
| .3 | CAN/ULC-S115-07, Fire Tests of Fire stop Systems. |

1.3 DEFINITIONS

- | | |
|----|--|
| .1 | Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings. |
| .2 | Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system. |
| .3 | Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system. |
| .4 | Tightly Fitted; (ref: NBC 2010): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction. |
| .1 | Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation. |

1.4 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 datasheet and include product characteristics, performance criteria, physical size, finish and limitations. |
| .2 | Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 33 - Health and Safety Requirements. |
| .3 | Shop Drawings: |
| .1 | Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation for each type of firestop condition. |
| .2 | Construction details should accurately reflect actual job conditions. |
| .4 | Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality |

FIRE STOPPING

Control.

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

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company specializing in fire stopping installations with 5 years documented experience and certified by manufacturer of firestop system.
- .2 Pre-Installation Meetings: convene pre-installation meeting two weeks prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building sub trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

FIRE STOPPING

2.0 PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN- ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: 1 hour FRR, F rating.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC and BCBC 2012.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

FIRE STOPPING

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Mechanical pipe insulation: fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 FIRE STOP LABEL

- .1 All fire stop penetrations shall be labeled. Labels shall be secured to surface directly on both sides of fire stop penetration. Fire stop penetration labels shall include the following information.
 - .1 Name of installer.
 - .2 Date of installation.
 - .3 Type of sealing system.
 - .4 Time duration of sealant.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

FIRE STOPPING

3.8 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION 07 84 00

JOINT SEALANTS

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- | | | |
|----|--|------------------|
| .1 | Finish Carpentry | Section 06 20 00 |
| .2 | Gypsum Board Assemblies | Section 09 21 16 |
| .3 | Interior Painting | Section 09 92 13 |
| .4 | Mechanical | Divisions 21-25 |
| .5 | Electrical Communications/Electronics/Security | Divisions 26-28 |

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C 919- 12, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 ASTM C920-11 Standard Specification for Elastomeric Joint Sealants
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE / MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.
- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Location to be decided with Departmental Representative.

JOINT SEALANTS

- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.5 DELIVERY, STORAGE & HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.
- .3 Upon completion of Work, after cleaning is carried out.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.
- .4 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .5 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .6 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

2.0 PRODUCTS

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

JOINT SEALANTS

- .4 Standard: For interior and exterior work unless otherwise specified, ensure compatibility of sealants being used and other materials in contact with them, meet VOC level of 250 g/L for architectural sealant.

2.2 SEALANT TYPE

- .1 S-1:
.1 ASTM C920, polyurethane or polysulfide.
.2 Type M.
.3 Class 25.
.4 Grade NS.
.5 Shore A hardness of 20-40.
- .2 S-2:
.1 ASTM C920, polyurethane or polysulfide.
.2 Type M.
.3 Class 25.
.4 Grade P.
.5 Shore A hardness of 25-40.
- .3 S-3:
.1 ASTM C920, polyurethane or polysulfide.
.2 Type S.
.3 Class 25, joint movement range of plus or minus 50 percent.
.4 Grade NS.
.5 Shore A hardness of 15-25.
.6 Minimum elongation of 700 percent.
- .4 S-4:
.1 ASTM C920, polyurethane or polysulfide.
.2 Type M.
.3 Class 25,
.4 Grade NS.
.5 Shore A hardness of 25-40.
- .5 S-5:
.1 ASTM C920, polyurethane or polysulfide.
.2 Type M.
.3 Class 25.
.4 Grade P.
.5 Shore A hardness of 25-40.
- .6 S-6:
.1 ASTM C920, silicone, neutral cure.
.2 Type S.
.3 Class: Joint movement range of plus 100 percent to minus 50 percent.
.4 Grade NS.
.5 Shore A hardness of 15-20.
.6 Minimum elongation of 1200 percent.
- .7 S-7:
.1 ASTM C920, silicone, neutral cure.

JOINT SEALANTS

- .2 Type S.
- .3 Class 25.
- .4 Grade NS.
- .5 Shore A hardness of 25-30.
- .6 Structural glazing application.

- .8 S-8:
 - .1 ASTM C920, silicone, acetoxycure.
 - .2 Type S.
 - .3 Class 25.
 - .4 Grade NS.
 - .5 Shore A hardness of 25-30.
 - .6 Structural glazing application.

- .9 S-9:
 - .1 ASTM C920, silicone.
 - .2 Type S.
 - .3 Class 25.
 - .4 Grade NS.
 - .5 Shore A hardness of 25-30.
 - .6 Non-yellowing, mildew resistant.

- .10 S-10:
 - .1 ASTM C920, coal tar extended fuel resistance polyurethane.
 - .2 Type M/S.
 - .3 Class 25.
 - .4 Grade P/NS.
 - .5 Shore A hardness of 15-20.

- .11 S-11:
 - .1 ASTM C920, polyurethane.
 - .2 Type M/S.
 - .3 Class 25.
 - .4 Grade P/NS.
 - .5 Shore A hardness of 35-50.
 - .6 Structural glazing application.

- .12 S-12:
 - .1 ASTM C920, polyurethane.
 - .2 Type M/S.
 - .3 Class 25, joint movement range of plus or minus 50 percent.
 - .4 Grade P/NS.
 - .5 Shore A hardness of 25-50.

JOINT SEALANTS

2.3 CAULKING COMPOUND

- .1 C-1: ASTM C834, acrylic latex.
- .2 C-2: One component acoustical caulking, non-drying, non hardening, synthetic rubber.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

3.0 EXECUTION

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant
 - .1 Apply sealant in accordance with manufacturer's written instructions and ASTM C919.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.

JOINT SEALANTS

- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

3.7 CLEANING

- .1 Clean adjacent surfaces immediately and leave work clean and neat. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints.

3.8 LOCATIONS

- .1 Sanitary Joints:
 - .1 Pipe Penetrations: Type S-12.
- .2 Interior Caulking:
 - .1 Typical Narrow Joint 6mm, (1/4 inch) or less at Walls and Adjacent Components: Type C-1 and C-2.
 - .2 Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Exterior Walls: Types C-1 and C-2.
- .3 Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
- .4 Expose Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.
- .5 Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
- .6 Concealed Acoustic Sealant Types S-4, C-1 and C-2.

END OF SECTION 07 92 00

GYPSUM BOARD ASSEMBLIES

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- | | | |
|----|---------------------------------|------------------|
| .1 | Rough Carpentry for Minor Works | Section 06 08 99 |
| .2 | Joint Sealants | Section 07 92 00 |
| .3 | Non-Structural Metal Forming | Section 09 22 16 |
| .4 | Interior Painting | Section 09 91 23 |

1.2 REFERENCES

- | | |
|-----|---|
| .1 | Aluminum Association (AA) |
| .1 | AA DAF 45-03 (R2009), Designation System for Aluminum Finishes. |
| .2 | ASTM International |
| .1 | ASTM C 475-12 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board. |
| .2 | ASTM C 514-04 (2009e1), Standard Specification for Nails for the Application of Gypsum Board. |
| .3 | ASTM C 557-03 (2009) e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing. |
| .4 | ASTM C 840-11, Standard Specification for Application and Finishing of Gypsum Board. |
| .5 | ASTM C 954-07, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness. |
| .6 | ASTM C 1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs. |
| .7 | ASTM C 1047-10a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base. |
| .8 | ASTM C 1280-13, Standard Specification for Application of Gypsum Sheathing. |
| .9 | ASTM C 1177/C 1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing. |
| .10 | ASTM C 1178/C 1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board. |
| .11 | ASTM C 1396/C 1396M-06a, Standard Specification for Gypsum Wallboard. |
| .3 | Association of the Wall and Ceiling Contractors (AWCC) |
| .1 | Specifications Standards Manual 2012 |
| .4 | Canadian General Standards Board (CGSB) |
| .1 | CAN/CGSB-51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction. |
| .2 | CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs. |
| .5 | Green Seal Environmental Standards (GS) |
| .1 | GS-11-2008, 2nd Edition, Paints and Coatings. |
| .6 | South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards |

GYPSUM BOARD ASSEMBLIES

- .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
- .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals.
 - .1 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants and used in building, showing compliance with VOC and chemical component limits or restriction requirements.

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 gypsum board assemblies materials level off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect from weather, elements and damage from construction operations.
 - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .5 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - .6 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 degrees C minimum (21 degrees C maximum) for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

GYPSUM BOARD ASSEMBLIES

2.0 PRODUCTS

2.1 MATERIALS

- .1 Standard board: to ASTM C 1396/C 1396M regular, 12.7mm and 15.9 mm thick Type X, 12.7 mm and 15.9 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges tapered.
- .2 Water-resistant board: to ASTM C 1396/C 1396M regular, 12.7mm and 15.9 mm thick and Type X, 12.7mm and 15.9mm thick, 1220 mm wide x maximum practical length.
- .3 Glass mat water-resistant gypsum backing board: to ASTM C 1178/C 1178M, 12.7 and 15.9 mm thick, 1200 mm wide x maximum practical length.
- .4 Glass mat gypsum substrate sheathing: to ASTM C 1177/C 1177M, 15.9 mm thick, 1200 mm wide x maximum practical length.
- .5 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .6 Resilient clips and drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .7 Nails: to ASTM C 514.
- .8 Steel drill screws: to ASTM C 1002.
- .9 Laminating compound: as recommended by manufacturer, asbestos-free.
- .10 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.
- .11 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
 - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
 - .2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .12 Joint compound: to ASTM C 475, asbestos-free.

3.0 EXECUTION

3.1 EXAMINATION

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

3.2 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840 except

GYPSON BOARD ASSEMBLIES

- where specified otherwise.
- .3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
 - .4 Install work level to tolerance of 1:1200.
 - .5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
 - .6 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
 - .7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
 - .8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
 - .9 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.
 - .10 Furr openings and around built-in equipment, cabinets, access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
 - .11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking as specified in Section 06 08 99, sound attenuation, electrical and mechanical work have been approved by Departmental Representative.
- .2 Apply single or double layer gypsum board to wood furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, and ducts, in partitions where perimeter sealed with acoustic sealant.
- .4 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

GYPSUM BOARD ASSEMBLIES

- .5 Install gypsum board with face side out.
- .6 Do not install damaged or damp boards.
- .7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Provide continuous polyethylene dust barrier behind and across control joints.
- .7 Locate control joints at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.
- .8 Install control joints straight and true.
- .9 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.
- .10 Install expansion joint straight and true.
- .11 Install cornice cap where gypsum board partitions do not extend to ceiling.
- .12 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 300 mm on centre.
- .13 Splice corners and intersections together and secure to each member with 3 screws.
- .14 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .15 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .16 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:

GYPSUM BOARD ASSEMBLIES

- .1 At typical wall and ceiling 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.
- .17 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION 09 21 16

NON-STRUCTURAL METAL FRAMING

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- | | | |
|----|---------------------------------|------------------|
| .1 | Rough Carpentry for Minor Works | Section 06 08 99 |
| .2 | Thermal Insulation | Section 07 21 00 |
| .3 | Gypsum Board Assemblies | Section 09 21 16 |

1.2 REFERENCES

- | | |
|----|--|
| .1 | ASTM International |
| .1 | ASTM C 645- 13, Specification for Nonstructural Steel Framing Members. |
| .2 | ASTM C 754- 11 , Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products |
| .2 | Green Seal Environmental Standards (GS) |
| .1 | GS-11-2008, 2nd Edition, Paints and Coatings. |
| .3 | Association of Wall and Ceiling Contractors of BC (AWCC) |
| .1 | Specification Standards Manual, 2012 Edition. |

1.3 SUBMITTALS

- | | |
|----|--|
| .1 | Submit in accordance with Section 01 33 00 - Submittal Procedures. |
| .2 | Product Data: |
| .1 | Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations. |
| .3 | Shop Drawings: |
| .1 | Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada. Submit APEGBC Model Letter of Assurance Schedule S-B and S-C. |
| .2 | Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required. |

1.4 QUALITY ASSURANCE

- | | |
|----|--|
| .1 | Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties. |
| .2 | Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. |

1.5 WASTE MANAGEMENT AND DISPOSAL

- | | |
|----|---|
| .1 | Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management And Disposal. |
|----|---|

NON-STRUCTURAL METAL FRAMING

2.0 PRODUCTS

2.1 MATERIALS

- .1 Steel Studs & Steel Stud Furring:
- .1 Conform to ASTM C645, non-loadbearing; C-shape, hot dipped galvanized steel studs with Z180 (G60) zinc coating.
Studs to have knurled face and pre-punched pass-through holes for horizontal runs of wiring and piping. Length to suit, no splicing allowed.
- .2 Flange: Depth not less than 32mm, edges bent back 90 deg. and edges hemmed 5mm minimum.
- .3 Widths: As scheduled and indicated.
- .4 Gauges: Interior steel stud to be a minimum of 0.88mm (20 gauge). Interior door jamb studs: 0.88 mm (20 gauge), two (2) studs each side of opening. Increase gauge of steel studs at over-height locations to suit stud manufacturer's design tables, in order to maintain overall partition dimension as detailed in wall schedule and in accordance with the BC Building Code. Exterior steel stud to be minimum 1.23 mm (18 gauge).
- .5 Colour code steel studs for gauge in accordance with AWCC colour code chart.
- .2 Stud Tracks:
- .1 Top and bottom runner tracks fabricated from same materials as studs; leg design min. 32mm high, slightly bent in to hold studs; widths to equal stud width.
- .2 Use extended leg top track to partitions as required for deflection.
- .3 Stud Fasteners: Manufacturer's standard, suitable for intended application.
- .4 Shaft Wall Framing Supports: Stud and track metal components fabricated from hot-dipped zinc coated steel meeting ASTM C645. Zinc coating shall be Z180 (G60). Steel I-studs, J-tracks, T-splines, L-runners, fasteners shall be of design gauge as used within appropriate shaft wall system tested under design numbers indicated in wall schedule.
- .5 Furring Channels: Hat section; roll formed from 0.53mm hot dipped galvanized steel having a Z180 (G60) coating, dimensions 68.2 mm or 66.7mm overall width, face width 35 mm by 22.2mm deep, face knurled.
- .6 "Z-bar" Furring: Roll formed from 0.46mm (26 ga.) hot dipped galvanized steel having a Z180 (G60) coating, 32mm face dimension x depth to suit rigid insulation thickness, see drawings and wall schedule.
- .7 Gypsum Board Ceiling Framing: Conform to Section 9.7, Part 2, Item 4 of the A.W.C.C. Standards which are minimum and as otherwise described below to exceed that minimum.
- .1 Tie Wire: 1.62mm (16 ga.) galvanized steel tie wire.
- .2 Hangers: 3.6mm (9 ga.) diameter galvanized soft annealed steel wire, or 4.8mm diameter zinc coated or cadmium plated steel rods. Ceiling area supported:
- | Area | Size of Hangers |
|---------------------------|--|
| Up to 1.15m ² | 3.6 mm (9 ga.) diameter galvanized wire. |
| Up to 1.48 m ² | 4.8mm diameter rods |
- .3 Inserts: Able to develop full strength of supported hangers.
- .4 Main Carrying Channels: Cold formed steel channels of dimension and weight as follows and protected with rust inhibitive coating. Main carrying channels shall not be less than 38mm x 12.7mm x 1.37mm cold formed channels.
- | Maximum Spacing
of Hangers | Maximum Spacing
of Main Runners |
|-------------------------------|------------------------------------|
| 900mm | 1200mm |
| 1000mm | 1000mm |
| 1200mm | 900mm |

NON-STRUCTURAL METAL FRAMING

.5 Cross Furring/Ceilings: Cross furring members shall be hat-shaped furring channels as specified in Clause 2.5, above. Max. spacing between furring channels shall conform to the following requirements, based on gypsum board thicknesses and layers.

.8 Metal Backing Plates: Flat sheet from 0.91mm (20ga.) thick galvanized steel of same type as are the studs as blocking to support work of other sections.

Maximum

<u>Gypsum Board Thickness</u>	<u>Furring Spacing</u>
Single 12.7mm board	400 mm
Single 15.9mm board	600 mm
Double layer	400 mm

3.0 EXECUTION

3.1 ERECTION

- .1 Fire Resistance Rated Walls: Comply with requirements of testing agency approved by the Departmental Representative for wall systems detailed on Drawings.
- .2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .3 Place studs vertically at on centre as detailed and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to bottom and ceiling track using pop rivets.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .9 Install heavy gauge single jamb studs at openings.
- .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .12 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .13 Extend partitions to ceiling height except where noted otherwise on drawings.

NON-STRUCTURAL METAL FRAMING

- .14 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.
- .15 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .16 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.
- .17 Provide clearances and isolation felt to ensure no contact between steel stud system and adjacent metal components to eliminate electrolytic action.

3.2 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 09 22 16

INTERIOR PAINTING

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- | | | |
|----|-------------------------|------------------|
| .1 | Concrete Unit Masonry | Section 04 22 00 |
| .2 | Finish Carpentry | Section 06 20 00 |
| .3 | Metal Doors & Frames | Section 08 11 00 |
| .4 | Gypsum Board Assemblies | Section 09 21 16 |

1.2 REFERENCES

- | | |
|----|---|
| .1 | Department of Justice Canada (Jus) |
| .1 | Canadian Environmental Protection Act (CEPA), 1999, c. 33 |
| .2 | Environmental Protection Agency (EPA) |
| .1 | EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings). |
| .3 | Health Canada / Workplace Hazardous Materials Information System (WHMIS) |
| .1 | Material Safety Data Sheets (MSDS). |
| .4 | Master Painters Institute (MPI) |
| .1 | MPI Architectural Painting Specifications Manual, November 2007. |
| .2 | MPI Maintenance Repainting Manual, latest edition. |
| .5 | National Fire Code of Canada - 2010 |
| .6 | Society for Protective Coatings (SSPC) |
| .1 | SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual. |

1.3 QUALITY ASSURANCE

- | | |
|----|---|
| .1 | Qualifications: |
| .1 | Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager. |
| .2 | Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work. |
| .3 | Apprentices: working under direct supervision of qualified trade's person in accordance with trade regulations. |
| .2 | Conform to the standards contained in the Master Painters Institute Architectural Painting Specification Manual, latest edition (hereafter referred to as MPI Painting Specification Manual) for all painting products including preparation and application of materials. MPI Painting Specification Manual as issued by the local MPI Accredited Quality Assurance Association having jurisdiction. |
| .3 | All paint manufacturers and products used shall be as listed under the "Approved Products" section of the MPI Painting Specification manual. |
| .4 | Other paint materials shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required. |

INTERIOR PAINTING

- .5 Single-Source Responsibility: provide primers and undercoat paint produced by the same manufacturer as the finish coat.
- .6 All painting and decorating work shall be inspected by Paint Inspection Agency (inspector) acceptable to the specifying authority 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.
- .7 All surfaces requiring painting or repainting shall be inspected by the inspection agency who shall advise on all aspects of painting work including preparation, notifying the Departmental Representative, the Contractor and the Trade Contractor of any defects or problems prior to commencing painting work or after the prime coat shows defects in the substrate, and as the work progresses.
- .8 Mock-Ups:
 - 1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .1 Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.
 - .2 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
 - .3 Locate where directed.
 - .4 Allow 24 hours for inspection of mock-up before proceeding with work.
 - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.
- .9 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .10 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.4 PERFORMANCE REQUIREMENTS

- .1 Environmental Performance Requirements:
 - .1 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.
- .2 Green Performance in accordance with MPI Standard GPS-1.

INTERIOR PAINTING

1.5 SCHEDULING

- .1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Departmental Representative for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
 - .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Samples:
 - .1 Submit manufacturer's standard range of color choices on each specified color type as listed in Colour Schedule of this section for selection, review and acceptance of each color.
 - .2 Submit triplicates 200 x 300 mm sample panels of each paint with specified paint in colours, gloss/sheen and textures required, based on selected colors, to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
 - .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface. 50mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .1 Lead, cadmium and chromium: presence of and amounts.
 - .2 Mercury: presence of and amounts.
 - .3 Organochlorines and PCBs: presence of and amounts.
 - .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .6 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
 - .7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.

INTERIOR PAINTING

1.7 MAINTENANCE

- .1 Extra Materials:
 - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
 - .2 Quantity: provide one - 4 litre (1 gallon) can of each type and colour of primer stain finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
 - .3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
 - .1 Identify products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well-ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Fire Safety Requirements:
 - .1 Provide one Type ABC fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling 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 paper, plastic, polystyrene corrugated cardboard and

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- packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
- .4 Separate for recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan (WMP).
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.
- .7 Ensure emptied containers are sealed and stored safely.
- .8 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.
- .9 Paint, stain and wood preservative finishes and related materials (thinners and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .14 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.

1.9 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .2 Provide continuous ventilation for seven days after completion of application of paint.
 - .3 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .5 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless pre-approved written approval by Paint Inspection Agency Authority and product manufacturer, perform no painting when:
 - .1 Ambient air and substrate temperatures are below 10 degrees C.

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- .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
- .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
- .4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
- .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
- .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
- .2 Perform painting work when maximum moisture content of the substrate is below:
 - .1 Allow new concrete and masonry to cure minimum of 28 days.
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
- .3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
 - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.10 GUARANTEE

- .1 Furnish a 100% two (2) year Maintenance Bond.
- .2 Painting and decorating Subcontractors providing a Maintenance Bond shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified cheque are not acceptable in lieu of surety consent.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this

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- project.
- .4 Conform to latest MPI requirements for interior painting work including preparation and priming.
 - .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
 - .6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
 - .7 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
 - .1 Water-based.
 - .2 Non-flammable.
 - .3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 Manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
 - .8 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
 - .9 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.
 - .10 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
 - .1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .11 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract award. Submit proposed Colour Schedule to Departmental Representative for approval.
- .2 Colour schedule will be based upon selection of two (2) colours – one for wall and ceiling, one for door and door frame.
- .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.

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- .5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.
- .6 Refer to Colour Schedule of this Section, and Section 09 06 00 Finish Schedule and drawings for identification and location of colours.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 Matte	Max.5	Max.10
Finish (flat) Gloss Level 2 -Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 -Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 -Satin-Like Finish	20 to 35	Min.35
Gloss Level 5 -Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 -Gloss finish	70 to 85	
Gloss Level 7 -High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated.

2.5 INTERIOR PAINTING SYSTEMS – NEW CONSTRUCTION

- .1 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):
 - .1 INT 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.
- .2 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
 - .1 INT 5.3M – High Performance Architectural Latex gloss level 5 coating (over waterborne primer).

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- .3 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2B – High Performance Architectural latex gloss level 3 finish (over latex sealer) for wall typical.
- .4 All paint systems to be MPI Premium Grade 3 coat systems.

2.6 INTERIOR REPAINTING SYSTEMS

- .1 Concrete masonry units: smooth and split face block and brick:
 - .1 RIN 4.2K – High Performance Architectural Latex gloss level 5 finish.
- .2 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):
 - .1 RIN 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.
- .3 Concrete Surface (ceiling)
 - .1 RIN3.1J High Performance Architectural Latex gloss level 1.
- .4 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 RIN 9.2B – High Performance Architectural latex gloss level 3 finish (over latex sealer) for wall typical.
- .5 All paint systems to be MPI Premium Grade 3 coat systems.

2.7 SOURCE QUALITY CONTROL

- .1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

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- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Stucco, plaster and gypsum board: 12%.
 - .2 Concrete: 12%.
 - .3 Clay and Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.4 PREPARATION

- .1 Protection:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
 - .4 Protect passing pedestrians, building occupants and general public in and about the building.
- .2 Surface Preparation in accordance with MPI Repainting Manual:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

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- .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.
- .6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes or vacuum cleaning.
- .8 Touch up of shop primers with primer as specified.
- .9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

- .1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, air or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.

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- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint natural gas piping yellow.
- .11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .12 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

- .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
- .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 FIELD QUALITY CONTROL

- .1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of

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- work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
 - .3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.
 - .4 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
 - .5 Cooperate with inspection firm and provide access to areas of work.
 - .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

3.9 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and patten immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION 09 91 23

ELEVATOR MODIFICATION

1. GENERAL

1.1 SCOPE – DECOMMISSION EXISTING ELEVATORS

- .1 This specification prescribes the minimum requirements for the decommissioning of the following elevators in the Summerland Research and Development Centre building located in Summerland, BC, prior to installing new elevators.

.1 One (1) Holed Hydraulic Passenger Elevator (PE01)

.2 One (1) Holed Hydraulic Service Elevator (SE02)

- .2 Where singular items are specified, provide as many such items as are appropriate.

- .3 All clauses apply to all elevators unless the heading of the clause, or a sub-heading, indicates otherwise.

1.2 SCOPE – NEW ELEVATORS

- .1 This specification prescribes the minimum requirements for the provision and installation of the following elevators in the Summerland Research and Development Centre building located in Summerland, BC.

.1 One (1) Holeless Hydraulic Passenger Elevator (PE01)

.2 One (1) Holeless Hydraulic Service Elevator (SE02)

- .2 Where singular items are specified, provide as many such items as are appropriate.

- .3 All clauses apply to all elevators unless the heading of the clause, or a sub-heading, indicates otherwise.

- .4 Where dimensions and/or building details including, but not limited to, floors served, floor heights, and entrance locations, are shown in the specification and on the drawings, and if there is a discrepancy between the two, the information on the drawings will apply.

- .5 All dimensions on drawings, specifications, manuals, equipment labels, etc. shall be in both imperial and metric (SI) units.

- .6 This Section shall be read in conjunction and coordinated with the following Sections:

.1 Section 14 24 00.01, Schedule 1.

.2 Section 14 24 00.02, Schedule 2.

.3 Section 14 24 00.04, Schedule 3.

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1.3 DEFINITION OF TERMS

- .1 Definitions given in the latest version of the Safety Code for Elevators and Escalators, CSA-B44, including all supplements, shall apply throughout the specification unless particularly defined otherwise.
- .2 The term “provide”, where it appears in this specification, refers to supply and installation of the item referenced.

1.4 SPECIFICATION INTERPRETATION

- .1 All clauses of the specification shall be read in detail. The specification shall be interpreted strictly with no assumptions of so-called standard or conventional practice.
- .2 All queries as to the technical content, overall intent, and strict interpretation of the specifications as well as any apparent errors, ambiguity and conflict between or within specifications and regulations shall be reported to the General Contractor.

1.5 PERFORMANCE OF WORK

- .1 In performing the work the Contractor acknowledges that it is fully conversant with local facilities and conditions, the requirements of the contract documents and of pertinent provincial and local codes, the state of labour and material markets, currency exchange rate variations.
- .2 Notwithstanding any information given in this specification, the Contractor is presumed to have met all necessary requirements in the Contract to comply with all applicable rules, regulations and local conditions.

1.6 CODES, REGULATIONS, BY-LAWS (BC)

- .1 The terms of the contract shall be carried out while complying with the latest applicable requirements of the following authorities. The Contractor shall advise the Departmental Representative of any regulations or requirements known to be in process which might affect the reliability or safety of the work.
 - .1 The building codes, by-laws, regulations and requirements of the local, provincial and, federal authorities having jurisdiction at the time. This shall include the requirements for persons with disabilities.
 - .2 National Building Code (2015)
 - .3 Canadian Electrical Code (2015).
 - .4 BC Building Code (2018).
 - .5 Fire Tests of Door Assemblies, CAN/ULC-S104-10.

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- .6 Safety Code for Elevators and Escalators, CSA-B44-07, including Appendix E.
- .7 Maintenance Requirements and Intervals for Elevators, Dumbwaiters, Escalators and Moving Walks, CAN/CSA B44.2-07.
- .8 Requirements of the Elevating Devices Safety Regulation and the Safety Standards Act of BC.
- .9 WorkSafe BC Occupational Health and Safety Regulation
- .10 Building Commissioning Standard CSA Z320.11 (R2016) for vertical and horizontal transportation section.

1.7 CERTIFICATES

- .1 The Contractor shall obtain and pay for certificates of approval and all other necessary permits, inspections, and re-inspections associated with the installation of the elevator equipment.

1.8 PATENT FEES AND INFRINGEMENTS

- .1 The Contractor shall pay all patent licence fees and royalties necessary for the completion of the contract. The Departmental Representative will not be held responsible for infringements of patents by the Contractor in the completion of his contract.

1.9 GUARANTEE OF EQUIPMENT

- .1 All equipment shall be guaranteed for a period of twelve (12) months from the date of Substantial Performance of the Project in accordance with the Contract Documents.
- .2 This guarantee must include for replacement or repair of all items that fail or cause improper operation unless caused by improper use of the equipment or by wilful damage. Written confirmation of the guarantee and the effective dates of this guarantee shall be submitted with the final invoice for the project.

1.10 RELATED WORK

- .1 Division 03 - Hoistway and front walls
 - .1 An existing structural hoistway will be provided as shown on the drawings.
 - .2 Any cutting, including cutouts to accommodate hall signal fixtures, patching, and painting of walls, floors.
 - .3 The hoistway was designed to accommodate support and anchoring of guide rail brackets at intervals not to exceed CSA B44 requirements (Approx. 168 inches).

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- .4 Rough openings will be provided as existing.
- .5 The elevator safety zone, adjacent the entrance at all levels, must be kept clear of all obstacles.
- .2 Division 03 - Support for main elevator loads
 - .1 Provision of support in the pit. The approximate loads are as per the ESTIMATED ELEVATOR LOADS table in the General Description.
 - .2 The exact reactions and location shall be provided by Contractor on the shop drawings.
- .3 Division 03, 13 – Vibration Isolation
 - .1 The details of the method of vibration isolation and the materials proposed for isolation of all elevator equipment must be reviewed by a Departmental Representative.
- .4 Division 05 - Hoisting Beams
 - .1 Contractor shall utilize the existing beams within their designed limits.
- .5 Division 03 - Pit
 - .1 A pit is provided for the elevators, capable of approximate reactions from buffers as indicated in the ESTIMATED ELEVATOR LOADS table in the General Description.
 - .2 For each elevator, a pit water sensor shall be provided to conform to CSA B44.
- .6 Division 03 - Raceway cutouts for elevators
 - .1 Between the hoistway and the machine room, either overhead or under the floor, existing raceway cutouts shall be used for the installation of the hydraulic line and the conduit for electrical control wiring.
- .7 Divisions 03, 05, 08 – Machine Room
 - .1 Fire-rated machine rooms with concrete floor is provided, complete with a permanent, unobstructed means of access. Access into the machine room is via a swinging door that is self closing, self locking, and has minimum dimensions of 3'-0" W X 6'-8"H (914mm x 2032mm).
 - .2 For hydraulic elevators only, direct or indirect venting to the outside will be provided from the machine room.
- .8 Division 23 – Heat Loads in Machine Rooms and Hoistways
 - .1 The machine rooms will be properly heated and ventilated to maintain a temperature of at least 15° C, and ventilated and cooled to maintain the temperature below 30° C with equipment heat loads approximately as indicated in the General Description. Humidity levels will be maintained below 95% non-condensing.

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- .2 Both hoistways will be maintained at a temperature between 5° and 30° C. Humidity levels will be maintained below 95% non-condensing.
- .9 Division 26 - Power supply
 - .1 Three phase power at **600V** will be provided with a fused lockable disconnecting means, grounding to earth ground, adequate for the elevators with motor sizes as indicated in the ESTIMATED ELEVATOR LOADS table in the General Description.
 - .2 The actual hp ratings shall be confirmed by the Contractor on the shop drawings.
 - .3 Duplex single phase GFCI power outlets will be provided, one per elevator in the machine room and one in each pit.
 - .4 Electric power will be provided during installation for tools and for operation of the elevators.
 - .5 A separate 110 VAC single phase (15 amp fused), lockable disconnect power supply will be provided to the elevator machine room for cab lighting, one for each elevator.
 - .6 A separate 110 VAC single phase (20 amp fused), lockable disconnect power supply will be provided to the elevator machine room for heat exchangers, where specified, one for each elevator.
 - .7 Adequate lighting shall be provided in the pit and machine room, as well as related light switch accessible from the entrance to each area.
 - .8 Lighting levels at elevator hall sills will be no less than 100 lux with the elevator doors closed.
- .10 Division 26 – Firefighters' Emergency Operation
 - .1 Fire alarm initiating devices (FAID's) will be provided in all elevator lobbies.
 - .2 A contact and signal wiring and conduit will be provided from the FAID's in the elevator lobbies (all floors except Designated Level) to the elevator machine room(s), to indicate a Designated Level recall condition.
 - .3 A contact as well as conduit and signal wiring will be provided from the FAID in the elevator lobby at the Designated Level to the elevator machine room(s) to indicate an Alternate Level recall condition.
 - .4 FAID's will be provided in the machine room(s). A contact as well as conduit and signal wiring will be provided from FAID's in the machine room to a point adjacent the elevator controller(s). This shall initiate emergency recall to the Designated Level with a flashing signal light in the cab. If the FAID in the machine room is at the Designated Level, the elevator shall recall to the Alternate Level with flashing signal light in the cab.

ELEVATOR MODIFICATION

- .5 FAID's will be provided in the hoistway(s) as required by the building code. If FAID's in the hoistway are provided, a contact and conduit and signal wiring will be provided from the FAID's in each hoistway for each elevator controller; this shall provide a signal to the elevators to initiate emergency recall to the Designated Level with a flashing signal light in the cab. If the FAID in the hoistway is at the Designated Level, the elevator shall recall to the Alternate Level with flashing signal light in the cab.
- .6 All signal wiring and conduit from fire alarm initiating devices to the elevator machine room will be provided through the building fire alarm system, or as required by building code.
- .11 Division 26 - Standby power supply
 - .1 A contact, and a pair of signal wires will be provided from the standby power system to the elevator machine room(s) to indicate the state of the power supply.
 - .2 A connection will be provided from the elevators to the standby power system. Standby power supply will be capable of delivering continuous full power to **two (2) elevators simultaneously. Refer the Standby Power Groups section herein.**
 - .3 The cab lighting, machine room lighting and pit lighting power supply for all elevators will be connected to standby power.
 - .4 A suitable switchgear will be provided to protect the equipment from sudden phase shift on resumption of normal power.
- .12 Divisions 26, 27 - Communication systems
 - .1 One (1) telephone line (analog and digital type acceptable) per elevator machine room will be provided. Also provided will be 24 hour monitoring of the elevator emergency telephone system.
- .13 Estimated Elevator Loads
 - .1 Refer to the General Description
- 1.11 VERIFY RELATED WORK
 - .1 The Contractor shall have examined all Contract Documents to ensure that items being provided as required by this Contract have been identified.
- 1.12 FIRESTOPPING
 - .1 Adequate firestopping for all hoistway penetrations shall be provided by the Contractor. Firestopping shall conform to the applicable codes and standards.

ELEVATOR MODIFICATION

1.13 VERTICAL LAYOUT

- .1 Refer to Section 14 24 00.01, Schedule 1

1.14 GENERAL DESCRIPTION

- .1 Passenger Elevator PE01
 - .1 Refer to Section 14 24 00.02, Schedule 2
- .2 Service Elevator SE02
 - .1 Refer to Section 14 24 00.04, Schedule 3

1.15 STANDBY POWER GROUPS

- .1 The Grouping of elevators for standby power operation shall be as follows:
 - .1 Group 1 – PE01, SE02

ELEVATOR MODIFICATION

2. PRODUCTS

2.1 DECOMMISSION AND REMOVE FROM SERVICE

- .1 The existing two (2) elevators shall be removed from service, and the Authority having Jurisdiction notified with the appropriate documentation filed.
- .2 The Elevator Contractor shall satisfy Safety Order SO-ED 2014-01 from Technical Safety BC, including the following scope of work:
 - .1 Rest the elevator cab on the buffers.
 - .2 Remove the drive unit and system piping.
 - .3 Permanently close all landing doors from the hoistway side, except the bottom landing.
 - .4 Return the identification plate number to the Authority having Jurisdiction.
- .3 The General Contractor will complete the remaining work to demolish the elevator, entrances and relocate the existing divider beams.

2.2 DESIGN CRITERIA

- .1 Operational Requirements:
 - .1 Hours of Operation: 16 hours per day, seven days per week;
 - .2 Starts per hour: 120 starts per hour.
 - .3 Speed: Refer to specifications in the General Description.
- .2 Design Life:
 - .1 The design life of the elevator and its components shall be twenty-five (25) years under the design conditions.
- .3 Parts Availability:
 - .1 Technical support and elevator spare parts shall be available for a period of twenty-five (25) years minimum from the expiration of the guaranteed maintenance period.
- .4 Non-Proprietary Equipment
 - .1 All equipment provided shall be fully non-proprietary such that it can be maintained by all qualified contractors, including but not limited to the provision of unrestricted purchase and installation of the equipment, availability of spare parts, diagnostic tools, technical and engineering support, and all required documentation, drawings, parts lists, and manuals.

ELEVATOR MODIFICATION

2.3 CONTROL EQUIPMENT

- .1 The control equipment, including the common group control system, shall provide the elevator operation as described under the applicable sections of this specification.
- .2 The controls shall be microprocessor based, and shall include details of the method of making field changes to the program. The tender submission shall state whether ROM firmware is written and burned in locally and, if not, where it is done and state the time required to make minor changes and obtain new ROM on site.
- .3 If part of the control system uses relays, including miniature pc mounted relays, the Contractor shall state clearly in his tender submission the extent to which they are used, that is for door control, safety circuit, etc.
- .4 One side of the power supply shall be grounded for all hoistway and safety control circuits in order to simplify trouble shooting. All fixture cover plates shall be properly grounded, including all hall and car fixtures. Circuits must be designed so that an accidental ground in a control circuit will not negate the safety provisions.
- .5 The proposed make and model of the control system shall be stated in the tender submission. The proposed control system shall be fully non-proprietary.

2.4 POSITION TRANSDUCER

- .1 A digital position transducer system shall be supplied which will provide continuous position feedback information to the car controller and to the group control as to the location of the car for purposes of controlling car motion, and for dispatching to respond to hall calls.
- .2 Such equipment shall suit a system of slowdown, door pre-opening, accurate and fast levelling, and flight times, as specified elsewhere.
- .3 There shall exist a means of retaining the position data when the normal power supply to the device is interrupted, for a period of at least four hours. The control system shall be capable of automatically recovering the data upon resumption of the power supply.

2.5 SUPPLEMENTARY DISCONNECT

- .1 If the main disconnect switch in the machine room is located so that, when all equipment is in place, it does not satisfy the code in respect to line of sight, an auxiliary disconnect means shall be provided on the controller in accordance with the code.

2.6 WIRING

- .1 Machine room wiring and a complete travelling cable shall be provided. The travelling cable shall be a continuous piece from the controller to the elevator car.

ELEVATOR MODIFICATION

- .2 Supply of wiring between the machine room and the car/hall/hoistway shall include spare conductors consisting of 10% or 10 spare conductors (whichever is greater) and two shielded pairs over and above the minimum wiring requirements.
- .3 The travelling cable(s) shall be suspended at the top of the hoistway and under the cab using the steel core or wire mesh grips, or as otherwise recommended by the manufacturer.
- .4 In addition to wiring requirements specified herein and wiring required for elevator operation, the travelling cable shall include a minimum of the following:
 - .1 Two (2) shielded pairs for voice communications. They shall be connected to terminals on the controller, in the car operating station and the telephone cabinet, and clearly marked as INTERCOM. Wires must not have breaks or intermediate connections. Spare wiring provisions shall be in addition to this requirement.
 - .2 Four (4) twisted shielded pairs for security access system, not less than #20 AWG.
 - .3 One (1) Co-axial cable for a cab mounted monitor.
 - .4 Two (2) twisted shielded pairs for additional cab provisions, such as background audio, not less than #20 AWG.
- .5 All necessary wiring between the elevator machine room or hoistway and the remote lobby panels, monitoring equipment, card access system, voice communication system and the fire alarm panel shall be provided. Remote conduit required for this will be provided by Others, provided this information is given to the General Contractor and a minimum of one month prior to concrete placement. Spare wiring shall be included to each location and consist of 10% or 10 spare conductors (whichever is greater) and two (2) shielded pairs per run over and above the minimum wiring requirements.
- .6 The Contractor shall provide all required wiring between the electrical disconnects in the machine room and the transformer/controller.

2.7 LOAD WEIGHING

- .1 All equipment required for weighing the load in the cab shall be provided. The controls can be signaled either with pre-set increments or a continuous analog signal.
- .2 This signal shall be used in the control logic to:
 - .1 Prevent elevator from operating if overloaded.

2.8 VIBRATION ISOLATION

- .1 Vibration isolation from the building structure shall, as a minimum, be provided for the following equipment.

ELEVATOR MODIFICATION

- .1 Tank unit, pump, and motors.
- .2 Controller cabinets.
- .3 All components connected to the above equipment that are also connected to the structure, including conduit.
- .2 Wiring to vibrating equipment such as the pumping unit must flexible enough to move under light "finger tip" pressure.
- .3 Provide a neoprene pad between the rope hitch and car frame. The pad must provide minimum 0.3" (8mm) deflection under the load.
- .4 Provide sound isolation couplings in the pipeline between the pump and cylinder.
- .5 Use bolts fitted with washers, lock washers and fabric separators, if necessary, to guarantee entire structure to operate entirely free from squeaks and metallic sounds.
- .6 Reduce airborne and structure borne sound created by the pumping unit as follows:
 - .1 The pump and motor assembly shall be mounted internally in the hydraulic tank and adequately vibration isolated with molded elastomeric mounts.
 - .2 Isolate the hydraulic pumping unit from the building by means of suitable isolation material.
- .7 Operate car and hoistway doors at each hoistway entrance simultaneously, quietly and smoothly without vibration, slam or shock, by electric operator located on the car.
- .8 Details of the vibration isolation shall be included on the elevator shop drawings, which will be submitted for review and approval by the Departmental Representative as required herein. The details must show the method of isolation as well as the isolation material proposed.
- .9 Manufacturer standard isolation packages may be considered acceptable, provided they are approved by the Departmental Representative. It is the Contractors responsibility to obtain the Acoustic Design Report and ensure compliance.

2.9 JACK AND CYLINDER – HOLELESS HYDRAULIC

- .1 Roped hydraulic, single stage and two stage telescopic hydraulic elevators are acceptable. Holed hydraulic elevators are not acceptable.
- .2 Supply shall include a complete twin jack unit consisting of cylinders, pistons, piston stop rings, guide bearings and packing, all designed to suit the service, the speed, and the rated capacity.
- .3 Means shall be provided to automatically maintain the synchronization between the twin jacks (e.g. lower elevators to bottom landing and synchronize jacks, once daily).

ELEVATOR MODIFICATION

- .4 For roped hydraulic elevators, sheaves and drive cables shall be provided as required for the operation of the holeless roped hydraulic elevator.
- .5 The Contractor shall assume responsibility for all hydraulic equipment, including the cylinders, under the terms of both the Guaranteed and full service maintenance agreements.
- .6 The pistons shall be sized to suit the travel without requiring intermediate support.
- .7 Supporting machine beams shall be included as required.
- .8 Hydraulic jacks shall be installed plumb to within 1/32 inch (0.8 mm) over the length of the cylinder casing and shall be parallel with the guiderails to within 1/16 inch (1.6 mm) over the length of the fully extended pistons.

2.10 HYDRAULIC PUMPING UNIT

- .1 A self-contained hydraulic pumping unit conforming to the following shall be provided.
- .2 A positive displacement rotary pump shall give steady non-pulsating flow, driven by a high efficiency AC motor. The HP rating of the motor shall be stated in the bid submission. The motor and pump unit shall be direct drive submersible. The motor must be easily accessible without removal of the controller cabinet or other equipment.
- .3 Reduced voltage starting, using electronic soft starting for the pump motor, shall be provided. Wye-Delta starting is not acceptable. A reverse phase relay circuit or similar control function is required for protection of the pump motor.
- .4 Suitable relief and by-pass valves and adjustments shall be provided to allow for smooth and rapid acceleration and slowdown of the elevator in both directions, with two-way levelling and re-levelling. The adjustment of speeds shall be controlled by valves only, with the motor and pump operating at full rated speed.
- .5 Valves shall:
 - .1 be located so that they can be adjusted without removal from the system, and
 - .2 be easily accessible without equipment removal as described herein.
- .6 A readily accessible and well marked valve, for manually lowering the elevator in the event of a power failure, shall be provided.
- .7 A covered oil reservoir with a strainer and an outside oil level indicator shall be provided. A tank shut-off valve shall be included to allow for repairs without emptying the tank.

ELEVATOR MODIFICATION

2.11 PIPING AND SOUND REDUCTION

- .1 Piping shall be provided between the cylinder and the pumping unit; this piping must be of a suitable diameter and thickness to allow for line friction losses. A suitable muffling system shall be included in the line that will eliminate, or reduce to an acceptable level, any transmitted hydraulic noise to the car system.

2.12 OVERSPEED PIT VALVE

- .1 For hydraulic elevators not equipped with safeties, a pipe rupture down overspeed pit valve shall be provided at the input to the cylinder(s), to stop the elevator in the event of an overspeed condition caused by a broken supply line or an abnormally high rate of flow from cylinder to tank.

2.13 PIT EQUIPMENT

- .1 All the pit equipment shall be provided, including the pit access ladder, all buffer supports, catwalks, working platforms, access ladders to catwalks, etc.
- .2 The pit floors and pit walls shall be painted to the level of the bottom sill level. The pits shall be thoroughly cleaned prior to painting.

2.14 GUIDE RAILS

- .1 Standard size T section car and counterweight guide rails are required, with tongue and groove joints, together with suitable splice plates at the connections.
- .2 The rail support brackets shall be secured at each floor level. Where additional intermediate supports are required to be provided by Others, this shall be indicated in the tender.
- .3 Guide rail joints shall be smooth and matching. If necessary, the joints shall be filed and polished to give a continuous plane working surface for the guiding member.
- .4 The installation of the rails and supports shall be carried out with particular care to ensure that the running surface is extremely smooth, straight, and solid so as not to cause any perceptible lateral sway, and not to result in any noise from the guides.
- .5 Guide rails shall be provided with a milling tolerance under 0.015mm per 3/16 inch (5mm).
- .6 Guide rails shall be installed plumb to within 1/32 inch (0.8mm) over any 14 ft (4270mm).

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2.15 CAR GUIDES

- .1 Roller guides are required. The rollers shall be spring applied to maintain uniform and constant contact with the finished rail surface and operate on dry unlubricated rail surfaces.
- .2 The material used on the rollers shall be neoprene or polyurethane as recommended by the manufacturer for the application and shall meet the ride quality requirements specified herein as well as any acoustic/vibration requirements specified by the Departmental Representative.
- .3 The minimum allowable car roller diameter is 4" (100mm).

2.16 FASCIA PLATES

- .1 Fascia plates are required between adjacent entrances, including in express zones. Fascia plates shall be of a width at least the entrance width, be constructed of 16 gauge sheet steel, and be painted or otherwise protected from corrosion.
- .2 Fascia plates are not required in express zones if the drawings indicate that the hoistway depth will be "stepped in" or reduced adequately. That is, where the hoistway clearance from the front hoistway wall to the car sill does not exceed the maximum clearance allowed by CSA B44, without a car door interlock.

2.17 CAR TOP STATION

- .1 Inspection operation and manual controls shall be provided to operate the equipment at reduced speed from the car top, in accordance with code requirements.
- .2 Car top control stations and associated wiring and circuits are required so that the elevators can be operated under maintenance control from the car top in accordance with the current regulations. Included on this fixture, or as a separate fixture on the car top light with a protective guard, shall be a light switch and a 110 Volt AC duplex power outlet.

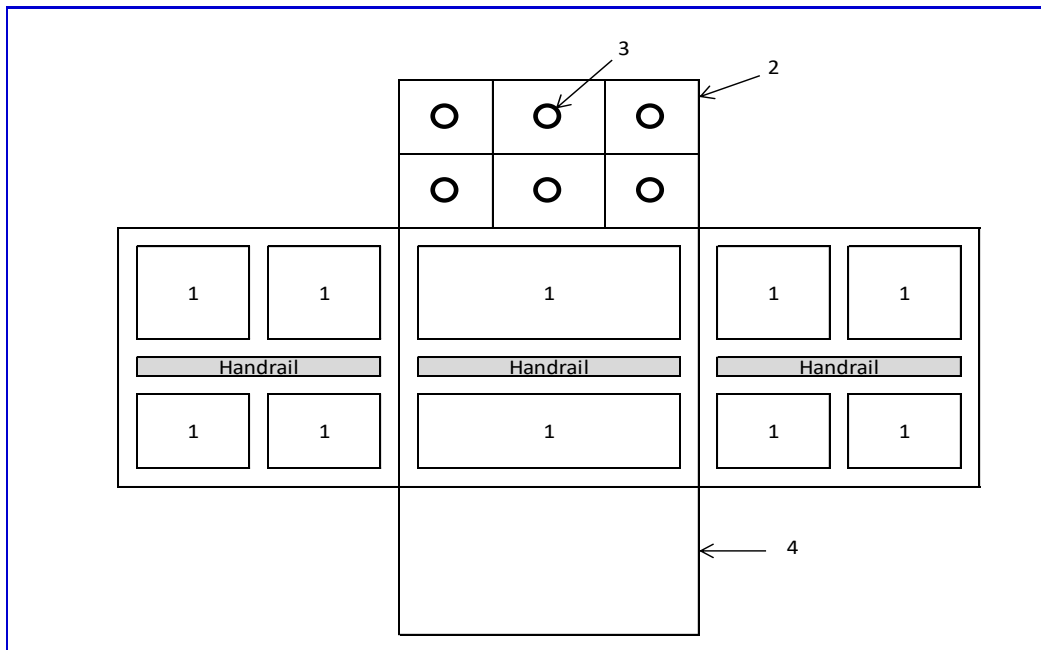
2.18 CAR TOP GUARD RAIL

- .1 Where the clearance between the cab and the hoistway wall exceeds that permitted by code, a guard rail is required on the car top.

ELEVATOR MODIFICATION

2.19 CAB DESIGN – PASSENGER ELEVATOR

- .1 A complete finished cab shall be provided as per the cab interior layout given below, and as follows:



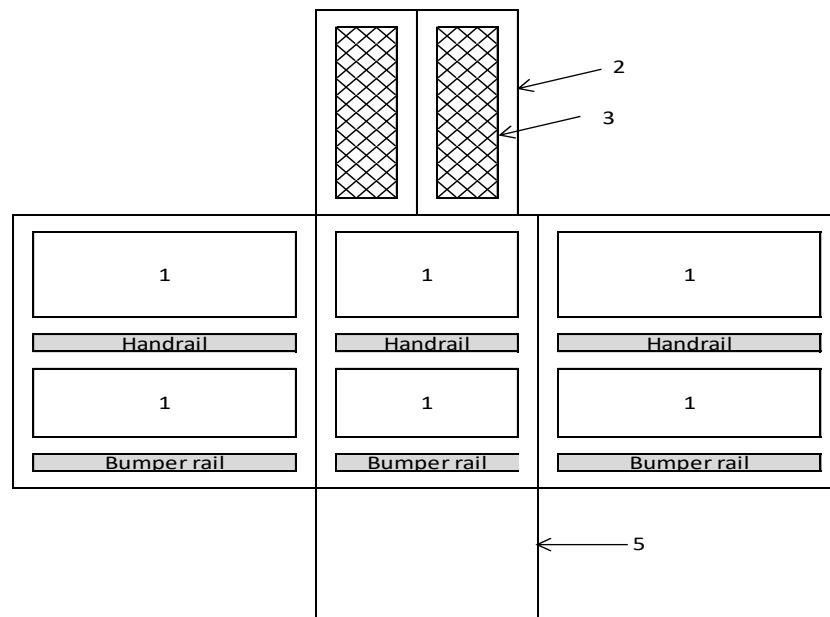
- .2 On surfaces noted with 1, raised removable panels finished in stainless steel, and stainless steel reveals, shall be provided.
- .3 A new suspended ceiling shall be provided with stainless steel panels, evenly sized (surface 2). Panels shall be suspended with concealed suspension (no exposed T-bars). Panel edges are to have a square edge return and to be tight butt jointed.
- .4 All stainless steel finishes shall be No. 4 brushed finish.
- .5 High efficiency LED down lights, 4" (100mm) diameter, shall be provided, one (1) in each ceiling panel (noted with 3), six (6) total.
- .6 A flat bar brushed stainless steel #4 handrail (3" / 75mm) shall be provided on all non-access walls. The handrail shall be three separate pieces.
- .7 Complete finished flooring, ACCZENT FLOURISH by TARKETT, colour Thrive 205 Serenade, shall be provided (Surface noted with 4).
- .8 The front wall and cab doors, including a front return, lintel, door post, kickplate, and cab door panels, shall be finished as specified for the car operating panel. The car control panel in each cab will comprise the entire front swing return panel with buttons and fixtures pierced into the panel wherever space permits.

ELEVATOR MODIFICATION

- .9 Where "Cab Light Dimming" feature is specified as required in the General Description, the cab lighting and cab fan shall automatically turn off after the elevator has not been in use for a prescribed period of time, as an energy saving feature. The time to activate this energy saving feature shall be variable and field adjustable as selected by the Departmental Representative.
- .10 Stainless steel cab curtain hooks shall be provided complete with a set of cab curtains for each elevator. The cab curtains shall be fire rated, shall cover all walls, and shall have a cut out for the car station(s).
- .11 Car sills shall be provided with finish as specified in the General Description.
- .12 The finalization of design details, availability of finishes and fabrication must not impede the installation schedule of the Contractor.
- .13 All composite woods shall be manufactured free of urea-formaldehyde.
- .14 The selection of materials and finishes must conform to the CSA B44 relating to flame spread rating and smoke developed classification as well as the requirements of the applicable building code. Finishes will be specified by the Departmental Representative.
- .15 Cab wall finishes shall not encroach on the clear inside dimensions required to accommodate a stretcher, as specified in the General Description.
- .16 The Contractor shall co-operate with the cab interior installer.

2.20 CAB DESIGN – SERVICE ELEVATOR

- .1 A complete finished cab shall be provided as per the cab interior layout given below, and as follows:



ELEVATOR MODIFICATION

- .2 On surfaces noted with 1, raised removable textured stainless steel , complete with textured stainless steel #4 panels edge returns and stainless steel #4 reveals, shall be provided.
- .3 Textured stainless steel shall be as follows:
 - .1 Rigidtex 5WL pattern, or equivalent
 - .2 16 gauge thickness
- .4 The ceiling (surface 2) shall be stainless steel panel finish.
- .5 Lighting (noted with 3) shall be LED tubes provided in a recessed fixture, and protected by non-breakable guards. A minimum of four (4) X 1200mm tubes shall be provided.
- .6 A flat bar brushed stainless steel handrail (3" / 75mm) shall be provided on all non-access walls. The handrail shall be three separate pieces.
- .7 A flat bar brushed stainless steel bumper rail (minimum 3" / 75mm high) shall be provided on all non-access walls, mounted approximately 8 inches (200mm) above the finished floor. The bumper rail shall be separate pieces, one (1) per wall.
- .8 Checker plate aluminum flooring shall be provided of suitable thickness. The floors shall be constructed of six (6) evenly sized panels that can be removable and replaceable from inside the cab. There shall be no discernible gap between the floor panels, or between the floor panels and the walls, when installed. The panels shall be fixed by recessed mechanical fasteners (surface 5).
- .9 The front wall and cab doors, including a front return, lintel, door post, kickplate, and cab door panels, shall be finished as specified for the car operating panel. The car control panel in each cab will comprise the entire front swing return panel with buttons and fixtures pierced into the panel wherever space permits.
- .10 Where "Cab Light Dimming" feature is specified as required in the General Description, the cab lighting and cab fan shall automatically turn off after the elevator has not been in use for a prescribed period of time, as an energy saving feature. The time to activate this energy saving feature shall be variable and field adjustable as selected by the Departmental Representative.
- .11 Stainless steel cab curtain hooks shall be provided complete with a set of cab curtains for each elevator. The cab curtains shall be fire rated, shall cover all walls, and shall have a cut out for the car station(s).
- .12 Car sills shall be provided with finish as specified in the General Description.
- .13 The finalization of design details, availability of finishes and fabrication must not impede the installation schedule of the Contractor.
- .14 All composite woods shall be manufactured free of urea-formaldehyde.

ELEVATOR MODIFICATION

- .15 The selection of materials and finishes must conform to the CSA B44 relating to flame spread rating and smoke developed classification as well as the requirements of the applicable building code. Finishes will be specified by the Departmental Representative.
- .16 Cab wall finishes shall not encroach on the clear inside dimensions required to accommodate a stretcher, as specified in the General Description.
- .17 The Contractor shall co-operate with the cab interior installer.

2.21 ALLOWANCE FOR ULTIMATE CAB WEIGHT

- .1 The above allowance (the potential future increase in weight after the specified finishes are installed) shall be 500 lbs (227kg) per elevator. This weight allowance can be used for walls, ceilings or flooring.
- .2 Allowance in this regard shall also be made for additional offsetting weight on the counterweight.

2.22 CLASS OF LOADING

- .1 Where an elevator is specified as Class A, B or C loading in the General Description, the elevator shall be designed to meet minimum rated load requirements of the CSA B44, Safety Code for Elevators.

2.23 CAB FAN

- .1 A two-speed ceiling mounted cab fan is required.
- .2 The fan capacity shall be a minimum of 350 cfm on high speed and 250 cfm on low speed.
- .3 The fan noise level shall not exceed 55 db when the fan is on high speed.

2.24 CAR BALANCE

- .1 After the cab enclosure work has been completed on the elevators, the following shall be done.
- .2 With the car empty and the doors closed, the upper car guides shall be removed. Suitable weights shall be added to the car so that it rests/hangs plumb in this condition.

2.25 ENTRANCES

- .1 All entrances shall be ULC labeled for minimum 1.5 hours, or greater if required by the building code and shall include the following.
- .2 Door panels, frames, tracks, and hangers shall be provided as follows:

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- .1 Door panels shall be supplied with two main rollers (per panel) having a non-metallic running surface and a minimum diameter of 2" (50mm), and two up thrust rollers with eccentric for fine adjustment of the vertical motion.
- .2 Standard door panels and standard frames shall be supplied to suit the wall thickness shown on the drawings.
- .3 Entrance frame and door panel finishes shall be as noted in the General Description.
- .4 Frames shall be installed in a rough opening with sizes as noted in the General Description.
- .5 All rollers for hangers and relating device pulleys shall have sealed bearings.
- .6 Hall door sills shall be provided with finish as specified in the General Description.

2.26 DOOR OPERATOR - CLOSED LOOP

- .1 High speed electrically driven closed loop door operators are required. The door operators shall be capable of a door opening time (from closed to 3/4 open) as shown in the performance table, and capable of closing the doors up to the limit allowed by code. The door operators must be capable of adjustment of speed, acceleration and slowdown, independently in each direction and of giving smooth and quiet operation.
- .2 The door operators must be capable of reversal of the direction from full speed closing to full speed opening within 0.5 seconds, without undue lost motion in the clutch or the linkages.
- .3 The proposed door operator make and model shall be included in the tender submission.

2.27 CAR DOOR DETECTOR EDGE

- .1 Infrared type detector edges are required, recessed a minimum of 1/2" (13mm) from the leading edge of car door panel, and conforming to the following.
- .2 The detector edge shall have a multiplicity of infrared beams across the entrance and operate to stop and re-open a closing door if an obstruction is in the elevator entrance. The doors must stop and reverse before contacting the obstruction.
- .3 The edge shall remain active until the doors are fully closed.
- .4 The detector edge shall reliably detect carts, wheelchairs, wagons, etc. of varying heights and finishes, including chrome.

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- .5 The interconnecting flexible electrical cable required for this shall not have sharp bends or strain points. The cab tire shall not rub against any hoistway or car equipment during the operation of the elevator.
- .6 The proposed door detector make and model shall be stated in the tender submission. Technical literature shall be included with the tender submission.

2.28 CAR OPERATING PANEL

- .1 Car operating panels shall be provided where specified in the General Description. The number of panels per elevator and faceplate finish shall be as specified in the General Description.
- .2 The main car operating panel shall be located in the front return and shall be applied faceplate type with hinged access that permit servicing of the panel without removal.
- .3 The following shall be included for each car operating panel, complying with the latest code requirements:
 - .1 Car call buttons and registration lights corresponding to each level served
 - .2 Run / Stop keyed switch.
 - .3 Firefighters' Emergency Operation Phase II provisions (keyed switch and indications).
 - .4 Emergency alarm button with spare contact for intercom.
 - .5 Telephone activation pushbutton.
 - .6 Door open button.
 - .7 Door close button.
 - .8 Door hold button, for Service Elevator SE02.
 - .9 Door hold cancel button, for Service Elevator SE02.
 - .10 Emergency Lighting Unit, complete with self charging battery unit.
 - .11 Smoked glass panel, behind which a card reader can be mounted and connected.
 - .12 A pit water sensor indicator.
- .4 All floor designations are subject to the Departmental Representative's approval. Registration of a car call shall cause the corresponding light to illuminate. When the call is answered the light shall extinguish.
- .5 All pushbuttons and fixtures shall be **Dupar US91, MAD type BS (Moon), or pre-approved equivalent**, with white illumination. They shall be complete with adjacent tactile markings and arranged at the code required height, all in accordance with the requirements for disabled persons access.

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- .6 The following switches shall be included in a lockable service cabinet with a finish the same as the car operating panel.
 - .1 Independent service.
 - .2 Maintenance.
 - .3 Fan.
 - .4 Light.
 - .5 Duplex electrical outlet.
 - .6 Emergency light test switch.
- .7 The following shall be engraved with black infill ½" (13mm) high letters minimum on the outside face of the locked cabinet door. An acceptable alternative shall be a separate engraved plate (same finish as panel) applied to the cabinet door. The method used to display this information shall be shown on shop drawings and shall be subject to approval by the Departmental Representative. Applied lamicaid plates shall not be acceptable.
 - .1 Government ID number
 - .2 Building Address
 - .3 Elevator Designation
 - .4 Capacity – Persons and Weight (Metric)
- .8 All keyed switches shall be engraved with black infill adjacent to each switch to identify the various switch functions. Except where specified by code, all keys shall be keyed the same, and shall match the keying system specified by the Departmental Representative.
- .9 All engraving, signage and annunciation shall be in both official languages, French and English.
- .10 A separate speaker grill and microphone shall also be incorporated into the car operating panel.
- .11 The final panel design shall be submitted for review.

2.29 POSITION INDICATORS

- .1 Position indicators shall be provided in the car and in the hall. The number and location of position indicators, as well as the faceplate finish, shall be as specified in the General Description.
- .2 Position indicators with LED segment type display are required. The colour of illumination shall be as provided for the car pushbuttons. The position indicators must display characters at least 2 inch high (50mm).

ELEVATOR MODIFICATION

- .3 Indicators must constantly indicate car position corresponding to level stopped at or through level being bypassed. Indications must be sufficiently bright to be easily read under normal ambient lighting conditions within the car and at the landings.
- .4 All floor designations are subject to Departmental Representative approval. Shop drawings shall be submitted for approval before manufacture.

2.30 HALL LANTERNS

- .1 Hall lanterns shall be provided where specified as required in the General Description. The number and location of lanterns, as well as faceplate finish, shall be as specified in the General Description.
- .2 The lanterns shall give advance warning of the approach of an elevator answering a hall call at that floor. The lanterns shall illuminate to indicate the intended direction of travel. The colour of illumination shall be as provided for the car pushbuttons.
- .3 The lantern shall operate as soon as the stopping decision has been made by the elevator controls and remain illuminated until the doors start to close. The lanterns shall not operate again if the doors are re-opened, except when the direction is being reversed, or as specified elsewhere. The lanterns shall not operate if the car is stopping for a car call only, and there is no hall call for either direction at that floor.
- .4 Lanterns shall utilize LED illumination and vandal resistant design, with no exposed plastic components.
- .5 Gongs shall sound when the lantern illuminates. The gongs must emit a soft "chime" type sound, with adjustable intensity. Harsh electronic beepers of the Sonalert type are not acceptable. The type of gong proposed is subject to approval.

2.31 IN-CAR LANTERNS

- .1 In-car lanterns shall be provided where specified as required in the General Description. The number and location of in-car lanterns, as well as faceplate finish shall be as specified in the General Description.
- .2 The lantern shall illuminate to indicate the current direction of the car, or if the car is stopped or approaching a stop, to indicate the future direction. The colour of illumination shall be as provided for the car pushbuttons.
- .3 The lantern shall emit an audible signal that will sound while the doors are opening, such that it can be heard by waiting passengers in the hall. The audible signal must be a soft "chime" type sound. Harsh electronic beepers of the Sonalert type are not acceptable. The type of gong proposed is subject to approval. The volume of the audible signal in the lantern shall be adjustable.
- .4 Lanterns shall utilize LED illumination and vandal resistant design, with no exposed plastic components.

ELEVATOR MODIFICATION

2.32 HALL BUTTONS

- .1 Hall pushbuttons shall be provided for elevators specified with standard dispatching. The number and location of risers, as well as faceplate finish shall be as specified in the General Description.
- .2 Intermediate floors must have an UP and a DOWN button while terminal floors must have only an UP or a DOWN button. Each button must illuminate when a call is registered and extinguish once the call is answered. The call registered light will originate from a long life LED source and be of an intensity that can clearly be seen in the normal ambient lighting level.
- .3 The pushbutton design and colour of illumination shall be as provided for the car pushbuttons.
- .4 The following signage shall be engraved on each hall station: "In case of fire use exit stairs do not use elevator".

2.33 HOISTWAY ACCESS SWITCHES

- .1 Hoistway access switches shall be provided where required by current code. Hoistway access switches shall be provided and mounted in the door jamb, sight guard or hall station. Finish shall be as provided for hall door frames and flush mount design.

2.34 VOICE COMMUNICATIONS

- .1 General
 - .1 In accordance with CSA B44, communication device(s) shall be provided in each elevator cab, where required by code, and at the main elevator lobby panel(s) at location(s) determined by the Departmental Representative.
 - .2 The Contractor shall provide the quantity of lobby phones as required by code.
 - .3 These devices shall permit two-way voice communication with the elevator cabs as required by code. Where a lobby phone device is required by code, should a call from the elevator cab to the lobby device not be answered within a prescribed number of rings, the device shall automatically forward the call to a 24hr manned station in accordance with code.
 - .4 The two-way communication device shall be activated by both the alarm button in the car and by a button located in the car operating panel.
 - .5 The devices shall meet all voice communication requirements of the applicable codes and regulations, including CSA B44, with capabilities for communication with both an off site monitoring station and the lobby station(s), and call initiation from the lobby phone(s) where provided.

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- .6 The monitoring and provision of the phone lines will be by Others.
- .7 The Contractor is responsible for connection and final testing of the communication systems.
- .8 The provision of all elevator phone devices shall be included in this Trade Contract, but shall be subcontracted to Webb Electronics Inc or other approved supplier.

2.35 DISABLED PERSONS ACCESS

- .1 Requirements for the disabled persons access shall comply the applicable local requirements and shall include the following, in accordance with CSA B44 Appendix E.
- .2 Buttons in the car operating panel must be marked for the visually impaired using tactile markings mounted adjacent to the buttons. Tactile markings shall be flush mounted in the panel and be secured by flanges and studs on the panel rear. Braille markings shall not be provided.
- .3 Hall buttons shall be mounted at the code required height for disabled persons access.
- .4 High quality cast metal tactile plates, two (2) per entrance frame, are required on each entrance door jamb to identify the floor level.
- .5 Audible tones shall be provided for car direction indication, with adjustable volume in the cab in accordance with regulations.
- .6 Audible position indication shall be provided in accordance with CSA B44 Appendix E. A sample of the proposed voice annunciation equipment shall be submitted for approval of sound quality.
- .7 Security card readers, if provided, shall be mounted within the allowable range of height for disabled persons access to car controls.
- .8 Handrails shall be mounted at the code required height for disabled persons access.
- .9 Buttons shall be raised face design.

2.36 FIREFIGHTERS' EMERGENCY OPERATION

- .1 Key switches and indicator lights shall be provided in the car control panels, at the main lobby and at the building CACF, or other remote location, to comply with the CSA B44, with respect to Firefighters' Emergency Operation (FEO), Phase I recall to the Designated and Alternate levels, and Phase II in-car emergency service.
- .2 The designation of the recall levels is subject to approval by the regulatory authorities and shall be confirmed by the Contractor prior to manufacture.

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- .3 The elevators controlled by FEO shall be identified at the Designated and Alternate levels by symbols corresponding to that particular elevator, mounted on or adjacent to the entrance. The characters shall be individually cast metal symbols.
- .4 All elevator(s) designated as the firefighters' elevator in the General Description shall conform to the requirements of the CSA B44, and the applicable building code.

2.37 STANDBY POWER PROVISIONS

- .1 The building is equipped with a standby power system, capable of providing power to the elevators indicated in the General Description. The standby power system shall be capable of operating **two (2) elevators simultaneously** in the standby power group herein.
- .2 The standby generator system will signal to the elevator controls, indicating whether the power is from Main (Normal) Supply or from Standby (Emergency) Supply.
- .3 A separate signal will be provided to the elevators to indicate whether that elevator is to operate on standby power.
- .4 Key switches and indicator lights shall be provided in the main lobby and at the building CACF, or other remote location, to comply with the CSA B44, with respect to Standby Power Operation.
- .5 On return of normal power supply, the elevators shall return automatically to normal operation.
- .6 The control system shall be designed to shut down a moving car at the next possible floor when the advanced warning contact opens.
- .7 All remote wiring to interconnect the various elevator groups for standby power sequencing shall be provided.

2.38 PIT WATER SENSOR

- .1 A pit water sensor shall be provided to detect accumulation of water in the pit area.
- .2 The signal from the pit water sensing device shall be interfaced with the elevator control system to achieve the following:
 - .1 An LED in the car operating panel shall automatically illuminate, and remain so until the pit water sensor is no longer activated,
 - .2 The elevator(s) shall travel to either the Designated Recall Level or the Alternate Recall Level, whichever is at the higher elevation in the building. The higher level shall also be identified as the flood recall level.
 - .3 All hall and car calls shall be cancelled,

ELEVATOR MODIFICATION

- .4 A car travelling towards the flood recall level shall continue nonstop to the flood recall level,
 - .5 A car travelling away from the flood recall level shall stop and proceed to the flood recall level,
 - .6 A car standing at any level other than the flood recall level shall close the door and proceed to the flood recall level,
 - .7 The elevator(s) shall remain parked at that level until the pit water sensor is no longer activated with only the cab door open button operative,
 - .8 Firefighters Emergency Operation shall override the above specified pit water sensor operation, and
 - .9 The elevator shall return to normal operation automatically when the pit water sensor is no longer activated.
 - .10 A signal shall be available in the controller to be sent to the commissioner desk on level 3 near the main entrance to provide an indication of the pit water sensor activation to a remote location within the building. Wiring to the remote location shall be by Division 26. Remote pit water sensor activation fixture to be provided by Elevator Contractor.
- .3 The Contractor shall be responsible for supply and installation of the pit water sensor.

2.39 SIGNAGE

- .1 All code required signage shall be provided in accordance with the requirements of the applicable Safety Authority and the CSA B44.
- .2 The signage shall include but not be limited to cab interior signage, "In case of fire...." signage at each hall station, and elevator machine room identification signage.

2.40 SEISMIC SAFETY PROVISIONS

- .1 Seismic safety provisions shall be provided for the elevators, in accordance with CAN/CSA B44, Section 8.4.

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3. OPERATION

3.1 SIMPLEX OPERATION

- .1 For all elevators operating as a simplex elevator with standard dispatching, the following shall apply.
- .2 All car and hall calls shall be stored until answered. Calls must be answered in a logical sequence, with the elevator only answering hall calls that correspond to the future direction of the elevator. The elevator shall not go to a terminal floor unless called to that floor, and must reverse the direction of travel at the furthest call.

3.2 HALL CALL ALLOCATION

- .1 Hall calls shall be allocated to the most suitable car, so as to minimize the average hall call waiting time. The controller shall consider at least the following when determining which car is most suitable for a particular hall call:
 - .1 Positions of cars.
 - .2 Number and location of car calls.
 - .3 Location, direction, and waiting time of hall calls.
 - .4 Intervening calls.
 - .5 Car load.
 - .6 Direction of travel.
 - .7 Cars in or out of service.
 - .8 Doors open, closed or delayed.

3.3 LEVELLING

- .1 The elevator platform shall stop level with the floor within 1/4" (6mm) at all stopping levels and under all conditions other than overload. Correction must be made for overtravel or cable stretch.

3.4 FLIGHT TIME

- .1 The elevator shall operate with an overall "flight time" as indicated in the PERFORMANCE TABLE in both directions for normal loading. This time is measured from the moment the doors start to close, until the doors are 3/4 open at the next floor.

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- .2 This performance must be accomplished without passenger discomfort. The rate of acceleration and the jerk must not exceed the values in the PERFORMANCE TABLE.

3.5 PERFORMANCE REQUIREMENTS

- .1 Performance Table
 - .1 Refer to the General Description

3.6 RIDE QUALITY

- .1 The horizontal vibration in the elevator cab, front to rear or side to side, shall not exceed 20 mg when measured inside the cab, and the elevator travelling at contract speed with less than 10% of the rated load. The vibration shall be measured between two consecutive points of opposite value.
- .2 The vertical vibration in the elevator cab shall not exceed 40 mg when measured inside the cab, and the elevator travelling at contract speed with less than 10% of the rated load. The vibration shall be measured between two consecutive points of opposite value.
- .3 The Contractor shall provide a high accuracy vibration/acceleration monitor, Physical Measurement Technologies EVA-625 Elevator Vibration Analysis System or pre-approved equivalent, and mount in the elevator cabs for the purposes of testing elevator ride quality, and conduct a test witnessed by the Departmental Representative to verify that the horizontal vibration does not exceed 20 mg as defined above.

3.7 OUT OF SERVICE TIMER

- .1 If the elevator is prevented from running (for reasons such as an open safety circuit or doors not closing, etc.) for more than approximately 30 seconds (field adjustable) the car shall be considered out of service.
- .2 At this time, the door detector (if equipped) shall deactivate and the doors close at reduced speed. This feature must be easily disconnected should it become inappropriate for the use of the elevators.
- .3 The doors shall remain open during this sequence if the OPEN button is pressed.

3.8 DOOR OPERATION

- .1 Door Opening and Closing
 - .1 Momentary pressure on the door OPEN button shall cause the doors to open or re-open, unless the doors are closing due to a long delay, in which case constant pressure on the door OPEN button is required.

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- .2 Door closing shall operate in conjunction with the door detectors according to the following:
 - .1 On answering a car or hall call, the door dwell (the time the doors remain in the fully open position) will initially be a period of approximately 4.0 seconds (field adjustable).
 - .2 If the detection system is briefly interrupted, the door dwell period will be reduced to approximately 1.2 seconds (field adjustable) after the detection system indicates the entrance is clear.
 - .3 If the detection system is interrupted while the doors are closing, the doors will immediately reverse; the doors will then start to re-close in approximately 1.2 seconds (adjustable) after the detection system indicates the entrance is clear.
- .2 Door Open/Close Failure
 - .1 If the doors fail to fully open within 6 seconds (field adjustable), they will re-close and attempt to open again.
 - .2 If the doors fail to fully close within 6 seconds (field adjustable), they will re-open and attempt to close again.
- .3 Door Re-Open for Hall Call
 - .1 If, during doors closing, a hall call is pressed at that floor,
 - .2 and if the elevator has no car or hall calls to answer, doors shall re-open immediately with the lantern and gong (if equipped) operating, for the direction of the hall call.
 - .3 and if the elevator has car or hall calls to answer, the doors shall not re-open and the hall call not be cancelled.
 - .4 and if the doors are re-opened by the open button or re-opening device, the lantern and gong (if equipped) shall momentarily operate and the hall call be cancelled if it is for the same direction.
- .4 Door Pre-Opening
 - .1 The doors shall start to open as the car approaches the floor at which it will stop. The doors shall be approximately 8 inches (field adjustable) open when the car reaches the floor. The amount of pre-opening shall be consistent at all floors and under all conditions.

3.9 DOOR HOLD OPERATION

- .1 Where a door hold and door hold cancel buttons are provided in the car operating panel(s), door hold operation shall function as follows:
- .2 When the door hold button is pressed with the elevator level at a given floor, the doors shall remain open for a prescribed period of time. This prescribed period of time shall be field adjustable from 5 to 60 seconds.

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- .3 When door hold operation and the door hold cancel button is pressed, door hold operation shall deactivate, and the doors shall start to close.

3.10 NUDGING OPERATION

- .1 Nudging operation is required and shall include the following.
- .1 The elevator doors shall close with reduced torque with the door detector bypassed.
 - .2 An adjustable timer (0 to 120 seconds) shall initiate the nudging operation should the doors be held open by the door detector.
 - .3 An electronic buzzer or other audible alarm shall sound when the door detector is bypassed and the nudging operation is activated.
 - .4 The doors shall stop and reopen, and remain open if the door open button is activated. Activation of the door open button shall also cause the audible signal to stop.
 - .5 Disconnection of the nudging operation must be easily accomplished should the operation prove to be unsuitable for use in this facility.

3.11 INDEPENDENT OPERATION

- .1 When the elevator is on independent operation, the following shall apply.
- .1 The elevator shall disconnect from the group.
 - .2 The elevator shall respond only to its car calls.
 - .3 The position indicators shall be operational.
 - .4 Doors shall open automatically upon arrival.
 - .5 The doors shall close by constant pressure on the door close button.
 - .6 The doors shall re-open if pressure on the close button is released before being fully closed.
 - .7 The door detector shall de-activate.

3.12 INSPECTION OPERATION

- .1 Inspection operation and manual controls shall be provided to operate the equipment at reduced speed from the car top, in accordance with code requirements.

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- .2 Car top control stations and associated wiring and circuits are required so that the elevators can be operated under maintenance control from the car top in accordance with the current regulations. Included on this fixture, or as a separate fixture on the car top light with a protective guard, shall be a light switch and a 110 Volt AC duplex power outlet.

3.13 NOISE CRITERIA

- .1 With the elevator cab in motion and at any position within the hoistway, the noise level when measured within the elevator cab, produced by all sources (excluding audible signals), shall not exceed 60 dBA. Noise levels shall be measured to ANSI type 1 or 2 accuracy sound level meter set on A-Weighting and "fast response".
- .2 The maximum noise level measured with doors opening, closing or reversing, shall not exceed 65 dBA, when measured in the elevator lobby at a distance of 2m from the centre of the elevator doors. Noise levels shall be measured using an ANSI type 1 or 2 accuracy sound level meter set on A-Weighting and "fast response".
- .3 The maximum noise level measured without doors opening, closing or reversing, shall not exceed 50 dBA, when measured in the elevator lobby at a distance of 2m from the centre of the elevator doors. Noise levels shall be measured using an ANSI type 1 or 2 accuracy sound level meter set on A-Weighting and "fast response".
- .4 The maximum noise level measured in the machine room shall not exceed 80 dBA. Noise levels shall be measured to ANSI type 1 or 2 accuracy. Sound level meter set on A-Weighting and "fast response".

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4. EXECUTION

4.1 TESTING AND INSPECTION

- .1 An inspection for life safety and code compliance by the applicable safety authority shall be provided under the base price.
- .2 In addition to the inspection by the applicable authority for life safety and code compliance, an inspection for material, workmanship and elevator performance will be carried out.
- .3 Qualified personnel shall be provided to assist in this inspection and in any repeat inspections that may be necessary.
- .4 The Contractor shall be advised at least two days in advance of the safety inspection so that he can be present during any testing procedures. Portable test weights totaling 125% of the full elevator capacity shall be available for these tests.
- .5 Any tests that require more than one elevator to be out of service at a time will have to be done at times specified by the Departmental Representative. If it is necessary to do some of this work in overtime, the extra cost of overtime shall be borne by the Contractor.
- .6 The Contractor shall provide an elevator mechanic to be present at a dry run and final demonstration testing of FEO and Standby Power Operation with the Departmental Representative and the authority having jurisdiction. A minimum of two (2) site visits to perform the demonstration and tests shall be provided in support of occupancy.

4.2 TRAINING

- .1 The Contractor shall provide a maximum of four (4) hours per elevator group on site training for the Departmental Representative, including a review of all manuals and demonstration of the equipment use and its features.
- .2 The Contractor shall provide a two (2) hour training session on the software used for the touchscreen operating panel or LCD position indicators (if applicable).

4.3 MAINTENANCE

- .1 For a period of twelve (12) months following Substantial Performance of the Project, maintenance of all the elevators shall be provided by the Contractor under the base bid price.
- .2 This maintenance shall include regular inspection, adjustment, and lubrication, callback for faulty operation, and the replacement of all parts and components that fail for any reason other than through malicious damage or gross misuse of the equipment. This shall include parts replaced as part of warranty as well as parts to be replaced due to normal wear and tear.

ELEVATOR MODIFICATION

- .3 Trouble calls shall be answered 24 hours a day, 7 days a week. All work other than trouble calls shall be done during regular working hours. On calls made after regular hours, charges for overtime premium will apply. Arrival time at the site for emergency calls must be as soon as possible but must never exceed 60 minutes. All maintenance must be documented and the records made available upon request.
- .4 Provide a written summary of work performed, date, inspection's name, to the Departmental Representative within 24 hours of inspection.
- .5 Maintain a complete maintenance record on each piece of equipment and submit a copy to the Departmental Representative at the end of the Guaranteed Maintenance Period.
- .6 Carry out maintenance on the elevators to the provisions of the CSA-B44, Section 8.6.
- .7 The Contractor shall provide a monthly written diagnostic report to the Departmental Representative, including faults, resolution, information, dates, time, etc.
- .8 During the warranty period following the date of Substantial Performance of the Project, the following, where applicable to the type of elevator installed, shall be performed as a minimum for the routine portion of the maintenance, at no extra cost to the Departmental Representative.
- .9 As part their regular maintenance, the Contractor shall,
- .10 Every FOUR (4) weeks
 - .1 report to the Departmental Representative's representative to determine if there are any minor problems that were not the subject of a callback.
 - .2 ride the elevator and check it for general operation, including quality of ride, quality of door operation, quality of levelling, and check for correct operation of the buttons, detector edge and indicators.
 - .3 check the general noise level of the ride, and of the door operation, taking corrective measures where performance or ride quality is not correct.
 - .4 check and replace lamps as necessary, in the call registered lights and lanterns.
 - .5 check the operation of hall buttons, in car lanterns, and position indicators.
 - .6 from the car top, check the door operation and linkage, inspect the clutch operation; check, clean and adjust the hall and car door rollers as necessary.
 - .7 generally clean equipment on a rotating basis.
 - .8 check all safety circuits for general operation.
 - .9 check governor tension sheave, and lubricate governor.

ELEVATOR MODIFICATION

- .10 check the limit and overtravel switches in actual running conditions and check all roller guides.
- .11 check the flight time of each elevator and from the cab, check the door operation including the door dwell times and the door open and close timing.
- .11 Every THREE (3) months
 - .1 check all door interlocks for adjustment and wear.
 - .2 check the hoisting cables and governor cables in detail.
- .12 Every SIX (6) months
 - .1 thoroughly clean the hoistway, including a complete vacuum cleaning of all projections; clean car top, door tracks, door sills, covers, limits, door operator and linkages etc.
 - .2 check the contract speed.
- .13 Regular working hours shall be 8am to 5pm, Monday to Friday.
- .14 The mean time between callbacks shall be greater than 90 days in any revolving 12 month period.
- .15 Elevators shall be operational greater than 99% of the time in any revolving 12 month period.

4.4 SPARE PARTS CARRIED LOCALLY

- .1 Spare parts shall be carried locally, either in the local office, or on site, for the total maintenance of all new equipment installed in this contract. At least one of each of the following items is required, where applicable to the type of elevators installed.
 - .1 Each type of printed circuit card for the new controls.
 - .2 Interlock.
 - .3 Limit switch, hoistway inductor or other position transducer.
 - .4 Hall pushbutton fixture, complete.
 - .5 Each type of button in the car station.
- .2 In addition, sufficient quantities of all fuses, lamps, contacts and brushes shall be carried on site.
- .3 At the Departmental Representative's request, the Contractor shall demonstrate a complete substitution of all logic cards involved in storage of hall calls and dispatching.

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- 4.5 DRAWINGS, PARTS LIST, SCHEMATICS, MANUALS
- .1 Before commencement of the work, the following shop drawings shall be submitted for review to the Departmental Representative and other jurisdictional authorities as required.
- .1 Hoistway and machine room layouts, including loads to be carried by the building structure, and motor sizes.
- .2 For hydraulic elevators with remote machine rooms, layout drawings indicating the proposed hydraulic piping and wiring trough route.
- .3 Vibration isolation details.
- .4 Hall buttons and fixtures.
- .5 Cab interior and car operating panels.
- .6 Entrances.
- .7 Emergency fixtures.
- .8 Voice annunciation equipment sample.
- .9 Electrical power confirmation, including regenerative power details.
- .10 Submissions to the applicable authority, where required.
- .2 Each drawing submitted shall bear stamp of qualified professional engineer registered in the province where the work is being carried out.
- .3 Upon completion of the work, the Departmental Representative shall be provided with the following. All information requested below shall be bound or in contained a three ring binder (hard copy) and saved electronically on a flash drive or USB stick. The information shall be organized logically, separated by suitable tabbed page dividers, and be complete with a table of contents.
- .1 Complete sets (one (1) hard copy, three (3) electronic copies) of maintenance and operating manuals, sufficiently detailed to enable the Departmental Representative to undertake maintenance of the equipment in the future should he wish to do so.
- .2 Copies (one (1) hard copy, three (3) electronic copies) of the parts list.
- .3 Copies (one (1) hard copy, three (3) electronic copies) of the control system and wiring schematic, showing final As-Installed details and adjustments.
- .4 Copies (one (1) hard copy, three (3) electronic copies) of all safety inspection certificates by the applicable authority.

ELEVATOR MODIFICATION

- .5 Copies (one (1) hard copy, three (3) electronic copies) of a list of replacement boards, logic diagrams, component lists, and any other technical information required to allow him to adjust and maintain the system using a qualified third party (for any solid state portion of the controls).
- .6 Copies (one (1) hard copy, three (3) electronic copies) of a complete list of company names, contact names, and telephone numbers of all suppliers of equipment used in the completion of this Contract.
- .7 Copies (three (3) electronic copies) of the touchscreen operating panel and LCD position indicator software (if applicable).
- .8 Ten (10) copies of each key required for the operation of the elevator.
- .9 Upon completion of the work, the Contractor shall also provide the Departmental Representative with all special proprietary diagnostic tools used for troubleshooting, diagnostics and/or adjustment of the equipment. The vendor may code the diagnostic tool to operate only with this particular equipment. All information other than the source code must be made available. In addition, one (1) duplicate copy of the control operational software shall be provided to the Departmental Representative.

4.6

SAMPLES

- .1 After award of the contract, samples of materials shall be submitted for review (which will be visible in finish) before fabrication. As a minimum, the following samples shall be supplied.
 - .1 Car and hall call buttons.
 - .2 Car and hall position indicator.
 - .3 Cab finishes.
 - .4 Voice annunciation device.

END OF SECTION 14 24 00

ELEVATOR MODIFICATION

Group / Bldg	Summerland Research and Development Centre	
Designation	PE01	SE02
Entrance	Front	Front
Penthouse		■
4	■	■
3	■ (DL)	■ (DL)
2	■ (AL) (MR)	■ (AL)
1		■ (MR)

Notes: DL = Designated recall level for Firefighters' Emergency Operation
 AL = Alternate recall level for Firefighters' Emergency Operation
 MR = Machine Room Location
 ■ = Level not served

Passenger Elevator			
1	Designation	PE01	
2	Number of Elevators	One(1) Passenger Elevator	
3	Operation	Simplex	
4	Type	Holeless Hydraulic	
5	Contract Speed	PE01 150 fpm; 0.76 m/s;	Existing beams located at 8'-1" hoistway width. Beams must be moved to 8'-8"
6	Rated Capacity	PE01 3500 lbs; 1588 kg;	
7	Hoistway Size (W x D)	** 9 ' - 9 " W x 10 ' - 7 " D	
	(Existing shaft size on site)	** 2972 mm W x 3226 mm D;	
8	Levels Served	Refer to Vertical Layout	
9	Door Type	Side Opening	
10	Door Size (W x H)	3 ' - 6 " W x 7 ' - 0 " H; 1067 mm W x 2134 mm H	
11	Door Rough Opening (W x H)	4 ' - 6 " W x 7 ' - 10 " H; 1372 mm W x 2388 mm H	
		Door Rough Opening to be confirmed on site by Elevator Contractor	
12	Cab Size (W x D x H)	6 ' - 8 " W x 5 ' - 5 " D x 8 ' - 0 " H; 7 ' - 6 "clearance	
		2032 mm x 1651 mm x 2438 mm; 2286 mm clearance	
13	Entrances	PE01 Front Opening Only	
14	Minimum Floor Height	8 ' - 6 "; 2591 mm	
15	Overhead	** 12 ' - 8 "; 3861 mm	Note 1: Measured from the highest level served to the underside of the top of hoistway.
16	Pit Depth	** 4 ' - 0 "; 1219 mm	
17	Pit Access	Pit ladder at lowest level served.	
18	Machine Room	Located adjacent to hoistway at Lowest Level	
19	Vibration Isolation	Yes	
20	Stretcher Accessible	Yes	
21		**	Dimensions shown shall be verified on site by elevator contractor

22	Firefighters Emergency Operation	Yes Phase 1 & Phase 2				
23	Firefighters Designated Elevator	N/A				
24	Standby Power Operation	Yes				
25	Top Hat	No				
26	Security	No				
27	Cab Finishes	Standard cab finishes as specified				
28	Cab Light Dimming	Yes				
29	Construction Use	No				
30	LCD Monitor	No				
31	Entrance Frame/Door Panel	Type	Standard			
		Finish	Brushed stainless steel #4 on Main Floor			
			Painted Steel at all other levels			
32	Hall Pushbuttons	Qty	One (1) hall station per floor			
		Finish	Brushed stainless steel #4			
33	Sill Finish	Hall Entrance Sill	Finish: Aluminum			
			Car Sill	Finish: Aluminum		
34	Lanterns	Qty/Type	One (1) hall lantern per elevator at all entrances			
		Finish	Brushed stainless steel #4			
35	Position Indicators (Per Elevator)	Qty/Type	One (1) in-car One (1) per entrance on main level			
		Finish	Brushed stainless steel #4			
36	Car Operating Panel	Qty	One (1)			
		Finish	Brushed stainless steel #4			
36	Voice Communication	Hands-free				
37	Weather Resistance	Not required				
38	Heat Exchanger Required	No				
39	Power Supply	600 V / 3 Phase				
40	Motor Size (Est.)	Per Elevator: 40 hp; 30 kW				
41	Regenerative Drives Required	N/A				
42	Pit Loads (Est. Per Elevator)	Car Buffer		Counterweight Buffer		
		27191 lbs; 121 kN		N/A lbs; N/A kN		
43	Machine Room Heat Load (Est.)	Per Elevator: 28000 BTU/h;				
44	Performance Times	Door Open	Door Close	Flight Time	Floor Height Basis	
		1.7 s	2.4 s	12.5 s	13 ' - 0 ";	3962 mm
45	Maximum Acceleration	3.9 ft/s²; 1.19 m/s²;				
46	Maximum Jerk	5.9 ft/s³; 1.80 m/s³;				

ELEVATOR MODIFICATION

Service Elevator			
1	Designation	SE02	
2	Number of Elevators	One(1) Service Elevator	
3	Operation	Simplex	(Class C3 loading. Single piece loaded onto elevator not to exceed 3,500lbs)
4	Type	Holeless Hydraulic	
5	Contract Speed	SE02 150 fpm; 0.76 m/s;	Existing beams located at 7'-5" hoistway width. Beams must be moved to 7'-8" .
6	Rated Capacity	SE02 4500 lbs; 2041 kg;	
7	Hoistway Size (W x D)	** 9 ' - 3 " W x 9 ' - 7 "	
	(Existing shaft size on site)	** 2832 mm W x 2921 mm D;	
8	Levels Served	Refer to Vertical Layout	
9	Door Type	Two Speed Side Opening	
10	Door Size (W x H)	4 ' - 0 " W x 7 ' - 0 " H; 1219 mm W x 2134 mm H	
11	Door Rough Opening (W x H)	5 ' - 0 " W x 7 ' - 10 " H; 1524 mm W x 2388 mm H	
		Door Rough Opening to be confirmed on site by the Elevator Contractor	
12	Cab Size (W x D x H)	5 ' - 8 " W x 7 ' - 10 " D x 8 ' - 0 " H; 7 ' - 6 " clearance	
		1727 mm x 2388 mm x 2438 mm; 2286 mm clearance	
13	Entrances	SE02 Front Opening Only	
14	Minimum Floor Height	8 ' - 6 " ; 2591 mm	
15	Overhead	** 13 ' - 2 " ; 4013 mm	Note 1: Measured from the highest level served to the underside of the top of hoistway.
16	Pit Depth	** 4 ' - 3 " ; 1295 mm	
17	Pit Access	Pit ladder at lowest level served.	
18	Machine Room	Located adjacent to hoistway at Lowest Level	
19	Vibration Isolation	Yes	
20	Stretcher Accessible	Yes	
21		**	Dimensions shown shall be verified on site by elevator contractor

22	Firefighters Emergency Operation	Yes	Phase 1 & Phase 2			
23	Firefighters Designated Elevator	N/A				
24	Standby Power Operation	Yes				
25	Top Hat	No				
26	Security	No				
27	Cab Finishes	Standard cab finishes as specified				
28	Cab Light Dimming	Yes				
29	Construction Use	No				
30	LCD Monitor	No				
31	Entrance Frame/Door Panel	Type	Standard			
		Finish	Brushed stainless steel #4 on Main Floor			
			Painted Steel at all other levels			
32	Hall Pushbuttons	Qty	One (1) hall station per floor			
		Finish	Brushed stainless steel #4			
33	Sill Finish	Hall Entrance Sill	Finish: Nickel Silver			
			Car Sill	Finish: Nickel Silver		
34	Lanterns	Qty/Type	Two (2) in-car door jamb mounted lanterns			
		Finish	Brushed stainless steel #4			
35	Position Indicators (Per Elevator)	Qty/Type	One (1) in-car		One (1) per entrance on main level	
		Finish	Brushed stainless steel #4			
36	Car Operating Panel	Qty	One (1)			
		Finish	Brushed stainless steel #4			
36	Voice Communication	Hands-free				
37	Weather Resistance	Not required				
38	Heat Exchanger Required	No				
39	Power Supply	600 V / 3 Phase				
40	Motor Size (Est.)	Per Elevator: 50 hp; 37 kW				
41	Regenerative Drives Required	N/A				
42	Pit Loads (Est. Per Elevator)	Car Buffer		Counterweight Buffer		
		35000 lbs; 156 kN		N/A lbs; N/A kN		
43	Machine Room Heat Load (Est.)	Per Elevator: 32500 BTU/h;				
44	Performance Times	Door Open	Door Close	Flight Time	Floor Height Basis	
		2.7 s	4.5 s	15.3 s	13 ' - 0 ";	3962 mm
45	Maximum Acceleration	3.9 ft/s²; 1.19 m/s²;				
46	Maximum Jerk	5.9 ft/s³; 1.80 m/s³;				

FIRE PROTECTION SYSTEM

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Fire protection system piping and accessories.
- .2 Sprinkler heads.
- .3 Spare parts.
- .4 Fire extinguishers.

1.2 QUALITY ASSURANCE

- .1 All work shall be installed in accordance with the current edition of NFPA No. 13, Standard for Installation of Sprinkler Systems.
- .2 Prior to construction provide a copy of the Sprinkler Permit.
- .3 All workers engaged in the construction or modification of the fire protection system shall be journeymen who have Trades Qualifications as Sprinkler Fitters under Province of British Columbia legislation, or are indentured apprentices working under a journeyman who is on the site. Trades Qualification certificates must be submitted prior to commencing work and must be on site for inspection.
- .4 All material, equipment, valves and devices installed and/or furnished under this section shall be listed and/or approved for use in fire protection installation by the following agencies or codes.
 - .1 Factory Mutual Engineering Association.
 - .2 Underwriters' Laboratories of Canada.
 - .3 Underwriters' Laboratories Incorporated.
 - .4 National Fire Protection Association.
 - .5 Local Fire Department.
- .5 Fire extinguishers must conform to any one of the following National Standards: ULC-S504, CAN4-503, ULC-S512, CAN4-S507.

1.4 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Submission details and requirements shall be as prescribed in the current edition of NFPA Standard 13.
- .2 Equipment Shop Drawings: Submit technical and maintenance detail for the following equipment:
 - .1 Each type of sprinkler head
 - .2 Sprinkler head guards
 - .3 Extinguishers, including rating and capacity

1.5 SUBMITTALS – PRIOR TO SUBSTANTIAL PERFORMANCE

- .1 Include shop drawings in each of the Maintenance Manuals.

1.6 RECORD DRAWINGS

- .1 Refer to Section 23 01 00, Documentation, Manuals and Record Drawings.

1.7 ACCEPTABLE MANUFACTURERS

- .1 Manufacturers of fire extinguishers and cabinets whose products are approved in principle, but subject to requirements of drawings and specifications are:
 - .1 CEB, National Fire Equipment, Flag, Wilson and Cousins, Silverline, Chubb.
- .2 Manufacturers of sprinkler heads and equipment whose products are approved in principle, but subject to requirements of drawings and specifications are:

FIRE PROTECTION SYSTEM

- .1 Viking, Reliable, Victaulic.

1.8 SPECIAL CONDITIONS

- .1 Provide 48 hours' notice to the Departmental Representative prior to disruption of systems. Obtain approval prior to proceeding with systems shutdown or disruption.
.2 Systems outside the work area are not to be left in inoperable conditions overnight.
.3 During periods of normal building operation, work in the building will not be permitted. All work must be executed either before or after normal operating hours.

2.0 PRODUCTS

2.1 SPRINKLER HEADS AND ESCUTCHEON PLATES

- .1 Sprinkler heads installed shall be upright sidewall or pendant, as conditions and density require, and shall be of the proper type and finish for the building and/or areas designated.
.2 Sprinkler heads on unfinished exposed piping, except where noted, shall be brass finish upright type.
.3 Heads in light hazard occupancies shall be quick response type, if required.

2.2 SPRINKLER HEAD GUARDS

- .1 Head guards shall be approved by the sprinkler head manufacturer for use on the sprinkler head approved.

2.3 FIRE EXTINGUISHER – TYPE FE-1

- .1 UL listed for class A, B and C fires, dry chemical ammonium phosphate powder, red finish, complete with surface mounting bracket.
.2 4.6 kg (10 pound), rating 6A/80BC 135 mm diameter, 521 mm high.

3.0 EXECUTION

3.1 GENERAL

- .1 Wall, ceiling and floor penetration – sprinkler head piping less than 65 mm: Chrome finished split rings, complete with fastening screws.

3.2 SPRINKLER HEADS

- .1 Head type, configuration and placement shall comply with the specification requirements as well as notation requirements on plans.
.2 Provide extended escutcheons if necessary to clear obstructions.
.3 Provide approved sidewall heads where required, or shown. Ensure heads are approved for range required to provide coverage.
.4 Temperature rating shall suit the specific area with a minimum margin of safety of 10 degrees C.
.5 The proximity of head to heat generating equipment shall be taken into consideration in determining the temperature ratings.

3.3 SPRINKLER HEAD GUARDS

- .1 Provide sprinkler head guard where shown on plans.

3.4 FIRE EXTINGUISHERS

- .1 Extinguishers less than 18 kg: Mount so top of extinguisher is 1,500 mm from floor.

3.5 INSPECTIONS AND TESTS

- .1 Provide all labour and equipment for all phases of final inspections, examinations, and tests required to obtain complete and final acceptance of the fire protection system. If required, tests and demonstrations shall be in the presence of representatives of the agencies having jurisdiction.

FIRE PROTECTION SYSTEM

- .2 Notify the Departmental Representative in writing when final inspection of the installation may be performed. The Departmental Representative shall be reimbursed by the Contractor for time and expenses involved in subsequent inspections resulting from deficiencies noted during final inspection.
- .3 Bleed all air from system so that alarm devices shall activate no less than 60 seconds after test valves are opened.
- .4 Sprinkler system discharge tests shall be conducted using system test pipes described. Pressure gauges shall be installed at critical points and readings taken under various modes of auxiliary equipment operation. Water flow alarm signals shall be responsive to discharge of water through system test pipes while auxiliary equipment is in each of the possible modes of operation.
- .5 Tests shall be executed with all trim and accessories in normal operating condition, air compressors and excess pressure pumps in auto mode, accelerators and retarders enabled, etc.

3.6 WET SYSTEM TEST AND SYSTEM PRESSURE INTEGRITY

- .1 Comply with all requirements of NFPA and this specification with respect to testing, reports and certifications.
- .2 Substantial Performance Inspection: Demonstrate that the fully charged system does not lose water pressure greater than 10 kPa (1.5 psig) over a 72 hour period. Submit reports.
- .3 Warranty Inspection: Demonstrate that the fully charged system does not lose pressure greater than 10 kPa (1.5 psig) over a 72 hour period. Note that this requirement for integrity of the piping system and accessories will be applied to the performance of the system during and after the warranty period. Failure of the system to maintain this standard, due to deterioration or failure of piping, couplings or accessories, will be viewed as a latent construction defect. Correction of such a defect will be considered as the responsibility of the Contractor. Since failures of this type are usually a fault of the couplings and seals, the Contractor is admonished to carefully select, install and test the couplings as well as all other accessories.

MECHANICAL EQUIPMENT SCHEDULES

SRDC Elevator Replacement			
Fan Schedule			
Ident	EF1005	EF2	
Status	New	Remove Existing	
Location	MECH1005	MECH1005	
Service	MECH1005	MECH1005	
Description	Cabinet - Integral Grille	Cabinet - Integral Grille	
Manufacturer			
Model			
Nominal Size			
Air Flow l/s	780		
External Air Pressure Drop Pa	65		
Width mm	832		
Length mm	575		
Height mm	330		
Diameter mm			
Weight kg	31		
Motor W	761.0		
Voltage/Phase	120/1		
Accessories And Notes	<ul style="list-style-type: none"> • Direct Drive • Low Leak Backdraft Damper • Select for Less than 4 Sones • Local Control thru Controls Agent • EC Motor With 0-10VDC Speed Input 	<ul style="list-style-type: none"> • Demolish Existing 	
Electrical Coordination	<ul style="list-style-type: none"> • DDC Controlled • 		

MECHANICAL EQUIPMENT SCHEDULES

SRDC Elevator Replacement		
Condensing Unit Schedule		
Ident		CU - 2013
Status		New
Location		Roof
Service		Passenger Elevator Machine 2013
Description		Air Cooled Condensing Unit
Manufacturer		
Model		
Nominal Size		030
Coil		FC-2013
Cooling Capacity kW		3.1
Capacity Control		DC Inverter
Refrigerant		R410a
Width mm		950
Length mm		360
Height mm		950
Weight kg		68
Voltage/Phase		208/1
MCA Amps		20.0
Accessories And Notes		<ul style="list-style-type: none"> • Off Cycle time delay • Low Ambient Kit for full capacity to - 17C • Inbuilt condensate pump
Electrical Coordination		<ul style="list-style-type: none"> • Provide Disconnect

MECHANICAL EQUIPMENT SCHEDULES

SRDC Elevator Replacement		
DX Coil Schedule		
Ident		FC - 2013
Status		New
Location		Passenger Elevator Machine 2013
Service		Passenger Elevator Machine 2013
Description		Wall mount fan coil
Manufacturer		
Model		
Nominal Size		030
Cooling Capacity kW		3.1
Air Flow l/s		370
Face Velocity m/s		0.9
Entering Air Temp °C		30
Leaving Air Temp °C		13
Fluid Type		R410a
Length mm		1,170
Height mm		365
Inlet mm		10
Outlet mm		16
Weight kg		21
Accessories And Notes		<ul style="list-style-type: none"> • SS Drain Pan c/w Trap
Electrical Coordination		<ul style="list-style-type: none"> • Connect to outdoor unit • Provide Disconnect

MECHANICAL EQUIPMENT SCHEDULES

SRDC Elevator Replacement	
Air Outlet Schedule	
Ident	G
Description	Heavy Duty Gym Grille
Manufacturer	
Model	96 Series
Color	Prime
Balancing Damper	No
Fire Damper	Yes
Backdraft Damper	No
Accessories And Notes	<ul style="list-style-type: none"> • Heavy Duty • 19 mm Spacing • 45 Deg Deflection

END OF SECTION 23 00 00

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Operating and Maintenance Manuals.
- .2 Assembly of equipment start up and performance tests and reports for new, renovated or necessary existing systems.
- .3 Assembly of equipment details sheets and shop drawings for new, renovated or necessary existing systems.
- .4 Assembly of equipment and systems operating and maintenance instructions for new, renovated or necessary existing systems.
- .5 Assembly of final permits for new, renovated or necessary existing systems.
- .6 Record Drawings.

2.0 PRODUCTS

2.1 OPERATION AND MAINTENANCE MATERIALS

- .1 Provide one hard copy in a 215 mm x 280 mm 3 post type catalogue binder, lettering front and spine, plastic tab dividers. Binder should be identified by both volumes if required.
- .2 Provide one flash drive labelled and containing the specified materials in Portable Document Format (PDF).
- .3 Manufacturers' data section is to be indexed and ordered to exactly match the sections of the specifications, including section numbering. Each section of the manufacturers' data section is to include an up to date copy of the equipment schedule for that section, with the same format as the equipment schedules in the tender document. The schedule is to be revised to suit all addenda, change orders and field changes, as well as manufacturers and model numbers matching the equipment supplied. Assemble or develop complete and correct documentation for the operation and preventative maintenance of equipment and systems provided.
- .4 Assemble or develop copies of all certified shop drawings and material required to complete the documentation. This generally includes but is not limited to the following:
 - .1 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.
 - .2 Permits
 - .1 Refrigeration
- .5 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service, and troubleshooting instructions.
- .6 Operating and maintenance schedule, indicating location, grades (grease or oil) for all lubricated equipment components.
- .7 Local source of supply for each item of equipment.
- .8 Shop drawings, including the Department representative's review stamp and comments.
- .9 Air system balance report.
- .10 Equipment start up reports as per manufacturer requirements.
- .11 Equipment start up reports to detail as left settings
- .12 Warranties, certificates and miscellaneous reports.
- .13 Manufacturers' operating and maintenance brochures, and shop drawings, including wiring diagrams, fan performance data, pump curves with the operating point indicated, and control maintenance bulletins.
- .14 Filter type, specification, model number, efficiency rating, and thickness, correlated with fan coil equipment identification.
- .15 Completed equipment inventory and submittal sheets.
- .16 Statutory inspection details.
- .17 Control device setting record sheets.
- .18 Letters of assurance from Seismic Specialty Engineer.

DOCUMENTATION, MANUALS AND RECORD DRAWINGS

- .19 Instructions for emergency operation, maintenance and shutdown of all systems.
- .20 Record Drawings photo reduced to 430 mm x 280 mm.
- .21 Copies of all Receipts for equipment handed over to the Departmental Representative.

2.2 RECORD DRAWINGS

- .1 Contractors shall certify final Record Drawings to be correct by notation and signature on the drawings.
- .2 Record drawings shall precisely identify the configuration, size and location of all systems and equipment installed under this Division.
- .3 Before Substantial Completion submit for approval to the Department representative, completed and detailed marked up white prints to reflect the record drawing status.

2.3 BALANCE REPORTS

- .1 Refer to Section 23 05 93.1 Testing, 23 05 93.2 Balancing and 23 05 93.3 Commissioning.
- .2 Provide specified number of final copies for inclusion in Operating and Maintenance Manuals.

2.4 PERMITS

- .1 Refer to Section 23 05 93.1 Testing, 23 05 93.3 Commissioning and Section 23 05 00, Common Work Results for HVAC.

2.5 EQUIPMENT TEST REPORTS

- .1 Refer to Section 23 05 93.1 Testing and 23 05 93.2 Balancing.

2.6 COMMISSIONING REPORTS

- .1 Refer to Section 23 05 93.1 Testing, 23 05 93.2 Balancing and Section 23 05 00, Common Work Results for HVAC.

3.0 EXECUTION

3.1 MAINTENANCE MANUALS

- .1 Substantial Performance cannot be declared until reviewed Manuals are in the hands of the Departmental Representative.
- .2 Submit a draft copy of proposed content, including comprehensive systems description, for approval prior to Substantial Performance.
- .3 Provide one corrected and final copy of the Maintenance Manual along with an electronic version (CD Read-Write or flash drive) of the maintenance manual, to the Departmental Representative at least five days prior to Substantial Performance.

3.2 RECORD DRAWINGS

- .1 The contractor is to maintain on site a clean set of drawings to be used to mark on any changes made during the course of construction. Changes must be kept up to date on a daily basis.

END OF SECTION 23 01 00

1.0 GENERAL

1.1 DESCRIPTION OF WORK

- .1 The scope of this contract includes but is not limited to the provision and installation of:
 - .1 Heating, ventilating and air conditioning equipment and accessories.
 - .2 Ductwork and accessories, new and renovated.
 - .3 Controls and accessories.
 - .4 Renovation or removal of existing systems, services and equipment.
 - .5 Renovated automatic fire sprinkler system and accessories.
 - .6 Renovations, cutting and patching.
 - .7 Cutting and patching for wall and floor openings less than 150 mm in any dimension.
 - .8 Roof repair, roof curbs, and roof openings of any dimension.

2.0 PRODUCTS

2.1 ACCESSIBILITY AND 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 Install all work so as to be readily accessible for adjustment, operation and maintenance. Furnish access panels where required in building surfaces for installation by building trades.
- .4 Locate access panels in service areas wherever possible. Do not locate in paneled or special finish walls, without prior approval.
- .5 If any doubt exists, inform Departmental Representative of impending installation and obtain his approval for actual location.

2.2 ALTERNATIVE PRODUCTS OR SYSTEMS

- .1 Where a list of acceptable materials, equipment or suppliers is included in this Division of the specification, Tenders are to be based on use of the specified equipment or equipment included in the acceptable materials clauses.
- .2 Where no list of acceptable materials, equipment or suppliers is included in the specification sections, Tenders are to be based on use of the specified materials, equipment or suppliers or any other material that complies with the specifications for quality, certification, material, performance, etc. A request for approval to supply alternative materials, equipment or suppliers is not required.
- .3 Request to have alternative materials, equipment or suppliers added to the list of acceptable materials, equipment or suppliers will be considered. Submit proposals to supply alternative materials, equipment or suppliers of equipment in writing, to the Department Representative at least seven days, unless otherwise noted, prior to Tender Closing Date for Divisions 23 and 25.
- .4 Materials or equipment alternatives: Identify specific materials or equipment for which alternates are requested. Provide specific technical data indicating dimensions, performance, weight, size, arrangement, etc. and other data as necessary or requested.
- .5 Suppliers or contractor alternatives: Provide references, project history, technicians qualifications, etc. and other data as necessary or requested.
- .6 Where specified equipment is included in a schedule, the request for approval must include an identical schedule, with each value of the alternate equipment compared to the specified equipment value. Photo copied schedules, marked with the alternate characteristics, would be acceptable.
- .7 All costs, including fees for re-design and record document correction, required to adapt alternative materials, equipment or suppliers shall be the responsibility of the Contractor.
- .8 Addition of materials, equipment or suppliers to the specifications will be by written addendum only.

2.3 ELECTRICAL MOTORS

- .1 Supply mechanical equipment complete with electrical motors. Motors provided under this Division shall have the characteristics as herein described.
- .2 Provide motors to CMA and CSA Standards for hard, continuous service, designed to limit temperature rise to 40°C for open housing and 50°C for drip proof housing and operate at 1200 or 1800 r/min. unless otherwise specified.
- .3 Polyphase, squirrel cage, single speed NEMA/EEMAC Design A or B induction motors, between 746 watts (1 hp) and 149.2 kw (200 hp), whether in packaged equipment or not, shall comply with the current requirements of the British Columbia Energy Efficiency Standards Regulation, and specifically, CSA C390-93 Energy Efficiency Test Methods for Three Phase Induction Motors.
- .4 For other three phase motors totally enclosed fan cooled, or ordinary drip proof motors provide energy efficient type motors with full-load efficiencies next step better than those listed in the following table:

Full Load		Full Load	
HP	Efficiency	HP	Efficiency
1.0	82.5	7.5	89.5
1.5	84.0	10.0	89.5

- .5 Motors shall have permanently lubricated ball or roller type bearings.
- .6 Refer to Division 16, Electrical for exact voltage, phase, requirements of electrically driven mechanical equipment, but generally motors shall follow this schedule.
 - .1 For motors up to and including 373 watts (1/2 HP) 120/1/60.
 - .2 For motors 560 watts and over, (3/4 HP) 208/3/60.
- .7 Provide all motors with terminal boxes, suitable for power connections.
- .8 Select motors for centrifugal fan applications, which are capable of being automatically cycled at 10 minute intervals.
- .9 Unless otherwise noted, starters and protection devices will be included under the Electrical Division of the Specification.
- .10 Motors less than 740 watts (1 hp) are to be provided with internal thermal motor protection feature.
- .11 Motors exposed to outdoor temperatures shall be lubricated with lubricants suitable for operation at -30 degrees C.
- .12 Assist the electrical trade to ensure proper connection, correct thermal overload selection and correct start/stop controls. Verify all motor voltages with electrical trade prior to operation.
- .13 Where starters are included in this Division of the Specification, they shall contain thermal overload protection in all ungrounded lines.
- .14 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch, supplied under this Division.

2.4 MATERIALS AND EQUIPMENT

- .1 Material and Equipment:
 - .1 Use new material and equipment unless otherwise specified.
 - .2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
 - .3 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.
 - .4 All Equipment and materials shall conform to the requirements of ASHRAE 90.1.

- .2 Manufacturer's Instructions:
 - .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
 - .2 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.
- .3 Fastenings, General:
 - .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior Work.
 - .2 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs not acceptable.
 - .3 Keep exposed fastenings to minimum, space evenly and lay out neatly.
 - .4 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
 - .5 Explosive actuated fastening devices shall comply with CSA Z166.
- .4 Fastenings, Equipment:
 - .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
 - .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
 - .3 Bolts may not project more than one diameter beyond nuts.
 - .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur and resilient washers with stainless steel.
- .5 Delivery and Storage:
 - .1 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.
 - .2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.
 - .3 Store material and equipment in accordance with supplier's instructions.
 - .4 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use primer or enamel to match original. Do not paint over name plates.

3.0 EXECUTION

3.1 BALANCING, COMMISSIONING AND DOCUMENTATION

- .1 The Balancing, Commissioning and Documentation work will be performed by this contractor under direction from the Commissioning Authority.
- .2 Record Drawings: The contractor is to maintain on site a clean set of drawings to be used to mark on any changes made during the course of construction. Changes must be kept up to date on a daily basis. Turn over drawings to Departmental Representative at Substantial Completion.
- .3 Maintenance Manual Materials: Turn over 3 paper copies and electronic copy of all maintenance materials to Departmental Representative's Documentation agent prior to substantial completion. These documents are to include but not limited to:
 - .1 Permits.
 - .2 Equipment start up reports.
 - .3 Warranties, certificates and miscellaneous reports.
 - .4 Manufacturers' operating and maintenance brochures, and shop drawings, including wiring diagrams, fan performance data, pump curves with the operating point indicated, and control maintenance bulletins.

- .5 Filter type, specification, model number, efficiency rating, and thickness; correlated with fan coil equipment identification.
- .6 Statutory inspection details.
- .7 Control device setting record sheets.
- .8 Instructions for emergency operation, maintenance and shutdown of all systems.
- .9 Training Records.

3.2 CERTIFICATES & TRANSCRIPTS

- .1 Submittals prior to start of construction:
 - .1 Certified copy of Insurance required to be provided by the Contractor.
 - .2 Letter of compliance with WorkSafeBC.
 - .3 Building permit compliance.
 - .4 Submittals as required elsewhere in this specification.
- .2 Submittals prior to initial progress claims:
 - .1 Cost breakdown.
 - .2 Submittals as required elsewhere in this specification.
- .3 Submittals during construction:
 - .1 Contractor's Statutory Declaration, on forms approved by C.C.A. is to accompany all progress claims subsequent to initial claim. Declaration is to certify that all past claims have been paid as certified or as noted and must be properly signed and notarized.
 - .2 Submittals as required elsewhere in this specification.
- .4 Submittals prior to Substantial Performance:
 - .1 Occupancy Permit and Inspection Certificates from authorities having jurisdiction and as required for equipment items to comply with governing Codes and Regulations.
 - .2 Operation and maintenance manuals.
 - .3 Record drawings.
 - .4 Results of all Tests required by the specification.
 - .5 Refer to Substantial Performance in this Section.
 - .6 Refer to Agreement GC 5.4 and GC 5.5.
 - .7 Submittals as required elsewhere in this specification.
- .5 Submittals at Total Performance:
 - .1 Refer to Project Close-out in this Section.
 - .2 Refer to Agreement GC 5.7.
 - .3 Submittals as required elsewhere in this specification.

3.3 CHANGES AND CLARIFICATIONS TO THE CONTRACT

- .1 During tender period: Errors, omissions or any questions regarding this Project must be referred to the Departmental Representative for clarification or correction not later than five working days prior to the Tender Closing Date. Any corrections or changes necessary to the Tender Documents will be contained in an Addendum issued by the Departmental Representative. All such corrections or changes confirmed by Addendum shall become part of the Tender Documents and their effect shall be included in the Tenderer's Contract Price. No extras will be permitted for elements of the Project which may be reasonably inferred from the Tender Documents to complete the Project. No proposed changes to the Contract, verbal or otherwise, shall be considered valid unless they are also included in a written addendum.
- .2 After tenders have been submitted, but prior to award of contract: Any corrections or changes necessary to the Tender Documents will be contained in a Post Tender Addendum issued by the Departmental Representative. Submit the cost for each change itemized in the Post Tender Addendum. Changes will not be considered part of the Contract unless confirmed in the letter of intent.
- .3 During the course of construction, after award of the Contract: Any corrections, changes or clarifications necessary to the Contract Documents will be contained in either a Change Notice, a

Change Order, a Change Directive, or a Site Instruction issued by the Departmental Representative. No proposed changes to the contract, verbal or otherwise, shall be considered valid unless they are also included in a written Change Directive or Change Order.

- .1 Contemplated Change Notice: All Contemplated Change Notice items are contemplated changes. Work is not to proceed until authorized by a Change Order. All materials and workmanship are to be as described in the contract documents unless otherwise stated. Provide a price for each item, including materials and labour breakdown. Provide further breakdowns as directed by the Departmental Representative. Indicate any change to the time of completion that will result from acceptance of the Change Notice items.
- .2 Change Order: Change Order items refer to Change Notice items that have been accepted and become part of the contract. The work is to proceed at the agreed upon price, which will be attached to the Change Order.
- .3 Site Instruction: All Site Instruction items are to be considered as clarifications to the contract, and not as additional work. No change to the Contract Price or time of completion will be accepted.

3.4 CODES AND STANDARDS

- .1 The work, including all materials, labour and other services shall conform, but not be limited to the requirements of the latest editions of the following Codes, Bylaws, Standards and Regulations:
 - .1 National Building Code of Canada.
 - .2 British Columbia Building Code.
 - .3 British Columbia Fire Code.
 - .4 Local Building Bylaws.
 - .5 WorkSafeBC.
 - .6 Canadian Standards Association.
 - .7 Canadian Electrical Code.
 - .8 .9 Other relevant codes as noted in each individual specification section. Note the most stringent code will apply.

3.5 CONCEALMENT

- .1 Conceal all piping, ductwork and conduit in partitions, walls, crawl spaces and ceiling spaces unless otherwise noted.
- .2 Do not install piping and conduit in outside walls or roof slabs unless otherwise directed, in which case install them with the building insulation between them and the outside face of the building.

3.6 CONTRACT BREAKDOWN

- .1 After tenders close, submit a breakdown of contract price into divisions to the satisfaction of the Departmental Representative with aggregate of breakdown totaling total contract amount. Breakdown will be used in computing of progress claims. Progress claims, when submitted, are to be itemized against each item of the contract breakdown.
- .2 Progress claims will not be approved unless broken down in a form approved by the Department representative. A typical format is as follows:
 - .1 Miscellaneous Mobilization
 - .2 Testing & Balancing
 - .3 Commissioning
 - .4 Manuals and Documentation
 - .5 Record drawings
 - .6 Vibration Isolation
 - .7 Insulation
 - .8 Fire Protection
 - .9 HVAC Equipment
 - .10 Ductwork

COMMON WORK RESULTS FOR HVAC

- .11 Controls
- .12 Change Orders with Divisions 21, 23 and 25 Change Notice reference.
- .3 Progress claims for major systems or equipment will not be approved to 100% status until after complete commissioning and testing of the systems or equipment. This includes, but is not limited to systems such as boilers, heat pump systems control systems, heat exchangers, chemical treatment. At the contractor's option, such systems or equipment may be identified as separate line items to allow approval of other sections of the work that have been completed.

3.7 CUTTING AND PATCHING - RENOVATION

- .1 Execute cutting, fitting and patching required to make Work fit properly together.
- .2 Making good is defined as matching the adjacent surfaces such that there be no visible difference between existing and new surfaces when viewed from 1.5 m in the ambient light, and includes painting the whole surface to the next change of plane.
- .3 Obtain Departmental Representative's approval before cutting, boring or sleeving load-bearing members.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Fit work airtight to pipes, sleeves, ducts and conduits.
- .6 At penetrations of fire rated assemblies, with any services or ducts completely seal voids with approved fire resistive material, for the full thickness of the construction element and to comply with Code requirements.
- .7 Before cutting or coring existing concrete slabs, X-ray locations to ensure that there are no concealed services or structural elements such as rebar.

3.8 DEMOLITION OF EXISTING SYSTEMS AND EQUIPMENT

- .1 Remove all identified equipment and systems complete with controls, mounting devices, electrical connections, control connections, mechanical services, gas connection, domestic water connection, hydronic water connection, etc.
- .2 Cut and cap services at the nearest main. Do not leave dead legs.
- .3 Where existing service is insulated, provide equivalent insulation at the capped location. Ensure that new and existing insulation is continuous and that the vapour barrier is intact.
- .4 Do not abandon equipment or systems in place unless otherwise indicated.
- .5 Patch and make good any building elements damaged by demolition work. This includes mounting points.

3.9 DEMONSTRATION INSTRUCTION TO DEPARTMENTAL REPRESENTATIVE

- .1 Demonstrate to and instruct representatives designated by the building operator on the complete systems operating and maintenance procedures using the assistance of specialist sub trades and manufacturers' representatives.
- .2 Allow for a minimum of 1 full day for demonstration.
- .3 Participate in, and aid the Commissioning Agent in, the Commissioning and Demonstration process for each system. Demonstration and training sessions will be convened separately for each piece of equipment and each individual system.
- .4 Submit a program for approval. When approval is obtained from the Commissioning Authority, arrange an acceptable time for the instruction periods.
- .5 Obtain a signed statement from the Departmental Representative certifying that the demonstration and instruction have been given to his satisfaction.
- .6 Obtain a list of all persons attending commissioning, demonstration, or training sessions, including their signatures and job title.

3.10 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy of each of the 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 the Construction Schedule.
- .9 Manufacturer's installation and application instructions.
- .10 Standards listed in Part 1 of specification sections under codes and standards.

3.11 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and intended to indicate the scope and general arrangement of work. Do not scale the drawings. Take field measurements where equipment and material dimensions are dependent upon building dimensions.
- .2 Review all drawings and documents for all trades on the project. Coordinate work specified in this Division with that of other Divisions. Advise other trades of requirements specified in this Division, and how those requirements affect the other trades.
- .3 Refer to Architectural, Structural, Electrical drawings and details for exact locations of fixtures and equipment, mechanical and otherwise. Obtain this information from the Departmental Representative where definite locations are not detailed.

3.12 DEPARTMENTAL REPRESENTATIVE APPROVAL

- .1 It is not incumbent upon the Departmental Representative to superintend the work so as to relieve the Contractor of any responsibility.
- .2 Permission to proceed does not constitute approval of the work, or portion thereof.
- .3 Approval of the work shall be made only upon the successful conclusion of tests and satisfactory performance under design operating conditions.

3.13 EQUIPMENT PROTECTION CLEANUP

- .1 Protect equipment and materials in storage and on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.
- .4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion.
- .5 Cover and protect all floors, furniture, millwork, computers, servers and other information technology equipment. Coordinate with the Departmental Representative to remove any equipment that is at risk and cannot be protected.

3.14 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, carry out work at times directed by local governing authorities, with a minimum of disturbance to work and/or building occupants and pedestrian and vehicular traffic. Notify Designated Representative at least 24 hours before carrying out such work.
- .2 Protect, relocate or maintain existing active services as required. When inactive services are encountered, cap off in a manner approved by local governing authorities having jurisdiction and stake or otherwise record location of capped service.

3.15 HANDOVER OF NEW OR RENOVATED SYSTEMS

- .1 Prior to Substantial Performance, some new or renovated sections of the building may be re-occupied by the building operator for normal operations. When new or renovated mechanical systems are activated for service on sections of the building being re-occupied, the systems must

- be formally handed over to the Departmental Representative.
- .2 Subject to the Departmental Representative accepting these reactivated systems, the Departmental Representative will assume responsibility for normal maintenance such as filter changes, lubrication, etc.

3.16 IDENTIFICATION AND LABELING

- .1 Equipment and panels: Provide engraved plastic identification plates for the following items:
- .1 Control panels.
 - .2 Electrical devices supplied under this Division of the Specification.
 - .3 All equipment provided under this Division.
 - .4 Refer to Section 25 01 05, Common Work Results For Integrated Automation System.
- .2 Ducts and pipes: Label with 25 mm high black letters on a white background on the following items, after painting is complete. Use stencil or pressure sensitive tape labels.
- .1 All pieces of equipment supplied under this Division.
 - .2 Duct runs, pipe runs including zone heads. Identify system and/or zone. Identify at 15 meter intervals or less, as required.
 - .3 Piping system label abbreviations must match the Existing building system.
- .3 Temporary equipment labels: Until permanent equipment labels have been installed, provide temporary labeling for use during course of construction to aid site coordination. Temporary labeling shall be completed once equipment has been uncrated and prior installation. Temporary labels shall be either removed or hidden once permanent labels are installed.
- .4 Where services are installed above suspended ceilings, or behind access doors, secure self-adhesive coloured dots to the access door or ceiling T-bar member, to identify the location of access to equipment concealed. To indicate exactly which tile or panel has to removed, the coloured dots should be placed on two of the bars adjacent to the subject tile.
- .5 Provide coloured circular stickers, minimum 12mm diameter, to identify access locations for mechanical equipment and services. The access shall be identified in accordance with the colour schedule shown below:

Item	Colour
Fire Damper	Red
Balancing Dampers	Dark Green
Control Device - Controller	Dark Blue
Control Relay Cabinets	Yellow
Controls Device - General	Orange

3.17 INTENT

- .1 Provide complete and fully operational mechanical systems with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.
- .2 Follow manufacturer's recommended installation details and procedure for equipment supplemented by the contract documents
- .3 Install equipment in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment.
- .4 Provide labour and materials required to install, test and place into operation on the mechanical systems. Provide additional material for modifications required to correct job conflictions.
- .5 The word "provide" shall mean "supply and install" unless otherwise indicated.
- .6 In the event of a disagreement between the drawings and specifications, the specifications shall take precedence.
- .7 Any reference to the Department Representative in this Division shall mean Public Services and Procurement Canada.

COMMON WORK RESULTS FOR HVAC

- .8 The main divisions of the work of this Division generally includes the supply and installation of the following:
 - .1 Heating, Ventilating, Air Conditioning Systems.
 - .2 Exhaust and Ventilation Systems.
 - .3 Equipment Control Systems.
 - .4 Fire Protection Systems.

3.18 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 Install all work so as to be readily accessible for adjustment, operation and maintenance. Furnish access panels where required in building surfaces for installation by building trades.
- .4 Locate access panels in service areas wherever possible. Do not locate in paneled or special finish walls, without prior approval.
- .5 If any doubt exists, inform Departmental Representative of impending installation and obtain his approval for actual location.

3.19 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Divisions 23 and 25 of the Specifications, including but not limited to:
 - .1 Support of equipment.
 - .2 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork fans and mechanical equipment.
 - .3 Ceiling ring bolts - secure to structure or steel supports.

3.20 BUILDING OPERATOR OCCUPANCY

- .1 The building operator will occupy the premises during the entire period of construction for the conduct of his normal operations. It is mandatory to cooperate with the building operator in all construction operations to minimize conflict, and to facilitate the building operator's continued and uninterrupted usage.
- .2 Schedule work so as not to disturb, disrupt, or endanger building occupants or normal facility operations. Coordinate work with the Departmental Representative.
- .3 Provide 48 hours' notice to the Designated Representative prior to disruption of systems. Obtain approval prior to proceeding with systems shutdown or disruption.
- .4 Provide temporary work as required to maintain systems in operation at all times. Short periods of discontinuous service may be approved for reconnection, modification or renovation of services or systems.
- .5 The Departmental Representative may instruct the contractor to activate systems in the area of work even if the remainder of the construction and installation of building components is not complete. The Contractor must schedule his work to allow minimal periods of inoperable system operation in the area of work.

3.21 PERMITS AND FEES

- .1 Unless otherwise specified, give all necessary notices, obtain all necessary permits, and pay all fees in order that the work may be carried out.
- .2 Furnish any certificates necessary and evidence that the work installed conforms with regulations of all authorities having jurisdiction before final certificates are issued.

3.22 PRIOR TESTS AND INSPECTION

- .1 Test all work prior to concealment.
- .2 Notify the Departmental Representative of the requirements for inspections or tests with forty-eight hours' notice.
- .3 If instructed by the Departmental Representative, material installed under this Division and covered before approval, must be exposed or uncovered at contractor's cost for the necessary inspection.

3.23 PROJECT COORDINATION

- .1 Coordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities and construction facilities.
- .2 All Contractors are required to perform an on-site examination prior to commencing Work and notify the Departmental Representative of any deviation from the Contract Documents. Commencement of Work shall indicate acceptance of existing conditions.
- .3 The responsibility as to which sub-trade supplies and installs any and all materials rests solely with the Prime Contractor.
- .4 Extras to the Contract will not be considered based on grounds of difference in interpretation of plans and specifications as to which trade involved shall be responsible for certain materials, installation or specialties.
- .5 The Contractor shall do all cutting and remedial Work that may be required to make several parts of the Work come together properly. Coordinate the schedule to ensure that as much as possible is built into the Work and that this requirement is kept to a minimum.

3.24 PROJECT MEETINGS

- .1 Attend project meetings as detailed in Division 1.

3.25 PROTECTIVE COATING AND PAINTING

- .1 All exposed steel piping, hangers, supports, brackets, stands and other miscellaneous metal and uncoated steel surfaces which is supplied under this Division are to be prime coated. Ceiling spaces, pipe shafts, and crawl spaces are not considered exposed.
- .2 Finish painting of all equipment and material installed under this Division is specified under Division 9 of the specification, unless specified otherwise.
- .3 Apply one coat of galvanizing paint to all steel which has had its galvanized coating damaged or sheared.

3.26 RECORD DRAWINGS

- .1 Keep on site, an extra set of drawings and specifications recording changes and deviations daily.
- .2 Include all details from revision drawings, supplementary drawings, change order and addenda.
- .3 Before Substantial Completion submit for approval to the Department representative, completed and detailed marked up white prints to reflect the record drawing status.
- .4 Contractors shall certify final reproducible record drawings to be correct by notation and signature.
- .5 After the contractor certifies and signs the completed record drawings, the contractor shall provide with each Maintenance Manual, the following record materials:
 - .1 One set of full size record drawings attached with each Manual.
 - .2 One set of reduced size record drawings bound in each Manual.
 - .3 Pdf and CAD files of record drawings.

3.27 RESPONSIBILITY

- .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 Departmental Representative without written approval.

COMMON WORK RESULTS FOR HVAC

- .2 Promptly advise the Departmental Representative of any specified equipment, material, or installation of same which appears inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; of any necessary items of work omitted from the Contract Documents; or of any discrepancies in the Specifications.
- .3 When the Contract Documents do not contain sufficient information for proper selection or bidding, notify the Department Representative during the tendering period. Failure to do this shall not relieve the Contractor of responsibility to supply the intended equipment.
- .4 The Contractor is to consider that this is a renovation project. Contractor must include for refitting or relocation of services and components that may be discovered during the course of construction that were not apparent at the commencement of the project, shown on plans, or concealed in walls, ceilings or floors. Necessary accessories for connection and modifications of configurations or materials shall be included at no extra cost to the Departmental Representative.

3.28 SETTING OUT OF WORK

- .1 Assume full responsibility for and execute complete layout of Work to locations, lines and elevations indicated. Provide devices needed to lay out and construct Work.
- .2 Exercise proper precautions to verify figures shown on the drawings, before laying out of work, and be responsible for any errors resulting from failure to exercise such precautions.
- .3 The drawings indicate the general location and route to be followed by the pipes and ducts, etc. Install so as to conserve headroom and interfere as little as possible with the free use of the space through which they pass. Keep all ducts, pipes, etc. at the ceilings as tight as possible to beams or other limiting members. Where headroom or space conditions appear inadequate, notify the Departmental Representative before proceeding with fabrication and/or installation.
- .4 Ensure non-interference between heating, plumbing, drainage, electrical and other equipment.
- .5 Make any corrections required in order to avoid the work of other trades, and/or as required by the Departmental Representative.
- .6 Maintain integrity of fire separations and compartments.

3.29 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Shop drawings must be submitted and reviewed by the Departmental Representative prior to the contractor ordering or shipping any subject equipment. Payments will not be processed for equipment not properly documented and reviewed under the terms of submittal.
- .2 Shop drawings shall be submitted in S.I. (Metric) Units. Shop drawings not submitted in the correct units may be automatically returned without review.
- .3 Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Department representative's office. Maintenance and operating manuals are not suitable submittal material.
- .4 Review of the shop drawings by the Departmental Representative does not relieve the contractor or his supplier of the responsibility to provide the correct and complete equipment, material or installation.
- .5 Prior to submission to the Department representative, the Contractor shall review all shop drawings. By this review the Contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data or will do so and that he has checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents.
- .6 The Contractor's review of each shop drawing shall be indicated by his approval stamp, date and signature on the front of each page. Drawings will not be considered if not previously checked by the Contractor.
- .7 Clearly mark each sheet of printed submittal material, using arrows, underlining or circling, to show particular sizes, dimensions, wiring diagrams, operating clearances, control diagrams, project

- identification, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable material. Note on the submittal specified features such as special tank linings, pump seals, materials or painting.
- .8 The contractor shall identify in writing, on the shop drawings, all aspects, accessories, options etc. that do not conform to the tender documents. Failure to do so will result in work being rejected.
 - .9 The mechanical contractor and the general contractor shall each review the shop drawings then stamp and initial the front page of each submission package and sign the original transmittal form. The contractor's shop drawing review shall include a detailed review of all installation details to ensure that they do not conflict with other trades, and to ensure that the system can be installed as intended.
 - .10 Submit PDF version of each shop drawing and all supporting material, sufficiently in advance of requirements to allow time for review. Reproducible means photocopy capable for small sheets up to 280 mm by 430 mm (11 inches by 17 inches). Larger sheets shall be printed full scale.
 - .11 Schedule submissions with adequate lead time for review by all concerned parties before the dates when reviewed submissions are required for ordering of equipment.
 - .12 Coordination of Submissions:
 - .1 Coordinate with field construction criteria.
 - .2 Coordinate each submittal with requirements of the work of all trades and Contract Documents.

3.30 SITE ASSESSMENT

- .1 Refer to Division 1.
- .2 Visit the site before tendering and examine all local and existing conditions on which the work is dependent.
- .3 No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site or insufficient site examination.

3.31 SLEEVES, HANGERS, AND INSERTS

- .1 Provide and set sleeves where conduits pass through walls, floors or ceilings. Pack sleeves with material approved for use in fire separations.
- .2 Obtain Departmental Representative's approval before cutting for sleeves.
- .3 Provide and install hangers and inserts where required.

3.32 SUBSTANTIAL PERFORMANCE PROCEDURE

- .1 Prior to the Substantial Performance Inspection, provide complete list of items which are not finished or deficient at the time of the inspection.
- .2 Provide all required submittals in a timely fashion prior to requesting substantial performance review. Confirm the required documentation with the Department representative.
- .3 Final cleaning:
 - .1 Make the work area clean before the inspection process commences.
 - .2 Clean and polish finish surfaces.
 - .3 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and ceilings.
 - .4 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
 - .5 Broom clean and wash exterior walks, steps and surfaces.
 - .6 Remove dirt and other disfigurements from exterior surfaces.
 - .7 Final clean-up of existing premises shall only be performed in areas where alteration work has been performed.
- .4 Demonstration and Inspection to Departmental Representative:
 - .1 Refer to Section 23 05 93.1 Testing, 23 05 93.2 Balancing, 23 05 93.3 Commissioning, 23 01 00 Documentation, Manuals and Record Drawings.
 - .2 Prior to Substantial Performance, demonstrate to and instruct the Departmental

- Representative on the complete systems operating and maintenance procedures using the assistance of specialist sub-trades and manufacturer's representatives.
- .3 Submit a program for approval to the Departmental Representative. When approval is obtained from the Departmental Representative, arrange an acceptable time for the instruction periods.
 - .4 Obtain a signed statement from the Departmental Representative certifying that the demonstration and instruction have been given to his satisfaction.
 - .5 Commissioning to be completed prior to substantial performance. Refer to 23 05 93.3 Commissioning.
 - .6 Prior to application for Certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected and the building is clean and in condition for occupancy.
 - .7 Notify the Departmental Representative in writing that the project is ready for inspection for Substantial Performance.
 - .8 During the Substantial Performance Inspection a list of deficiencies and defects will be tabulated.
 - .9 A deficiency holdback will be established as specified. This holdback shall be retained until all items on the deficiency list are completed. No interim payments will be released.
 - .10 Deficiency items shall be confirmed completed by all parties prior to Total Performance.
 - .11 Should the Departmental Representative perform re-inspection due to failure of the Work to comply with the claims of status of completion made by the Contractor:
 - .1 Building operator will compensate the Departmental Representative for such additional services.
 - .2 Building operator will deduct the amount of such compensation from the final payment to the Contractor.
 - .12 Submittals: As required, including but not limited to requirements specified in this section.

3.33 TAXES

- .1 Pay all taxes levied by law, including Federal, Provincial, Municipal and Goods and Services Taxes.
- .2 Goods and Services Tax is to be shown as a separate item on all progress claims.

3.34 TEMPORARY OR TRIAL USAGE

- .1 Temporary or trial usage by the building operator of mechanical equipment before Substantial Completion shall not represent acceptance.
- .2 Temporary use of mechanical systems and equipment for temporary heating service, either for construction or occupant benefit, before Substantial Completion shall not represent acceptance. Warranty periods shall not commence until the date of Substantial Completion.
- .3 Repair or replace permanent equipment used temporarily.
- .4 Take responsibility for damage caused by defective materials or workmanship during temporary or trial usage.

3.35 TOTAL PERFORMANCE INSPECTIONS AND PROJECT CLOSE OUT

- .1 Prior to Total Performance provide a declaration, in writing, that deficiencies as noted on current Inspection Report are not outstanding.
- .2 Notify the Departmental Representative in writing that all deficiencies have been corrected and that the building is ready for Final Inspection.
- .3 Submit a final Statement of Account showing total adjusted Contract Price, previous payments and any other adjustments and monies due.
- .4 Submit a current Statutory Declaration.
- .5 Submit WorkSafeBC (Workers' Compensation Board) Certificate of Compliance.
- .6 Departmental Representative will issue a final change order reflecting approved adjustments to contract price not previously made.

3.36 TRADES QUALIFICATIONS, COMPETENCY ASSURANCE LICENSES

- .1 All workers engaged in the construction or renovation of systems or equipment, shall be journeymen who have Trades Qualifications under Province of British Columbia legislation, or are indentured apprentices working under a journeyman who is on the site.
- .2 All workers engaged in the construction or renovation of systems or equipment governed by other agencies such as the Federal or Provincial Ministry of Labour, Ministry of Health or the Ministry of Environment shall be appropriately licensed under Federal or Provincial legislation.
- .3 Tradesmen shall perform only work that their certificate permits.
- .4 Trades Qualification certificates or other licenses must be submitted prior to commencing work and must be on site for inspection.
- .5 Trades Qualifications or certificates or competency or licenses must be carried for workers including, but not limited to the following:
 - .1 Duct Insulation
 - .2 Sprinkler Fitting
 - .3 Refrigeration
 - .4 Sheet Metal Work

3.37 WORKMANSHIP

- .1 Standards of Workmanship shall be in accordance with well-established practices and standards accepted and recognized by the Departmental Representative and the Trade.
- .2 Do not employ any unfit person or anyone unskilled in their required duties.
- .3 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 acceptance.

3.37 WARRANTY

- .1 Refer to Division 0 and Division 1.
- .2 The warranty period with regard to the Contract, other than for latent defects, is limited to one year from the date of Substantial Performance of the Work unless otherwise specified.
- .3 Correct any defects in the work due to faulty products or workmanship appearing within the warranty period.
- .4 The warranty shall not apply to work or other products damaged after Acceptance, by causes beyond the Contractor's control such as lack of prescribed maintenance, vandalism and abuse.
- .5 Correct and pay for any damage to other work resulting from any correction required under these conditions.
- .6 In the event that the repair time of defective equipment or systems is delayed for whatever reason, maintain the equipment or system in an approved manner until repairs can be made.

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Duct hangers and supports.

1.2 QUALITY ASSURANCE

- .1 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.
- .2 Sprinkler or Standpipe supports shall meet the requirements of NFPA.

2.0 PRODUCTS

2.1 HANGER RODS

- .1 Provide steel hanger rods, threaded both ends, or continuous threaded, complete with lock nuts on both ends.

2.2 DUCT HANGERS AND SUPPORTS

- .1 Hangers:
 - .1 Concealed - Round Duct: Galvanized steel band iron.
 - .2 Concealed - Rectangular Duct: Galvanized steel band iron or rolled angle and 9 mm rods.
 - .3 Exposed - Round Duct: Continuous galvanized steel band iron secured to single 9 mm hanger rod.
- .2 Wall Supports: Galvanized steel band iron or fabricated angle brackets.
- .3 Vertical Support at Floor: Rolled angle.

2.3 INSERTS

- .1 Inserts shall be malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods.
- .2 Size inserts to suit threaded hanger rods.

3.0 EXECUTION

3.1 GENERAL REQUIREMENTS

- .1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.
- .2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- .3 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- .4 Do not cut, drill or weld to structural elements without prior approval from the department representative.
- .5 Perforated metal strapping is not an acceptable means of supporting piping, ducting or mechanical equipment.

3.2 LOW PRESSURE DUCT HANGERS AND SUPPORTS

- .1 Hanger minimum sizes:
 - .1 Up to 760 mm wide or 460 mm diameter: 15 mm x 16 gauge at 3.0 m spacing.
 - .2 760 mm to 1,200 mm wide, or over 460 mm diameter: 38 mm x 16 gauge at 3.0 m spacing.
 - .3 Over 1,200 mm wide: 38 mm x 16 gauge at 3.4 m spacing.
- .2 Horizontal duct on wall supports minimum sizes:
 - .1 Up to 460 mm wide: 38 mm x 16 gauge or 25 mm x 25 mm x 3 mm at 2.5 m spacing.
 - .2 460 mm to 1,000 mm wide: 38 mm x 38 mm x 2 mm at 1.5 m spacing.

- .3 Vertical duct on wall supports minimum sizes:
 - .1 Riveted or screwed to duct:
 - .2 Up to 1,520 mm wide: 38 mm x 38 mm x 3 mm.
 - .3 Over 1,520 mm wide: 51 mm x 3 mm.
- .4 Vertical duct floor supports minimum sizes:
 - .1 Riveted or screwed to duct:
 - .2 Up to 1,500 mm wide: 38 mm x 38 mm x 3 mm.
 - .3 Over 1,500 mm wide: 51 mm x 51 mm x 3 mm.

3.3 PRIME AND COATING

- .1 Prime coat exposed steel hangers and supports. Hangers and supports located in crawlspaces, pipe shafts and suspended ceiling spaces are not considered exposed.

3.4 EQUIPMENT BASES AND SUPPORTS

- .1 Concrete housekeeping pads are specified under other divisions of the specification. Bases shall be 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. This Division will provide templates anchor bolts and accessories required for mounting and anchoring equipment.
- .2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- .3 Provide rigid anchors for ducts and pipes immediately after vibration connections to equipment.
- .4 Suspend mechanical equipment from structure with adjustable length steel rods. Provide spreader beams to distribute weight.

3.5 INSERTS

- .1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
- .2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 102 mm or ducts over 1,500 mm wide.
- .3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
- .4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.
- .5 Expansion bolt type connections will be approved under certain conditions. Obtain approval from the Department representative. Generally pipe 51 mm or smaller, and duct less than 600 mm x 300 mm will be approved, subject to adequate number of support points.

3.5 EXPOSED DUCT SUPPORT

- .1 Supply and return ducts exposed in the finished areas are to be supported by continuous strap installed around the duct. Only one joint on the strap is approved, at the top to secure the strap ends together and to connect to a threaded rod.
- .2 The threaded rod shall be secured to trusses or to steel angle bars spanning the trusses. The steel spanning bars are to be provided by this division.
- .3 Supports for equipment suspended within the space frame, are to be connected to the bolted node joints of the space frames. The locations of duct and piping suspension connections to the node joints must be coordinated and installed before the space frames are assembled and lifted to position. Refer to detail.
- .4 Supports for equipment supported above the space frame, may be connected to the bolted node joints of the space frames, or from the fluted steel deck above. The locations of duct and piping suspension connections to the node joints must be coordinated and installed before the space frames are assembled and lifted to position

SLEEVES, FLASHING AND SEALS

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Flashing for mechanical equipment.
- .2 Sleeving for mechanical equipment.
- .3 Fire stop seals.

1.2 QUALITY ASSURANCE – FIRESTOP SEALANTS

- .1 Standard method of fire tests : CAN4-S115-M85, ASTM E814, UL1479, UL 2079.
- .2 Materials shall be listed by FM and certified by UL or ULC for the service application.

1.3 QUALITY ASSURANCE – FIRESTOP COLLARS

- .1 Standard method of fire tests : CAN4-S115-M85, ASTM E814, UL1479, UL 2079.
- .2 Seals, assemblies and materials for penetration of fire rated surfaces shall be listed by FM and certified by UL or ULC for the service application.

1.4 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Firestop materials: Submit service limitations, installation instructions, UL certification and FM listing.
- .2 Fire rated penetration seals: Submit dimensional data, service limitations, installation instructions, UL certification and FM listing.

2.0 PRODUCTS

2.1 SLEEVES - DUCT

- .1 Round Ducts: Form with galvanized steel.
- .2 Rectangular Ducts: Form with galvanized steel.

2.2 FLASHING

- .1 Steel Flashing: 26 gauge galvanized steel.
- .2 Aluminum flashing: 26 gauge sheet aluminum.

2.3 FIRESTOP SEALANT

- .1 Tested and rated for mechanical fire protection for protection of penetrations utilizing PVC or CPVC pipe, PVC conduit, polyethylene conduit or pipe, other non-metallic pipes, cables, and combustible pipe insulations as the penetrant.
- .2 Single component, low modulus flexible sealant to form pressure tight seal resistant to water, smoke and toxic gases, resistant to cracking, degradation by ultraviolet radiation and ozone.
- .3 Compatible with construction materials of galvanized steel, aluminum, concrete, gypsum board.
- .4 Contain no water soluble expansion ingredients.
- .5 Wall and floor openings: equal to Self Seal GG-200.
- .6 Floor openings: equal to Self Seal SL-100.

2.4 FIRESTOP COLLARS

- .1 Tested and approved for protection of penetrations utilizing PVC or CPVC pipe, PVC conduit, polyethylene conduit or pipe, other non-metallic pipes, cables, and combustible pipe insulations as the penetrant.
- .2 Intumescent insert: Flexible, elastomeric strip, two stage expansion, designed to firestop penetrations in fire-rated walls and floors and floor/ceiling assemblies.
- .3 Provide a minimum free expansion factor of 15.
- .4 Contain no water soluble expansion ingredients.

SLEEVES, FLASHING AND SEALS

3.0 EXECUTION

3.1 SLEEVES

- .1 Provide and set sleeves required for equipment, including openings required for placing equipment.
- .2 Set sleeves in position in advance of other work. Provide suitable reinforcing around sleeves.
- .3 Extend sleeves through potentially wet floors 50 mm above finished floor level. Caulk sleeves full depth and provide floor plate.
- .4 Where ductwork passes through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Provide tight fitting metal caps on both sides.
- .5 Where piping passes through floor, ceiling or wall, close off space between pipe and sleeve with non-combustible insulation or approved non-combustible insulation, fire rated as required to match the rating of the penetrated surface. Provide tight fitting metal caps on both sides.
- .6 Install chrome plated escutcheons where piping passes through finished surfaces.
- .7 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

3.2 FLASHING

- .1 Where mechanical equipment passes through weather or waterproofed walls and roofs, counter flashing shall be provided under this Division. Roof flashing is specified under other divisions of this specification.
- .2 Curbs for mechanical roof installations are specified under other divisions of this specification. Curbs must be minimum 200 mm higher than the top of the finished roof, unless noted otherwise.

3.3 FIRESTOP SEALANT

- .1 Apply in conjunction with manufacturer's instructions and all related codes.
- .2 Clean all concrete, masonry and stone penetrations of all contaminants and impurities, concrete form release agents, water repellents, oils, surface dirt and rust, scale, all old sealants and other surface treatments.
- .3 Metal surfaces shall be cleaned by wiping them with an oil-free absorbent cloth saturated with solvent such as xylol or toluol. Do not use alcohols.
- .4 Pack voids with approved, non-combustible void filling material, recessed the appropriate dimension and fill the cavity with approved sealant. Prime mating surfaces if necessary.
- .5 Installation only when temperatures are between 5 degrees Celsius and 35 degrees Celsius.

3.4 FIRESTOP COLLARS

- .1 Apply in conjunction with manufacturer's instructions and all related codes.
- .2 Clean all concrete, masonry and stone penetrations of all contaminants and impurities, concrete form release agents, water repellents, oils, surface dirt and rust, scale, all old sealants and other surface treatments.
- .3 Metal surfaces shall be cleaned by wiping them with an oil-free absorbent cloth saturated with solvent such as xylol or toluol. Do not use alcohols.
- .4 Do not apply to polycarbonates or to building materials that bleed oils, plasticizers or solvents, or where sealant is not exposed to atmospheric moisture, or to surfaces which have been or will be painted.
- .5 Collars are to be installed with steel fasteners or steel expansion anchors. Low melting temperature anchors of lead, plastic or aluminum are not approved.
- .6 Installation only when temperatures are between 5 degrees Celsius and 35 degrees Celsius.

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Seismic restraints for suspended piping systems.
- .2 Seismic restraints for floor mounted equipment and tanks.
- .3 Certification by a Professional Engineer registered in BC.

1.2 GENERAL REQUIREMENTS

- .1 All seismic restraining devices shall be supplied by an approved supplier with the exception of seismic restraining devices which are factory installed and are standard equipment with the machinery.
- .2 All submittals shall bear the seal and signature of a registered Professional Department representative.

1.3 STANDARDS

- .1 Seismic restraint devices, accessories and methods shall meet the requirements of the National Building Code of Canada and British Columbia Building Code, whichever is more stringent.

1.4 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Letters of Assurance: Submit Supporting Registered Professional Schedule S-B covering the mechanical systems, within the scope of this project, in their entirety. Schedules shall not be qualified or include any notes that would reduce the scope or responsibility.

1.5 SUBMITTALS – PRIOR TO SUBSTANTIAL PERFORMANCE

- .1 Letters of Assurance: Submit Supporting Registered Professional Schedule S-C covering the mechanical systems, within the scope of this project, in their entirety. Schedules shall not be qualified or include any notes that would reduce the scope or responsibility.

1.6 INSPECTION AND CERTIFICATION

- .1 Mechanical systems Seismic Specialty Engineer: Include for and pay the necessary fees for the services of a qualified Professional Engineer, registered in the province of British Columbia, to provide the necessary certifications required by the British Columbia Building Code, all local codes, and as herein specified.

2.0 PRODUCTS

2.1 SEISMIC RESTRAINTS

- .1 The restraints shall conform to the requirements of the mechanical systems Seismic Specialty Engineer.

3.0 EXECUTION

3.1 APPLICATION

- .1 It is the responsibility of the contractor to ensure that device sizing and application is correct for each individual system or piece of equipment.
- .2 Provide restraints on all new piping, tanks and equipment that are provided under the scope of the mechanical contract.

3.2 INSPECTION AND CERTIFICATION

- .1 The Seismic Specialty Engineer shall inspect all components of the completed seismic restraints installation.
- .2 Submit a sealed inspection report declaring that the completed seismic installation is installed in

SEISMIC RESTRAINTS

- .3 accordance with the plans and specifications prepared by the Seismic Specialty Engineer.
Letters of Assurance: Submit Supporting Registered Professional Schedules S-B and S-C covering the mechanical systems in their entirety. Schedules shall not be qualified or include any notes that would reduce the scope or responsibility.

END OF SECTION 23 05 49

TESTING

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Test and report of existing and new heating, air conditioning and ventilation systems specified, renovated or modified under Division 21, 23, and 25.

1.2 QUALITY ASSURANCE

1.3 SUBMITTALS – PRIOR TO CONSTRUCTION

1.4 SUBMITTALS – PRIOR TO SUBSTANTIAL PERFORMANCE

- .1 Obtain certificates of approval and acceptance from authorities having jurisdiction and include in Operating and Maintenance Manuals.
- .2 On completion of mechanical installation, provide certification of tests with detailed data as required. Itemize tests as to time performed and personnel responsible. Include a copy of field data in Operating and Maintenance Manuals.

1.5 LIABILITY

- .1 During tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration.

2.0 PRODUCTS

NOT APPLICABLE

3.0 EXECUTION

3.1 PRESSURE TEST

- .1 Piping, fixtures or equipment shall not be concealed or covered until inspected and reviewed by the Department representative.
- .2 Provide equipment, materials and labour for tests. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy. Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.
- .3 Low Pressure Ducts: Test for tightness such that leakage is inaudible and not detectable by feel.
- .4 Fire Sprinkler System Piping: shall be tested to 1,380 kPa (200 psi) for two hours.
- .5 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by remaking joints in screwed fittings, cutting out and re-welding welded joints, remaking joints in copper lines. Do not caulk.

3.2 PERFORMANCE TEST

- .1 Refer to Section 23 05 93.3, Commissioning, and assist the Commissioning Agent.
- .2 Provide fresh filters for all air handling equipment prior to testing or balancing.
- .3 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required as tests may indicate prior to operating tests.
- .4 Use or modify manufacturers' reports. Test and adjust equipment and systems as specified, and as required by the manufacturer. Ensure that manufacturers' start up reports are complete and acceptable.
- .5 Provide detailed listing of equipment set up parameters "as left".
- .6 Make operating tests for minimum of five days during heating season of first year of operation and at times when directed, for proper setting of controls under peak load conditions.

TESTING

- .7 Conduct final operating tests in presence of the Departmental Representative. Vary loads to illustrate start-up and shutdown sequence, and simulate emergency conditions for safety shutdowns, with automatic and manual reset. Make final adjustments to suit exact building conditions.
- .8 Provide labour, ladders, tools and associated equipment required to assist in all tests.

END OF SECTION 23 05 93.1

BALANCING

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Balancing and adjustment of all new, renovated or necessary existing systems specified under Division 23 and submit reports.
- .2 Balance, adjust and test HVAC air systems and equipment and submit reports.
- .3 Fire damper drop test report.
- .4 Assisting in the commissioning of all new, renovated or necessary existing systems specified under Divisions 21, 23 and 25.
- .5 Allow for sheave change on existing exhaust system to be rebalanced.

1.2 BALANCE REPORTS

- .1 Submit draft copies for approval prior to proceeding. Sample balancing report forms for some equipment are available from the Departmental Representative to indicate a minimum expected level of testing. Written approval of draft copies must be obtained before balancing begins.
- .2 Balancing information for each system should be organized and presented in a manner that groups all relevant information about that system in a continuous and contiguous manner.
- .3 Provide reports suitable for inclusion in Maintenance Manuals. Reports not considered acceptable to the Departmental Representative will be revised to a standard and format acceptable to the Department representative.
- .4 Provide initial or interim balancing reports for review by the Department representative. The contractor will contact the Departmental Representative to arrange a meeting for further adjustment of the systems. A minimum of one initial report and meeting will occur, with further reports and meetings as deemed necessary by the Department representative.
- .5 Balance reports to include 'as found' values along with final values.

1.3 SYSTEM DATA

- .1 Reports shall include balance and equipment data listed in S.I. (Metric) units.
- .2 Report data shall include system description, manufacturer, model, serial number, arrangements, motor size, electrical characteristics, and equipment size.
- .3 Provide calibration reports for all instrumentation used, including range and minimum accuracy.
- .4 Provide an as-found system schematic noting the approximate locations of all equipment tested, measured or balanced. Cross reference all diffusers, grilles, terminal equipment etc. with the reported data.
- .5 Indicate all ductwork traverse points on the system schematic.

1.4 COMMISSIONING AND DOCUMENTATION

- .1 Refer to Section 23 05 93.3 Commissioning.
- .2 Refer to Section 23 01 00 Documentation, Manuals and Record Drawings.
- .3 Provide all necessary coordination services between the documentation-balancing operations and the commissioning operations.
- .4 Work with the Commissioning Agent throughout the project to provide necessary tests, adjustments, reports, certifications to complete the project.

2.0 PRODUCTS

2.1 MAINTENANCE MANUAL MATERIALS

- .1 Provide copies to the Commissioning Agent, of all shop drawings, reports and forms, materials, etc., required to complete the documentation. This generally includes but is not limited to the following:
 - .1 HVAC air system balance reports.
 - .2 HVAC air equipment test reports.

BALANCING

- .3 Test reports for all equipment provided or installed under Division 23.

2.2 FAN TEST REPORTS

- .1 Report designed and adjusted air flow, air pressure at inlet and discharge, air pressure differential between inlet and outlet, external static pressure, air temperature, initial and final fan speeds, manufacturer, model, serial number, fan wheel size, sheave sizes and position, belt size and quantities.
- .2 Test, adjust and report air flow, air pressure at inlet and discharge, air pressure differential between inlet and outlet, external static pressure, air temperature, initial and final fan speeds, manufacturer, model, serial number, fan wheel size, sheave sizes and position, belt size and quantities.
- .3 For fans with power greater than 250 watts, plot design and actual pressure and flow on manufacturer's or drafted fan performance curve.
- .4 Report the motor manufacturer, model, serial number, horsepower, current, voltage, speed.

2.3 FAN COIL UNIT TEST REPORTS

- .1 Report measured inlet and discharge air temperature during cooling operation, cooling capacity, initial and final fan speeds, manufacturer, model, serial number, fan wheel size.

2.4 AIR OUTLETS AND INLETS

- .1 The word "outlet" shall also mean "inlet" where appropriate.
- .2 Report initial, designed and adjusted air flows, air velocity, outlet size, flow factor (Ak), method used to obtain Ak factor, and supply air temperature.
- .3 Test, adjust and report initial, design and adjusted air flow, air velocity, outlet size, flow factor (Ak), method used to obtain Ak factor, and supply air temperature.

2.5 FIRE DAMPER DROP TEST REPORT

- .1 Report the functioning of each fire damper.
- .2 The report shall list all fire dampers and indicate whether or not they close freely.

3.0 EXECUTION

3.1 GENERAL PROCEDURE

- .1 Coordinate with Departmental Representative to ensure clean filters are installed prior to balancing.
- .2 Balance to maximum measured flow deviation from specified values of 10% at terminal device and 5% at equipment.
- .3 If design air flow rates cannot be achieved, investigate the cause and report to the department representative. Review motor sizes, motor rotation, balancing damper positions, static pressures, system effects and any other elements required to ascertain the cause of the shortfall. Report the maximum air flow that can be achieved with the current configuration. Provide any additional site visits that may be required to complete the investigation.
- .4 Mark settings on dampers and other adjustment devices.
- .5 Take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- .6 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Department representative.
- .7 Balancing to include 'as found' values along with final values.
- .8 Report duct dimensions and air velocities when using a pitot traverse to determine airflow in a duct.

3.2 AIR SYSTEM PROCEDURE

- .1 Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities.
- .2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of

BALANCING

- duct.
- .3 Measure air quantities at air inlet and outlet.
- .4 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices, such as dampers and splitters.
- .5 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- .6 Provide system schematic with required and actual air quantities at each outlet or inlet.
- .7 Provide and adjust belts and sheaves as required to meet required air flows.

3.3 FIRE DAMPER DROP TEST REPORT

- .1 The sheet metal trade shall remove the fusible links and demonstrate that damper can close freely and without obstruction.
- .2 Report obstructed or non-functioning dampers to the mechanical trade. Perform test again once repairs have been completed and as required.

END OF SECTION 23 05 93.2

COMMISSIONING

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Commissioning and final adjustment of all systems provided or installed under Divisions 21 23 25 under supervision from the Commissioning Authority.
- .2 Cooperate with the Commissioning Authority.
- .3 Verification of building automation system sequences, schedules, and normal operation.
- .4 Verification of correct normal and emergency operations for all systems provided or installed under Division 21 23 25.
- .5 Verification of balancing reports.
- .6 Direction to the contractors for minor system revisions during the construction process.
- .7 Direction to the contractors for system adjustment for all systems provided or installed under Division 23.
- .8 Coordination of system testing and balancing with other systems requiring set-up by manufacturers.
- .9 Coordination of contractor and manufacturer presented training sessions for all systems and equipment provided or installed by Division 23.
- .10 Participation in the handover of systems to the Departmental Representative.
- .11 Development of a scheduled, planned and certified handover process of systems to the Departmental Representative.
- .12 Training and instructions to Departmental Representative of all systems provided or installed under Division 15.

1.2 SYSTEM DATA

- .1 Reports shall include balance and equipment data listed in S.I. (Metric) units.
- .2 Report data shall include system description, manufacturer, arrangements, motor size, electrical characteristics, equipment size, design and actual temperature, flows, RPM, power, amperage, a pressure (air and water, static and velocity), water temperature, room temperature and humidity, outdoor temperature and humidity, etc.
- .3 Review requirements with the Balancing contractor.

1.3 SUBMITTALS

- .1 Balance reports: Refer to Section 23 05 93.1, Testing 20 05 93.2 Balancing.
- .2 Equipment start up reports: refer to requirements specified in other Sections of this specification.
- .3 Provide receipts from Departmental Representative for components, spare parts, testing equipment, etc., as specified in this section.

1.4 QUALITY ASSURANCE

- .1 Commissioning of mechanical systems shall be performed by an agency that specializes in this type of work.
- .2 Technicians performing the work shall be experienced in projects of similar scale and nature.

1.5 ACCEPTABLE AGENCIES

- .1 Commissioning agencies who are approved in principle, but subject to requirements of drawings and specifications are:
 - .1 KD Engineering Ltd., Vancouver
 - .2 Inland Technical Services Ltd., Kelowna.
 - .3 West Rockies Services, Abbotsford

COMMISSIONING

2.0 PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUALS MATERIALS

- .1 Ensure copies of all shop drawings, reports and forms, materials, etc., required to complete the documentation are provided.
- .2 Prepare proper documentation to instruct the building operator in the operation and preventative maintenance of equipment and systems provided. Complete and turn over documentation prior to Substantial Performance inspection.
- .3 Refer to Section 23 01 00 Documentation, Manuals and Record Drawings.

2.2 BALANCE REPORTS

- .1 Coordinate submission of draft copies of reports.
- .2 Ensure specified number of final copies for inclusion in Operating and Maintenance Manuals are provided.
- .3 Verify reports specified under Section 23 05 93.1 Testing, and Section 23-05-93.2 Balancing.

2.3 EQUIPMENT TEST REPORTS

- .1 Use or modify reports specified under Section 23 05 93.1 Testing and 23 05 93.2 Balancing.
- .2 Use or modify manufacturers' reports. Test and adjust equipment and systems as specified, and as required by the manufacturer. Ensure that manufacturers' start up reports are complete and acceptable.
- .3 Provide detailed listing of equipment set up parameters "as left"

3.0 EXECUTION

3.1 CONSTRUCTION PERIOD SERVICES

- .1 The Commissioning Agent will attend at the site during the construction period. Cooperate with the Commissioning Authority and undertake the required modifications and renovations as instructed. The number of site visits shall be as required, and shall be coordinated with the construction process to provide the following:
 - .1 Attend and organize commissioning meetings as outlined by the Commissioning Authority.
 - .2 Comment to the Departmental Representative with respect to system configuration and provide recommendations for changes that should be considered in order to achieve the specified system performance.
 - .3 Comment to the Division 21 23 & 25 contractors with respect to system configuration and the effect that the construction conditions will have on system performance.
 - .4 Instruct the Division 21 23 & 25 contractors with respect to configuration changes required to achieve the specified system performance.
 - .5 Provide written report on recommendations.

3.2 COMMISSIONING PHASE ONE – PRE-COMMISSIONING

- .1 Prior to commencing commissioning tasks on any system, confirm or provide the following:
 - .1 Certification that the subject systems are ready for the commissioning process.
 - .2 Permanent electrical connections are complete and accepted by the Electrical Department representative.
 - .3 All safety controls are complete and operational.
 - .4 All operating controls are complete and activated.
 - .5 Ductwork related to the subject systems are cleaned, and satisfactory filters are installed.
 - .6 Refrigeration systems related to the subject systems are fully charged and commissioned.
 - .7 Related vibration isolation components are properly adjusted.
 - .8 Schedule of all electric motors provided under this division, identifying manufacturer, model number, power rating, frame size, voltage, speed, and efficiency.

COMMISSIONING

- .9 Fire sprinkler systems are complete and activated.
- .10 All permits are in hands of the contractor.
- .2 Provide written reports on all necessary systems. Do not proceed to the next phase, without written acceptance of this phase, by the Department representative.

3.3 COMMISSIONING PHASE TWO – COMMISSIONING OPERATIONS

- .1 As each system is started and tested, and balancing and adjusting is underway or completed, the overall performance of the components and systems, including the controls, shall be tested, properly adjusted, verified under all operating conditions and reported.
- .2 Commissioning tasks shall include but not be limited to the following:
 - .1 In the accompany of equipment suppliers and the Division 21, 23, and 25 contractors, each piece of equipment provided by these Divisions shall be started and checked for correct operation and for correct interlocking and parallel operation with other equipment and systems.
 - .2 Activation of all components, systems and sub-systems, both manually and through the automatic control systems.
 - .3 Testing and adjustment of all components, systems and sub-systems.
 - .4 Adjustment and securing of all adjustment devices such as dampers.
 - .5 Adjustment and calibration of all control and safety devices.
 - .6 Adjustment and securing of all air inlet or outlet balancing devices.
 - .7 Adjustment and setting of automatic controls for accurate response and precise sequencing.
 - .8 Adjustment of vibration isolators and earthquake restraints.
 - .9 Operation of fire dampers.
- .3 Provide written reports on all necessary systems. Do not proceed to the next phase, without written acceptance of this phase, by the Department representative.

3.4 COMMISSIONING PHASE THREE – VERIFICATION OF COMMISSIONING

- .1 Verification of commissioning by the Departmental Representative shall not commence until Phase Two Commissioning is totally complete.
- .2 Operate and demonstrate entire system operation with the Departmental Representative present. The Departmental Representative will indicate acceptance of the tests by initialing items on the checklists. The commissioning process will not be considered complete until all system components are tested and accepted in concert with all other systems.
- .3 Submit test reports, test completion certificates, and related data at the time of requesting the commencement of the verification phase.
- .4 The verification process will include, but not be limited to the following:
 - .1 Locating and demonstrating the opening capability of all access panels, and confirming that the record drawings show these devices in the correct location.
 - .2 Locating and demonstrating the accessibility and setting of all air flow balancing dampers, and confirming that the record drawings show these devices in the correct location.
 - .3 Locating and demonstrating proper operation of fire dampers, randomly selected by the Department representative, and confirming that the record drawings show these devices in the correct location.
 - .4 Demonstrate noise levels from air handling systems in all modes of operation.
 - .5 Verifying operation of all systems and components in all sequences, and under varying loads. The commissioning agent will require thorough knowledge of the control system in order to adjust and reset operating ranges in order to force the systems into required demonstration modes.
 - .6 Verifying all DDC system features.
 - .7 Verifying all mechanical systems control features.
 - .8 Verifying correct operation of all refrigeration, and heat generating systems.

COMMISSIONING

- .9 Operation of all exhaust fan systems.
- .5 Provide written reports on all necessary systems. Do not proceed to the next phase, without written acceptance of this phase, by the Department representative.

3.5 COMMISSIONING PHASE FOUR – DEMONSTRATION, TRAINING, HANDOVER, AND ACCEPTANCE

- .1 Demonstration to the Departmental Representative shall not commence until Phase Three services are totally completed.
- .2 Substantial Performance will not be considered until the successful completion of Phase Four Commissioning.
- .3 The process of Demonstration, Training, Handover and Acceptance is a planned process, requiring pre-approval of the plan and stages, and a signed statement of Acceptance by the Departmental Representative at the completion of each stage of the process.
- .4 As the project moves close to the final stages, a formal dialogue will be established by the Departmental Representative and the Contractor, in order to schedule times, dates and required personal for systems and equipment commissioning, demonstration and training. No Commissioning, Demonstration, or Training session shall occur at the same time as any other Commissioning, Demonstration, or Training session.
- .5 The Departmental Representative will attend on the site on a scheduled basis, to inspect and review the installation. The Contractor shall arrange for all necessary and specified personal and equipment specialists to be in attendance for purposes of demonstrating and training.
- .6 Obtain a signed statement from the Departmental Representative certifying that the demonstration and instruction have been given to his satisfaction.
- .7 Obtain a list of all persons attending commissioning, demonstration, or training sessions, including their signatures and job title.
- .8 If systems are deemed complete and acceptable by the Department Representative and the building operator, the Departmental Representative will signify acceptance by signing a formal handover receipt relating to the subject system or equipment. If systems are not deemed complete and acceptable by the Department Representative, the Contractor will re-schedule the session for a future time. The costs of the Departmental Representative and building operator's attendance at this or other subsequent sessions will be charged to the Contractor.
- .9 The Departmental Representative will issue lists of required submissions, receipts and acceptance forms, for execution by the contractor. Refer to sample forms for Handover and Acceptance included in this Section.
- .10 The services to be provided by the commissioning agent and other contractors in this phase include, but are not limited to the following:
 - .1 Training in the normal, abnormal and emergency operation of all systems provided under this Division.
 - .2 Training in the programming, normal, abnormal and emergency operation of the control system.
 - .3 Review and instruction in the normal maintenance and operation of the fire protection systems. This training is to include thorough review of the procedures for adjustment and testing of devices, and the procedures to be followed when there is an activation of automatic systems or trouble annunciation.
 - .4 Review of all necessary maintenance procedures of all systems provided under this Division.
 - .5 Provision of a documented maintenance program covering all systems provided or modified under this contract.
 - .6 Review of all documents and reports created during Phases One, Two, and Three of the Commissioning process.
 - .7 Final certification letters from the commissioning agent, balancing contractor, controls contractors, and the Division 21 22 23 25 contractors, that all systems are installed and operating, providing the intended service to the building.

3.6 COMMISSIONING PHASE 5 SEASONAL VERIFICATION

- .1 Contractor and commissioning agent to allow for additional field reviews to verify seasonal performance within the warranty period.

END OF SECTION 23 05 93.3

DUCT INSULATION

1.0 GENERAL

1.1 DESCRIPTION OF WORK

- .1 Duct thermal insulation on new ducts.
- .2 Adhesives, tie wires, tapes.
- .3 Recovering.

1.2 QUALITY ASSURANCE

- .1 All workers engaged in the application of insulation shall be journeymen, or indentured apprentices working under a journeyman who is on the site. Trades Qualification certificates must be submitted prior to commencing work and must be on site for inspection.
- .2 The British Columbia Insulation Contractors Association (BCICA) Standards Manual for Mechanical Insulation, latest edition, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification. The Contractor responsible for mechanical installation work shall keep a copy of the above manual available for reference.
- .3 The Departmental Representative may open, cut or remove sections of insulation in order to examine the installation. Make all repairs necessary that may result from this examination.
- .4 Furnish the Departmental Representative with a Quality BCICA Assurance Certificate for the mechanical insulation work at Substantial Performance of the Work in accordance with the BCICA Quality Assurance Certificate Program (QACP).
- .5 To qualify for the QAC Program, workmanship must conform to the latest QAC Standards as published in the BCICA Quality Standards for Mechanical Insulation (Commercial and Institutional Buildings) Manual (QSMIM).
- .6 Only materials that conform to the standards listed in the QSMIM and accepted by BCICA may be used in the QAC Program.
- .7 Materials must be installed by tradespersons with a Red Seal or TQ designation in the Heat and Frost trade, and/or registered apprentices / helpers supervised by qualified journeypersons.
- .8 Inspection as required under the QAC Program is to be performed by an independent inspector specifically "designated" by BCICA for the purpose of inspecting QAC Program.

1.3 JOB CONDITIONS

- .1 Deliver material to job site in original unbroken factory packaging, labelled with manufacturer's density and thickness.
- .2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

1.4 ALTERNATIVES

- .1 Alternative insulations are subject to approval. Alternatives shall provide the thermal resistance within 10% of specified at normal conditions as material specified.

1.5 DEFINITION

- .1 Supply air duct includes all discharge duct connected to air handlers, furnaces, fan coils, heat pumps, rooftop units.

1.6 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Trades Qualification certificates.
- .2 Insulation shop drawings, including but not limited to:
 - .1 Insulation Material
 - .2 Insulation Values
 - .3 MSDS Information

DUCT INSULATION

1.7 ACCEPTABLE INSULATION CONTRACTORS

- .1 Contractor must be a member of the British Columbia Insulation Contractors Association.

2.0 PRODUCTS

2.1 GENERAL

- .1 Adhesives, Insulation, Coatings, Sealers and Recovering Jackets: Composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed. Adhesives, coatings and sealers shall be waterproof.
- .2 Recovering Jackets ULC listed treated cotton fabric.
- .3 Pre-covered, preformed insulation complete with foil or Kraft all-purpose jacket.

2.2 MATERIALS

- .1 Exposed Rectangular Ducts: Rigid fibrous glass insulation, "K" value at 24 deg. C maximum 0.035 w/m deg. C (0.24 btu/in/sq. ft. /deg. F/hr) with factory applied reinforced aluminum foil vapour barrier.
- .2 Exposed Round Ducts: Flexible fibrous glass insulation, "K" value at 24 deg. C maximum 0.038 w/m deg. C (0.26 btu/in/sq. ft. /deg. F/hr) with factory applied reinforced aluminum foil vapour barrier.
- .3 Concealed Round Ducts and Concealed Rectangular Ducts: Flexible fibrous glass insulation, "K" value at 24 deg. C maximum 0.038 w/m deg. C (0.26 btu/in/sq. ft. /deg. F/hr) with factory applied reinforced aluminum foil vapour barrier.
- .4 Acoustic Lining: Fiberglass insulation with "K" value at 24oC maximum 0.035 w/m deg. C (0.26 btu/in/sq. ft. /deg. F/hr) absolute roughness of exposed surface not to exceed 0.033 mm coated to prevent fibre erosion at air velocities up to 2.0 m/s, 24 kg/m3 minimum density. All substrate material to be non-darkened, contrasting colour from liner layer.

3.0 EXECUTION

3.1 PREPARATION

- .1 Do not install covering before ductwork and equipment has been tested and approved.
- .2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

3.2 INSTALLATION - GENERAL

- .1 Insulate exhaust ductwork within 1,500 mm of insulated surface penetration.
- .2 Insulate all supply duct unless it is exposed in the area it serves.
- .3 Insulate all unheated outdoor air, combustion air, and ventilation air inlet ducting.
- .4 In non-fire rated surfaces, ensure insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation material properly sealed.
- .5 Finish insulation neatly at hangers, supports and other protrusions.
- .6 Locate insulation or cover seams in least visible locations.
- .7 Unless otherwise noted do not provide external insulation on supply, return or exhaust duct exposed in the area it serves. Provide acoustic liner where indicated.
- .8 Where existing insulated ductwork has been capped, provide equivalent insulation at the capped location. Ensure that new and existing insulation is continuous and that the vapour barrier is intact.
- .9 Insulation thickness shall not be compressed or altered in any way.

DUCT INSULATION

3.3 RECTANGULAR DUCTS - CONCEALED

- .1 Secure Insulation to ductwork using one of the following methods:
 - .1 Flare Staples installed on 50 mm centres. Cover staples with 75 mm wide foil face tape to maintain vapour barrier.
 - .2 Polypropylene twine or 16 gauge annealed tie wire, spiral wound or half hitched at 400 mm centres.
- .2 For ducts 600 mm and larger, also use insulation pins on 300 mm centres. Pins shall be secured by capacitor welder. The use of adhesive pins is not permitted.
- .3 It is not permitted to use only adhesives to secure insulation.
- .4 Secure and seal all seams and joints with 75 mm foil face tape.
- .5 Ensure that the vapour barrier is complete and intact. Seal all openings.

3.4 ROUND DUCTS - CONCEALED

- .1 Secure Insulation to ductwork using one of the following methods:
 - .1 Flare Staples installed on 50 mm centres. Cover staples with 75 mm wide foil face tape to maintain vapour barrier.
 - .2 Polypropylene twine or 16 gauge annealed tie wire, spiral wound or half hitched at 400 mm centres.
- .2 It is not permitted to use only adhesives to secure insulation.
- .3 Secure and seal all seams and joints with 75 mm foil face tape.
- .4 Ensure that the vapour barrier is complete and intact. Seal all openings.

3.5 DUCTS - EXPOSED

- .1 Generally comply with the requirements of concealed ducts except modify to allow application of canvas recovering.
- .2 Recovering to be smooth and ready for painting. Painting is specified in other Divisions.

3.6 ACOUSTIC LINING

- .1 Apply to interior of ducts where shown.
- .2 Secure insulation to ductwork with insulation pins on 400 mm centres. Pins secured by adhesive or capacitor welder. Ensure pin welds do not damage duct zinc coating protection. Cut off excess fastener length and cover with brush coat of sealer.
- .3 Provide vapour barrier located on the warm side for outside air intakes.
- .4 Seal exposed edges with heavy coat of sealing material.
- .5 Ducts with equivalent acoustic insulation do not require external thermal insulation.
- .6 Use 25 mm thick insulation unless otherwise noted.

3.7 INSULATION THICKNESS SCHEDULE

.1	Ducts and System	Thickness mm
.1	Combustion Air Duct	25
.2	Outside Air Intake Ducts	25
.3	Supply Air Ducts Warm Space	25
.4	Exhaust Air Ducts	25
.5	Return Air Ducts Warm Space	Not Required

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Ductwork and plenums.
- .2 Fasteners.
- .3 Sealants.
- .4 Flexible ducts

1.2 DEFINITIONS

- .1 Duct sizes are inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.
- .2 Low Pressure: Static pressure in ducts less than 0.50 kPa (2" wg) and velocities less than 10 m/s (2,000 fpm).

1.3 QUALITY ASSURANCE

- .1 Ductwork and methods shall meet the requirements of:
 - .1 National Building Code of Canada
 - .2 British Columbia Building Code.
 - .3 NFPA 90A Air Conditioning and Ventilation Systems.
 - .4 All other local codes and requirements.
- .2 Fabricate in accordance with ASHRAE and SMACNA manuals.

1.4 JOB CONDITIONS

- .1 Store ductwork on site or in warehouse in dry, heated locations. Cover all opening ductwork with polyethylene sheets and seal with tape.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Ducts: Galvanized steel lock forming quality, having galvanized coating of 0.38 kg/m² on both sides.
- .2 Fasteners: Use sheet metal screws, rivets and bolts.
- .3 Sealant: Water resistant, fire resistive, compatible with mating materials.

3.0 EXECUTION

3.1 FABRICATION

- .1 Unless otherwise indicated, branch ductwork serving a single diffuser or grille shall be sized equal to the nominal grille size or the diffuser neck size.
- .2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 300 mm, cross break for rigidity. Open corners are not acceptable.
- .3 Lap metal ducts in the direction of air flow. Ensure the interior is smooth.
- .4 Construct tees, bends and elbows with radius of not less than 1.5 times the width of the duct on centre line. Where this is not possible, and where rectangular elbows are used, provide approved type of air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type.
- .5 Increase duct sizes gradually, not exceeding 15 degrees divergence.
- .6 Rigidly construct metal ducts with joints mechanically tight, substantially air tight, braced and stiffened so as not to breathe, rattle, vibrate or sag.
- .7 Ducts subject to noise transfer or vibration are to be reinforced to prevent duct vibration and sound transmission. Provide cold rolled steel angle bar, not sheet metal break angle, bolted or riveted to the duct in parallel or cross fashion to completely eliminate duct vibrations and sound

- transmissions.
- .8 Provide easements where low pressure ductwork conflicts with piping or structure, with easements not exceeding 10% of the duct area. Where easements are not required, split ductwork into two ducts maintaining original duct area.

3.2 INSTALLATION

- .1 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can and spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring. Provide sealing grommet flush plug for holes.
- .2 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .3 Supply, return and exhaust ducts shall be sealed with approved sealant. Sealant shall be applied to all joints and connections of all descriptions in such a manner that no air may enter or leave the ductwork through a joint or connection. The Departmental Representative must be satisfied that no joint or connection will leak. If necessary, the ductwork shall be pressurized with the specified equipment to demonstrate that there are no leaks. Tape seal only joints are not approved.
- .4 In concealed spaces where conditions will not permit metal ducts, diffusers or troffer boots may be connected to low pressure ducts with flexible duct maximum length 1,000 mm. Hold in place with strap or clamp.
- .5 At each point where ducts pass through partitions, seal joints around duct with non-combustible material.
- .6 Do not install new or renovated ductwork in a position that would affect the spray pattern of new or existing sprinklers heads. If such a configuration is required, notify the Departmental Representative and await instructions. Failure to notify the Departmental Representative in advance of installation of the duct will leave the costs to rectify the situation solely as the responsibility of the contractor.

3.3 DUCTS GAUGES - GENERAL

.1	Rectangular Ducts	gauge	mm
	Maximum Width		
.1	Up to 300 mm	26	0.55
.2	300 mm to 750 mm	24	0.70

3.5 EXPOSED DUCTWORK

- .1 Install ducts substantially straight and level. All fittings and branch ducts to be installed with tight, well fitted joints.
- .2 All joints to be properly sealed. Sealer to be carefully applied to limit poor appearance of improperly applied sealer.
- .3 Align duct with building lines and structure.
- .4 All exposed duct to be prepared and suitable for painting.

END OF SECTION 23 31 13

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Duct access doors.
- .2 Fire dampers.
- .3 Balancing dampers.
- .4 Back draft dampers.
- .5 Flexible connections.

1.2 QUALITY ASSURANCE

- .1 Fire dampers shall be UL listed and constructed in accordance with ULC Standard S112 "Fire Dampers".
- .2 Fusible links on fire dampers shall be constructed to ULC Standard S505.
- .3 Demonstrate resetting of fire dampers to authorities having jurisdiction, and to Departmental Representative's representative.
- .4 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.
- .5 Fabricate in accordance with ASHRAE Handbooks and SMACNA Duct Manuals.

1.3 JOB CONDITIONS

- .1 Store duct accessories on site or in warehouse in dry, heated locations. Cover all openings with polyethylene sheets seal with tape.

1.4 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Submit shop drawings for:
 - .1 Fire dampers (all types).
 - .2 Balancing dampers (all types).
 - .3 Flexible connections.
 - .4 Access doors.

2.0 PRODUCTS

2.1 DUCT MOUNTED ACCESS DOORS

- .1 Rigid and close fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Install minimum 25 mm thick insulation with suitable sheet metal cover frame for insulated duct work.
- .2 Fabricate with two butt hinges with one sash lock, or two sash locks, for sizes up to 250 mm; two hinges and two compression latches without outside handles for sizes up to 600 mm; with additional hinges for larger sizes.

2.2 FIRE DAMPERS

- .1 Galvanized steel or prime coated black steel, weighted or spring loaded to close and lock in closed position when released by fusible link.
- .2 Fire dampers in low pressure duct work may be multi blade offset butterfly or curtain type.
- .3 Curtain fire dampers shall have blades retained in a recess, so that free area of connecting duct work is not reduced.
- .4 Fire dampers shall be dynamic type designed and listed to close with air flow.
- .5 Fusible links shall be set for 30 Celsius degrees above unit high limit setting, or 100 degrees Celsius, whichever is greater.

2.3 GASKETED AIR CONTROL DAMPERS - MANUAL

- .1 Single blade damper of galvanized steel minimum 18 gauge, and provide with quadrants and lock screw.

- .2 Fully flanged seat, 100% of blade perimeter, 20 gauge galvanized, secured and sealed to duct.
- .3 Compressible neoprene or non-combustible felt seals on flange seat to ensure tight shut off configuration.
- .4 Adjustable and lockable quadrant lock on exterior of duct.
- .5 Refer to detail in this section.

2.4 BALANCING DAMPERS

- .1 Single blade damper: Galvanized steel minimum 18 gauge, provide with quadrants and lock screw.

2.5 FLEXIBLE CONNECTIONS

- .1 Neoprene coated, flameproof fabric, approximately 50 mm wide, tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 150 mm centres.

3.0 EXECUTION

3.1 ACCESS DOORS – DUCT MOUNTED

- .1 Provide adequately sized access doors for inspection and cleaning before and after filters, coils, fans, and automatic dampers, at fire dampers and elsewhere as indicated. Review locations prior to fabrication.
- .2 Provide 100 mm x 100 mm quick opening access doors for inspection at balancing dampers.
- .3 Access doors are to be secured to ducts with pop rivets or other means that do not result in sharp screw points or metal barbs within the duct at the door perimeter.

3.2 FIRE DAMPERS

- .1 Confirm rating of devices with ratings of surfaces or separations.
- .2 Provide fire dampers at locations shown, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction.
- .3 Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- .4 Provide fire stop flaps on air outlets penetrating fire rated membranes or surfaces.
- .5 Perform the fire damper drop tests with the Balancing Agent. Remove the fusible links and demonstrate that damper can close freely and without obstruction.
- .6 If any dampers fail perform all repairs and replacements required to ensure that all fire dampers are functional.

.3.3 BALANCING DAMPERS

- .1 During the construction process, before duct systems are constructed, review the systems with the balancing and commissioning agents and the commissioning authority. Provide balancing dampers at locations instructed by the balancing and commissioning agents.
- .2 Provide balancing dampers for proper air balancing, whether shown or required, at points on supply, return and exhaust systems, where branches are taken from larger ducts.

HVAC FANS

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Cabinet exhaust fans.

1.2 QUALITY ASSURANCE

- .1 Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal.

1.3 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Shop drawings must be submitted and reviewed by the Departmental Representative prior to the contractor ordering or shipping any subject equipment. Payments will not be processed for equipment not properly documented and reviewed under the terms of submittal.
- .2 Submit certified shop drawings for the following:
 - .1 Fan curves and sound data, with fan and system operating point plotted on curves.
 - .2 Fan details, isolation and details.
 - .3 Cabinet construction, gauge, access doors, fasteners.
 - .4 Power wiring diagrams and electrical characteristics.
 - .5 Control wiring diagrams and interfacing details.
 - .6 Maintenance requirements.

1.4 JOB CONDITION

- .1 Do not operate fans for any purpose, temporary or permanent until ductwork is clean, filters in place, bearings lubricated and fan has been run under close supervision.
- .2 Alternatives Equivalent fan selections shall not decrease motor power, increase noise level, increase tip speed by more than 10% or increase inlet air velocity by more than 20% from that specified.

2.0 PRODUCTS

2.1 GENERAL

- .1 Statically and dynamically balance fans so no objectionable vibration or noise is transmitted to occupied areas of the building.
- .2 Provide balanced variable sheaves for motors 11 kw (15 hp) and under, and fixed sheaves for over 15 kw.
- .3 Fans shall be capable of accommodating static pressure variations of +10% with no objectionable operating characteristics.
- .4 Unless otherwise noted, include all motors and drive combinations with electrical characteristics as detailed elsewhere.
- .5 Rate drive as recommended by manufacturer, but minimum 1.5 times power rating of the motor. Submit calculations and technical data with shop drawings, to support drive selection.
- .6 Provide all necessary specialized tools and equipment required to perform speed adjustments on ECM or other motor types.

2.2 CABINET FANS

- .1 Resiliently mount multi-blade direct driven fan and motor.
- .2 Cabinet shall be heavy gauge metal with galvanized or baked enamel finish. Provide junction box for wiring. Provide white plastic, brushed aluminum or baked enamel grille or duct connection on inlet, and duct connection flange on outlet.
- .3 Motors complete with internal thermal protection.
- .4 Accessories:
 - .1 External or internal pre-wired receptacle disconnect fitting.
 - .2 Single blade, rattle free, back draft flap with felt lined blade edges.

HVAC FANS

- .3 EC Motor with variable speed motor and controller where indicated.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Where inlet or outlet is exposed, provide safety screen.

3.2 PERFORMANCE

- .1 Refer to schedules.

END OF SECTION 23 34 00

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Grilles.

1.2 QUALITY ASSURANCE

- .1 Air flow tests and sound level measurement shall be made in accordance with applicable Air Diffusion Council equipment test codes and ASHRAE Standards.
- .2 Unit ratings shall be approved by the Air Diffusion Council.
- .3 Manufacturers shall certify catalogued performance and ensure correct application of air outlet types.

1.3 JOB CONDITIONS

- .1 Review the requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlets.
- .2 Positions indicated are approximate only. Check locations of outlets, and make necessary adjustments in position to conform with Architectural features, symmetry and lighting arrangement.

1.4 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Physical: For each type of air outlet, louvre, grille, register etc., submit manufacturer certified data on dimensions, mounting method, accessories, dampers, materials, finish, etc.
- .2 Performance: For each type of air outlet, louvre, grille, register etc., submit manufacturer certified data on air flow, sound, pressure loss, velocity.
- .3 Colour chips and samples for powder coated louvres, outlets, fittings and accessories.

2.0 PRODUCTS

2.1 GENERAL

- .1 Base air outlet application on maximum space noise level of NC 25.

2.2 WALL GRILLES - RETURN OR EXHAUST TYPE G

- .1 Heavy gauge steel frame, screw fastening.
- .2 Heavy gauge steel bars in horizontal dimension, 5 mm wide, 19 mm spacing, 45 degree deflection.
- .3 Grille bars supported by heavy gauge flanges secured to the grille frame.
- .4 Grilles to be one piece.
- .5 Colour: Refer to Schedules.

3.0 EXECUTION

3.1 GENERAL

- .1 Paint ductwork visible behind air outlets, flat black.
- .2 Provide fire rated material, either blanket or rigid board, with rating equal to ceiling or wall system, behind outlets piercing fire rated membranes.
- .3 Size air outlets as indicated on drawings.
- .4 Refer to air outlet schedule for requirements.

**FAN COILS & COMMERCIAL HEAT PUMP
AND CONDENSING UNITS**

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Outdoor Evaporator/Condensing Units
- .2 Indoor Fan Coil Units
- .3 Refrigerant Piping
- .4 Refrigeration Specialties
- .5 Controls

1.2 QUALITY ASSURANCE

- .1 Meet the requirements of CSA, CGA Provincial and Municipal Codes and be CSA listed.
- .2 Test and rate cooling system to ARI Standard 210.
- .3 Fans shall confirm to AMCA Bulletins regarding construction and testing.
- .4 Filter media shall be UL listed.
- .5 Comply with applicable codes, laws and regulations. Conform to CSA - B52, Code for Mechanical Refrigeration; and CSA-B31.5, Code for Refrigeration Piping.
- .6 Technicians shall be certified under Ministry of Environment regulations for working with and handling CFC, HFC, and CFHC refrigerants.

1.3 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 Shop drawings must be submitted and reviewed by the Departmental Representative prior to the contractor ordering or shipping any subject equipment. Payments will not be processed for equipment not properly documented and reviewed under the terms of submittal.
- .2 Submit certified shop drawings for the following:
 - .1 Cooling and air delivery performance data.
 - .2 Fan performance curves and sound data.
 - .3 Fan details, isolation and details.
 - .4 Filter frame and media details, dimensions and efficiency.
 - .5 Coil materials, pressure drop, accessories.
 - .6 Compressor details, isolation and accessories.
 - .7 Refrigeration specialties and accessories.
 - .8 Cabinet construction, gauge, access doors, fasteners.
 - .9 Dimensions and weights.
 - .10 Power wiring diagrams and electrical characteristics.
 - .11 Control wiring diagrams and interfacing details.
 - .12 Maintenance requirements.
 - .13 Installation instructions.
 - .14 Field piping layout drawings with pipe sizes, refrigerant flows, pressure drops in solenoid valves, driers, shutoff hand valves, pipe and fittings on liquid lines, and pressure drop or change in saturation temperature of suction lines. Shop drawings shall be endorsed by equipment manufacturer.
 - .15 Ministry of Environment qualification and registration number for technicians working with and handling CFC, HFC and CFHC refrigerants.

1.4 ALTERNATIVES

- .1 Requests for approval as an alternative manufacturer must be accompanied by a scale drawing of the proposed equipment in the space available, fan performance, power and sound data, in the form of fan curves (tabulated data will not be accepted), coil arrangement and performance, full physical characteristics including weight, sizes, construction details etc.
- .2 Size, NBS test efficiency, initial and final resistance of alternate manufacturer's filters, shall be same as types specified.

**FAN COILS & COMMERCIAL HEAT PUMP
AND CONDENSING UNITS**

- .3 Number of tube rows, air pressure drops and such features as clean ability, drain ability, same or opposite end connections, support and venting of alternative manufacturer, shall be same as type specified.

1.5 ACCEPTABLE MANUFACTURERS

- .1 Manufacturers whose products are approved in principle, but subject to requirements of drawings and specifications are:
 - .1 Mitsubishi, Daikin, Fujitsu.

1.6 WARRANTY

- .1 Provide five year warranty on compressor.

2.0 MATERIALS

2.1 GENERAL

- .1 Provide lockable weatherproof disconnect switches on outdoor units.

2.2 REFRIGERANT PIPING AND ACCESSORIES

- .1 Piping shall pre charged flexible piping kits supplied by the manufacturer or hard temper type K-ACR copper, configured in accordance with ASME and provincial government standards.
- .2 Shutoff valve shall be refrigeration grade; angle, globe or ball type.
- .3 Provide valved refrigerant charging connection on liquid line.
- .4 Provide service valves on liquid and suction lines of condensing unit.
- .5 Provide pressure gauge taps where required.
- .6 Provide combination filter/drier sized for full capacity of system.
- .7 Silver brazed joints using copper phosphorous alloy, with melting point between 1100°F and 1500°F, using current quality control procedures.
- .8 Utilize mounting strut and fittings of one manufacturer. Do not mix products.

2.3 INDOOR UNIT

- .1 Self - contained, factory assembled and pre-wired, consisting of cabinet and frame, supply fan, coil, controls, air filter and holding frame.
- .2 Cabinet: Heavy gauge steel or plastic easily removed access doors or panels with quick fasteners, reinforced where required.
- .3 Fan: Multi-speed direct drive, centrifugal, forward curved, statically and dynamically balanced.
- .4 Provide all necessary specialized tools and equipment required to perform speed adjustments on ECM, PSC or other motor types.
- .5 ARI certified coils of seamless copper tubing, force fitted to aluminum fins. Enclose coils in coil section with headers and U - bends fully contained within the casing
- .6 Drain pan. Heavy gauge galvanized steel drip pan and drain connection for each coil section, extending 75 mm from face of coil leaving side.
- .7 Provide factory supplied disconnect switch. The disconnect switch shall be in approved case mounted externally on the unit or in such a manner that access can be gained by quick release fasteners or hinged access panels. No other electrical conductors or control devices shall be exposed when gaining access to the main disconnects.
- .8 Provide factory supplied / installed condensate pump.

2.4 OUTDOOR UNIT

- .1 Self - contained, factory assembled and pre-wired, consisting of cabinet and frame, fan, coil, controls.
- .2 Cabinet: Heavy gauge steel with baked enamel finish, easily removed access doors or panels with

**FAN COILS & COMMERCIAL HEAT PUMP
AND CONDENSING UNITS**

- quick fasteners, reinforced where required.
- .3 Fan: Direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
- .4 ARI certified coils of seamless copper tubing, force fitted to aluminum fins. Enclose coils in coil section with headers and U - bends fully contained within the casing.
- .5 Drain pan. Heavy gauge galvanized steel drip pan and drain connection.
- .6 Provide factory supplied disconnect switch. The disconnect switch shall be in approved case mounted externally on the unit or in such a manner that access can be gained by quick release fasteners or hinged access panels. No other electrical conductors or control devices shall be exposed when gaining access to the main disconnects.

2.5 REFRIGERANT COMPRESSOR

- .1 Hermetic compressor, 3,600 rpm maximum with the following accessories:
 - .1 Spring mounted
 - .2 High and low pressure safety controls
 - .3 Motor overload protection
 - .4 Crankcase heater
 - .5 Service valves
 - .6 Filter dryer
- .2 Solid state time out system to prevent rapid compressor cycling.
- .3 Low ambient kit to allow compressor operation to minus 17 degrees Celsius in cooling mode.

2.6 INSULATION

- .1 Insulate refrigeration lines throughout. At hanger locations, provide 150 mm long curved metal plate to protect insulation.
- .2 Insulate refrigerant suction lines with 15mm closed cell insulation.
- .3 Maintain insulation integrity at hangers and penetrations.
- .4 Where insulation is exposed outdoors, provide mechanical protection jacket of close crimped 22 gauge aluminum.

2.7 CONTROLS

- .1 Provide necessary refrigeration controls as specified or required, including relays and control devices.
- .2 Provide for proper operation of safety controls and automatic controls provided under this Division.
- .3 Microprocessor remote panel control panel, hard wired into system:
 - .1 Liquid crystal display screen
 - .2 24 hour on-off timer
 - .3 Heating cooling set point control
 - .4 Fan speed control
 - .5 Space and air flow temperature display

2.8 OUTDOOR UNIT BASES

- .1 Provide roof pans and galvanized steel channel to install condensing unit 300mm above the house keeping pad.

3.0 EXECUTION

3.1 REFRIGERANT PIPING

- .1 Size piping for minimum pressure drop in system. Pipe sizing shall be in accordance with manufacturer's requirements.

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- .2 Arrange piping runs and equipment locations to comply with manufacturer's maximum elevation difference and piping length between outdoor and indoor unit.
- .3 Arrange piping to return oil to compressor. Provide traps in piping systems if required. Keep horizontal dimensions of traps as small as possible.
- .4 Attach hangers and supports as required. Provide one hanger 500 mm minimum from each change of direction. Hangers and support to allow unbroken insulation and vapour barrier.
- .5 Arrange piping loops in suction lines to prevent liquid refrigerant from draining into compressor during shutdown.
- .6 Provide flexible connections where required.
- .7 Purge piping with inert gas when brazing.

3.2 INDOOR UNITS

- .1 Secure unit to structure.
- .2 Pipe condensate to drain.

3.3 OUTDOOR UNITS

- .1 Mount units on housekeeping pad on structural base as noted on drawings.
- .2 Secure outdoor unit to base with hold down lag screws or bolts. Adjust lock nuts to maintain clearance required by neoprene pads and mounting base.
- .3 Position condensing unit no closer than 2 metres from roof edge.

3.4 TESTING, DEHYDRATION, CHARGING AND START-UP

- .1 At completion of the installation, pressurize system and check for refrigerant leaks. Repair leaks and retest. Dehydrate system and charge with refrigerant. Start up system, and check out operation.
- .2 Utilize services of certified refrigeration technicians for start - up. Include completed and signed check lists in operating and maintenance manuals.
- .3 If installation is completed in winter season, pump down refrigerant and repeat procedure at start of next cooling season.
- .4 Provide manufactures start up and test documentation.

3.6 PERFORMANCE

- .1 Refer to outdoor unit schedule.
- .2 Refer to indoor unit schedule.

1.0 GENERAL

1.1 WORK INCLUDED

- .1 Electronic and electric control system for mechanical systems.
- .2 Control devices, components, wiring and material.
- .3 All relays, devices, components, wiring, conduit, etc., for line or low voltage interlocking.
- .4 Software and programming for new and existing systems.
- .5 Wiring and testing of equipment control panels not factory mounted and wired.
- .6 Modifications and renovations to existing systems.
- .7 Check out and commissioning of new and modified control systems.
- .8 Training and instructions to Departmental Representative for new and existing systems.
- .9 Remove all existing wiring, material and equipment not being reused. Do not abandon in place.

1.2 QUALITY ASSURANCE

- .1 Work specified in this Section shall be done by qualified technicians, experienced and skilled in the tasks of installing and checking out the components, wiring and systems installed.
- .2 Adhere to all applicable electrical codes and regulations.
- .3 Obtain electrical permit.
- .4 For non-CSA equipment, submit to Inspection Authorities and obtain approval prior to installation of equipment on site.

1.3 SUBMITTALS – PRIOR TO CONSTRUCTION

- .1 No work on control systems is authorized, nor will progress payments be considered until all control systems submissions have been provided and accepted.
- .2 For the systems and components provided under this Division, provide complete documentation including but not limited to wiring diagrams, installation and maintenance instructions, verification and check-out procedures, performance range, voltage and current characteristics, etc.
- .3 Provide fully integrated diagrams and shop drawings for all systems and components, including those supplied under other Sections or Divisions of the specification.
- .4 Controller and panel shop drawings are to include the model number of the control chips and other components included in the equipment.
- .5 Controller configuration, positioning and location to be coordinated and confirmed with Departmental Representatives prior to installation. Provide plan showing all main panels, controllers and controls cabinet locations to Departmental Representative for approval.
- .6 Provide full schematic drawing of mechanical systems with all control points and devices clearly marked and labelled. The Departmental Representative will provide electronic copies of mechanical systems schematic for this purpose.
- .7 Provide full list of all points and control systems devices, reconciled with the points list included in the specification.
- .8 Provide written Sequence of Operation for every system under the scope of this Contract. The sequence must be written with wording differing from the Sequence of Operations below, but with the same intent.

1.4 SUBMITTALS – PRIOR TO SUBSTANTIAL PERFORMANCE

- .1 Once the systems has been commissioned and all components are operational, provide trend logs for all systems.
- .2 Provide hand written “end to end” checks of all control points.
- .3 Provide post construct “record” shop drawings for inclusion in maintenance manual. Include handwritten end to end checks for all points.

1.5 GENERAL

- .1 The scope of the work specified in this Division includes but is not limited to:
 - .1 All sensors, actuators, relays, contactors, power supplies, conduit, wiring, tubing, and other field devices, control valves etc.
 - .2 All required wiring and conduit from field input/output devices, to the BAS panel terminal strip and the control modules locations and termination of same.
 - .3 All required 120 volt AC wiring and connections for control systems, operators and components.
 - .4 Wiring from all control modules back to the BAS panel terminal strip.
 - .5 Supply, installation and mounting of all controls equipment and components.
 - .6 Verification, calibration and continuity checks of all wiring and components installed by this Division.
 - .7 Request and witness tests, for installation certification conducted by the Departmental Representative on each sensor and actuator point installed.
 - .8 Comply with all the requirements stated elsewhere in the specification for shop drawings, approvals, documentation and record drawings. This requirement applies specifically to physical location layout drawings and detail drawings.
 - .9 Coordinate the location and mount the supplied metal enclosure. Connect all conduit, and terminate all wiring to a removable termination strip. Provide wiring, tagging, and panel point layout sheets on inside panel door.
 - .10 Standardized tagging to be used to identify all points on project.

1.6 COORDINATION DIVISION OF RESPONSIBILITY

- .1 Provide coordination services between the Departmental Representatives, Commissioning Authority, the Contractor, the Specialty Engineer, the Commissioning Agent, and others as necessary.
- .2 Cooperate and attend as required to complete the installation and commissioning procedures as specified in this Section and in other Sections of the Specification.
- .3 Cooperate and assist the Commissioning Agent in the verification and commissioning of all systems and components.

1.7 VERIFICATION AND ACCEPTANCE

- .1 Refer to Section 23 05 93.3 Commissioning.
- .2 Complete all pre-testing and verification of points, and systems installed under this Section using qualified and experienced personnel.

1.8 DESCRIPTION OF CONTROL SYSTEM

- .1 The new points are an extension to the existing DDC control system.
- .2 System display and interface to be full colour graphics type.
- .3 The HVAC system is defined by a points list which identifies each input or output. Review the point sheet which identifies panel numbers, point description, input output number, field device and wiring detail reference, etc.
- .4 For specific definition of each sensor and actuator, its installation and connection to SAP, the contractor shall refer to the detailed point sheets included, and wiring details for that device.
- .5 Point sheets identify each specific device, sensor or operator and certain connection details or requirements.

- .6 When the project is completed this documentation is to be updated by these contractors to record drawing condition.

1.9 DEFINITIONS AND ABBREVIATIONS

- .1 The following are abbreviations used throughout the section defining computerized control systems specified herein or defined on plans.
- | | | |
|-----|------|--|
| .1 | DDC | Direct Digital Control |
| .2 | BAS | Building Automation System |
| .3 | SAP | Stand Alone Panel |
| .4 | DI | Digital Input |
| .5 | DO | Digital Output |
| .6 | AI | Analog Input |
| .7 | AO | Analog Output |
| .8 | HVAC | Heating, Ventilating, Air Conditioning |
| .9 | MCC | Motor Control Centre |
| .10 | R | Relay |
| .11 | WTS | Water Temperature Sensor |
| .12 | RTS | Room Temperature Sensor |
| .13 | DTS | Duct Temperature Sensor |
| .14 | SAT | Supply Air Temperature Sensor |
| .15 | MAT | Mixed Air Temperature Sensor |
| .16 | RAT | Return Air Temperature Sensor |
| .17 | OAT | Outdoor Air Temperature Sensor |
| .18 | CT | Current Transformer |
| .19 | OPR | Damper or Valve Operator |
| .20 | DMP | Damper Operator |

1.10 SOFTWARE AND DOCUMENTATION

- .1 Software: Update the existing software with new control points and graphics as required for the new systems.
- .2 During the first year warranty period, the controls system supplier shall maintain duplicate software back-up copies of the most current software and programs. The control system supplier shall be capable of uploading the back-up programs by, at the request of the Departmental Representative.
- .3 Provide fully operational and unrestricted copies of HVAC control system software and documentation to the Departmental Representative, for the unconditional operational and maintenance use by the building operator.
- .4 Provide copies of the software and documentation to the Departmental Representative for use by the building operator to monitor the system.
- .5 Provide training, documentation and software necessary to allow the Departmental Representative to access the control system through the Departmental Representative owned personal computers.

1.11 ALTERNATIVE COMPONENTS

- .1 Submission for alternative components will be reviewed by the Departmental Representative, subject to the following:
- | | |
|----|---|
| .1 | Complete and acceptable submissions for alternates must be received ten days prior to the closing of sub trade tenders. |
| .2 | Submissions must include precise and complete detail for wiring, electrical ratings, and accessory requirements. |

1.12 MAINTENANCE DATA AND SERVICE

- .1 Refer to Section 23 01 00 Documentation, Manuals and Record Drawings.
- .2 Provide for complete service of controls systems, including call backs, for one year running concurrent with guarantee.

- .3 Verify system operation throughout the one year maintenance period to ensure stable and acceptable operation in all operating conditions.

1.13 GUARANTEE

- .1 Provide a written guarantee, signed and issued in the name of the building operator stating that the controls system, materials, devices and software are guaranteed against faulty material and workmanship for a period of one year from the date of Substantial Performance.

1.14 TRADE CO-OPERATION

- .1 The control subcontractor shall oversee the operation, installation and adjustment of all devices and components that are directly or indirectly controlled or affected by the systems installed under this Division.
- .2 Provide wiring diagrams, instructions, supervision, and attendance services to other trades as necessary to complete the installation, testing and adjustment of the systems installed under this Division.

1.15 ACCEPTABLE MANUFACTURERS

- .1 Control system contractors must be factory certified to alter the existing DDC system.

2.0 PRODUCTS

2.1 FIELD DEVICES

- .1 All sensors and controllers shall be of commercial grade. Provide full details of all sensors and controllers proposed, including their range and accuracy.
- .2 The sensors shall conform to the following table:

Description	Accuracy	Range
Space temperature	+/- 0.2 degrees C	0 to 50 degrees C
Current sensors		+/- 2% of full scale

- .3 Provide data on accuracy, range, output signal characteristics, repeatability, linearity, dead band as applicable. Include data on hysteresis and defined curve/calibration points for any products for pre-tender approval as an equal to those specified.

2.2 CONTROLLER

- .1 Controllers shall be fully free programmable and shall not be limited to predetermined sequences.
- .2 Panel I/O configuration to be universal inputs, capable of accepting 0-5 vdc, 4-20 ma, thermistor or dry contact signals. universal outputs, type digital or analog, software selectable. Outputs to source 10 vdc @ 20 ma or digital triac outputs capable of switching 24 vac @ 0 amps maximum.
- .3 Panel to have 2 communication ports for connection to local networked sensors, and BMS network.
- .4 Panel to UL916 Listed and FCC rated Class A.

2.3 TEMPERATURE SENSORS - GENERAL

- .1 Sensors shall be thermistor or RTD type with a high resistance versus temperature change to ensure good resolution and accuracy.
- .2 Sensors to be compatible with input requirements of BAS system.
- .3 The sensor shall give an end to end accuracy of not less than +/-0.2oC.
- .4 The sensor shall connect to the controller by means of a two wire cable.

2.4 TEMPERATURE SENSORS - SPACE

- .1 Electronic wall mounted sensors compatible with controllers and input requirements for BAS system.
- .2 Sensors to be tamper proof where specified. Refer to the points list.

2.5 MOTOR CURRENT SENSOR

- .1 Sensors shall vary or interrupt voltage with sensing motor current draw.
- .2 Provide analogue type as identified on points list.

2.6 TRANSFORMERS

- .1 Transformers required for DDC Panels shall be 120 volt/24 volt, 50 or 100 volt amp capacity and shall contain an integral circuit breaker. Provide mounting box to accommodate transformer, accessories, etc.

2.7 WIRING AND METHODS

- .1 Conduit general: EMT conduit, Steel fittings.
- .2 Conduit flexible; liquid tight, coated flexible, maximum length 500 mm, cast or liquid tight fittings. Application only from junction box and EMT conduit to equipment requiring flexible connection for vibration isolation or service access.
- .3 Conductor:
 - .1 Line voltage power or switched power wiring - No. 12 gauge copper wire minimum.
Line voltage control wiring - No. 14 gauge copper wire, length not to exceed 50 metres, No. 12 gauge copper wire, lengths exceeding 50 metres.
Low voltage No. 18 gauge, twisted, stranded wire as directed by applicable electrical codes and requirements. Shielded cable where required or specified.
Low voltage No. 22 gauge, twisted stranded pair. Shielded cable where required or specified.
MSTP Network Cable shall be no. 24 twisted, shielded, stranded, low capacitance cable.
- .4 Device and Wiring Boxes
 - .1 Heavy gauge aluminum or steel, front access hinged cover, screwed fastening, no gasket unless required by installation environment.
 - .2 Comply with BC Electrical Code and all other applicable codes. Rating suitable for installation environment.
 - .3 Provide inside separation walls and dividers to separate low voltage wiring from line voltage wiring.
 - .4 Size as required, minimum as shown on detail sheets.
- .5 Provide FS style boxes in Public areas.

2.8 DEVICE AND WIRING BOXES

- .1 Heavy gauge aluminum or steel, front access hinged cover, screwed fastening, no gasket unless required by installation environment.
- .2 Comply with BC Electrical Code and all other applicable codes. Rating suitable for installation environment.
- .3 Provide inside separation walls and dividers to separate low voltage wiring from line voltage wiring.
- .4 Size as required, minimum as shown on detail sheets.

2.9 CONTROL PANEL

- .1 Provide heavy gauge, surface mount steel panels with gasketed and hinged access door to house control equipment. Enameled finish.
- .2 Provide terminal strip connection for external wiring, transformers, override timers, clocks, night setback thermostats etc.
- .3 Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- .4 Mount panels in equipment room near equipment served, on vibration free walls.

2.10 IDENTIFIER LABELS AND PLATES

- .1 All components, cables, wires, devices, valves, and accessories shall be identified by label or tag. The label or tag shall include the device identification, point name, plus a functional description.
- .2 Labels - General: Engraved plastic, two colours, white background with black contrasting letters. Plates shall be minimum 20 mm high, letters shall be minimum 3 mm wide, 12 mm high.
- .3 Labels - Emergency: Engraved plastic, two colours, red background with white contrasting letters. Plates shall be minimum 40 mm high, letters shall be minimum 12 mm wide, 20 mm high.
- .4 Labels - Warning: Engraved plastic, two colours, amber background with black contrasting letters. Plates shall be minimum 40 mm high, letters shall be minimum 12 mm wide, 20 mm high.
- .5 Tagging - Conductors: Thomas & Betts E-Z-Coder wire marking system, or heat shrink label, or equivalent system.
- .6 Provide labels for the following systems:
 - .1 Standard: All control panels and devices: Refer to Part One of this Section and Section 23 05 00 Common Work Results for HVAC.

3.0 EXECUTION

3.1 GENERAL

- .1 Check and verify location of sensors and thermostats and other control devices with plans and room details before installation.
- .2 Supply approved accurate and complete shop drawings and wiring diagrams to complete the installation.
- .3 Do not install top entry wiring connections to control panel enclosures where there is a risk of sprinkler operation of other source of water ingress.
- .4 Provide minimum 2m of spare wire in control enclosures for each point.
- .5 Ensure that the wiring and device location, installation and labelling, is correct, and operation is in compliance with specifications. Submit a written report.
- .6 The installation shall conform both to manufacturer's recommended procedures, and all applicable codes and regulations, and to the approval of authorities having jurisdiction.
- .7 All equipment installed shall be mechanically stable and as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.
- .8 Equipment shall be installed so as to allow for ease of maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding areas.
- .9 Mount and wire equipment control panels intended to be installed as part of packages or systems specified under this Division.
- .10 Tune controllers to ensure systems do not hunt. Verify system operation throughout the one year maintenance period to ensure stable and acceptable operation in all operating conditions.

3.2 IDENTIFICATION AND LABELLING

- .1 Permanently identify all components, cables, wires, devices, valves, and accessories provided under this Section in accordance with specifications.
- .2 All concealed equipment is to be noted by tagging the appropriate wall or ceiling panel with a colour coded dot.
- .3 All field wiring shall be tagged at both ends.
- .4 Each terminal or termination point shall have a designation unique for each wire.

3.3 INTERLOCK

- .1 Three phase motor control starters or contactors are specified under other Divisions. This Division will provide interlocking or enabling relays on the 24 volt coils on the starters, or horsepower rated relays on single phase motors. Refer to equipment schedules.
- .2 Interlocking is to be done through the BAS program, not by relay or auxiliary contacts on motor

- starters.
- .3 Allow for installation and programming of specified number of relays for control of new fans. Connect to appropriate controller or main panel. Refer to points list.

3.4 INSTALLATION OF SENSORS - GENERAL

- .1 Sensors shall be rigidly mounted and mountings shall be adequate for the environment within which the sensor operates.
- .2 All temperature sensors shall have their locations pre-approved by the Departmental Representative prior to installation.
- .3 Mount all sensing elements where stratification is minimal so accurate air temperature measurement is achieved.
- .4 Select the location to ensure proper space temperature is sensed and building, room and solar effects are minimized.

3.5 SPACE SENSORS AND THERMOSTATS

- .1 Mount 1,500 mm above floor, or at the same level as lighting controls.
- .2 Sensors located on outdoor or cold walls are to be provided with an approved insulating sub-base.
- .3 Conduit and mounting boxes for sensors are to be sealed and plugged with expanding foam spray material to prevent convective air currents in the conduit or wall from affecting the sensor.
- .4 Sensors are not to be located near or above heat producing equipment or fixtures.
- .5 Sensors connected to a control panel by network wiring shall not be connected on the same sub network as any other piece of equipment other than sensors of the same type.

3.6 WIRING

- .1 Flexible conduit with maximum length of 500 mm is allowed only from junction box and EMT conduit to equipment requiring flexible connection for vibration isolation or service access. BX sheathed cable is not approved.
- .2 All control wiring not concealed in walls, shall be run in conduit. This includes mechanical and service rooms, and ceiling spaces. Conduit and wiring shall conform to the standards specified under Division 26.
- .3 Conductors not installed in conduit shall be adequately secured with tie wraps or other approved methods, secured to building structure or walls. Wiring shall not be secured to other systems, conduit, piping or ductwork etc. Routing of exposed cable will be parallel with building lines, provided with 90 degree change of direction, tensioned to prevent sagging, and maintain clearance above ceilings by securement to structure or walls.
- .4 Conduit and wiring accessories are not to be secured or mounted on equipment, except where terminations are to be completed. Circuitry from unit to unit is to be branched from a conductor run positioned remote from the equipment, allowing adjustment or removal of the equipment without the need to disrupt the conduit. Conduit shall not hinder access to, or opening of, access panels or doors and service positions. Flexible conduit shall be used where devices are mounted on doors or other moving components, including spring isolated elements.
- .5 Any exposed conduits or cables shall be run parallel to or at right angles to building lines and in a neat manner.
- .6 The Departmental Representative may reject work, wiring and installations not done in a fashion demonstrating care and workmanship to an acceptable level.
- .7 Provide power circuit, 120 volts, single phase, for any control equipment requiring same. Power circuit to be run with materials and methods in compliance with standards specified under Division 26.
- .8 Lace or clip groups of power or control conductors in panels, pull boxes and termination points.
- .9 All grounding conductors are to be copper. All ground conductors to have green insulation jacket.
- .10 Data cabling verification required at both ends shall be completed by the controls agent.
- .11 The controls agent is responsible for the continuity of all controls wiring, even if the wiring was

- installed by others.
- .12 All control and power wiring shall conform to the following ratings based on construction type as well as whether or not the ceiling space is used as a return air plenum:
- .1 Non-combustible construction, plenum ceiling: FT6 rated wiring

3.7 CONTROL PANEL WIRING AND INSTALLATION

- .1 All wiring shall be clearly tagged at terminations.
- .2 All equipment located inside the panel shall be securely fastened to the panel.
- .3 Panels shall be mounted with the clearance and provision for mounting an additional future panel adjacent. Conduit entry into the SAP shall be from the top or bottom to allow for future panel additions on each side.
- .4 Terminate all conductors on the terminal strips supplied with the enclosure.
- .5 For new wiring, provide minimum 2m of spare wire in control enclosures for each point.
- .6 If any wire splicing is required, it shall be completed in new terminal strips.
- .7 All data cabling requires verification at both ends by same party.

3.8 CALIBRATION AND VERIFICATION

- .1 Refer to Section 23 05 93.3 Commissioning, Section 23 01 00, Documentation, Balancing and Record Drawings.
- .2 For systems and components supplied or installed under this Section, check, adjust and calibrate each device and individual wiring sections, to the satisfaction of the Departmental Representative.
- .3 Every point shall be checked end to end to ensure accuracy and integrity of systems.
- .4 Provide signed and dated reports certifying that all systems have been tested and adjusted to specified or instructed conditions.
- .5 Provide record copies of all set points, tests and adjustments for all devices and schedules.

3.9 CONTROLLERS

- .1 Confirm location and positioning of all controllers and panels with Departmental Representative prior to installation. Submit plan.
- .2 Mount devices as required near equipment served.
- .3 Controllers are to be installed in compliance with the specifications and as shown on detail sheets.
- .4 Unless otherwise specified, neither controllers nor any other device is to be mounted on equipment served. Devices are to be mounted on structure, walls or field fabricated brackets near equipment served in such a manner that equipment can be removed for service without dismounting the controller, sensor or device. Only wiring and conduit from the controller to the controlled device need be disconnected.
- .5 Install controllers complete with accessories. Provide 120 volt AC connection, and transformers as required for each controller. Alternating current power source is to be taken from the control panel of equipment served, or from a dedicated 120 volt AC source provided from a local electrical panel.
- .6 This Division is responsible for determining the nature of the requirement, providing necessary breakers and local panel, providing conduit and wire and other accessories from the panel to the point of use. All wiring and accessories to be in compliance with the standards of Division 26.

3.10 TREND LOGS

- .1 Once the systems has been commissioned and all components are operational, provide trend logs over a minimum period of two days for all rooms, zones, primary systems, terminal systems and any other systems required to confirm correct BMS operation.
- .2 All points must be trended using a colour display format, complete with legend. Use a multi-trend system to display set points and measured parameters for individual systems on the same page. Trends shall be recombined and resubmitted if the format is deemed to not be acceptable by the Departmental Representative.
- .3 Identify and explain any discrepancies or undesired systems responses.

- .4 Be prepared to alter programming, tune control loops, adjust damper linkages, verify sensor calibration, adjust dead bands etc.
- .5 Repeat the above process until trend logs show that systems operation is acceptable and within tolerances.

3.11 POINTS LIST

- .1 Refer to points list in Specification section 25 90 02.

END OF SECTION 25 01 05

SEQUENCE OF OPERATIONS

1. GENERAL

1.1 Graphics

- .1 Existing graphics shall be updated to include new points and systems.
- .2 Current Sensor Display: Any electric motor required by the points list to display running amps, shall also have on the display, whether graphics or screen text, the rated full load amps of the motor.
- .3 All set points, valves and measurements listed in the control sequences must be user adjustable from the graphical user interface.

1.2 Split System HVAC Control

- .1 Operate to cool the space.
- .2 Install factory control accessories.
- .3 A DDC connected room sensor will provide temperature feedback to the DDC system for monitoring.
- .4 Install control panels in ceiling space or as located on plans. Provide access for service.
- .5 Unit shall only operate in cooling mode.
- .6 Unit is capable of full cooling capacity down to -17C outdoor air temperature.
- .7 Fan shall run continuous.
- .8 The thermostat set points shall be set as follows:
 - .1 Cooling set point shall be initially set to 28C.
- .9 Room temperature will be monitored by the DDC room temperature sensor alarm operator if temperature exceeds cooling set point by 2C.

1.3 EF14 Control

- .1 Operation unchanged.
- .2 Balancing trade will rebalance existing fan/grille serving MECH 2013
- .3 New current sensor will generate an alarm if current draw is outside of acceptable range.
- .4 Provide temperature sensor in MECH 2013. Generate alarm if room temperature rises above 35C

1.4 EF1005 Control

- .1 EF-1005 is controlled by the DDC system (new).
- .2 EF-1005 operates at a minimum speed to provide 6 air changes per hour to the space.
- .3 A wall mounted HOA (by controls trade) will enable an occupant to override unit off, or override unit to full ventilation rate.
- .4 Room thermostat senses room temperature and varies the speed of EF-1005 from minimum flow to maximum flow on a rise in temperature from 28C to 30C.
- .5 A new current sensor on the fan will generate an alarm if the current draw is outside of acceptable range.
- .6 Generate alarm if room temperature rises above 30C.

1.5 Elevator Sump Alarm

- .1 The elevator trade will supply and install a sump water level sensor.
- .2 Monitor output provided by the elevator trade indicating the presence of water.
- .3 Upon sensing water, generate an alarm on the DDC system.

POINTS LIST

SRDC Elevator Replacement					
CONTROLS POINTS LIST					
					SECTION 25 90 02
					19-Apr-17
DESCRIPTION					
DATA	INPUT	OUTPUT	STATUS	TYPE	ALARM
	MECH 1005 Room Temperature		NEW	ANALOGUE	OR
	MECH 2013 Room Temperature		NEW	ANALOGUE	OR
	Passenger Elevator Sump Alarm		NEW	DIGITAL	HL
	Freight Elevator Sump Alarm		NEW	DIGITAL	HL
	EF1005_AMPS		NEW	ANALOGUE	OR
	EF14_AMPS		NEW	ANALOGUE	OR
		EF1005_SS	NEW	DIGITAL	
		EF1005_RATE	NEW	ANALOGUE	
* Unless otherwise noted all points and devices listed are provided by the controls trade.					
ALARM LEGEND					
	LL - LOW LIMIT				
	HL - HIGH LIMIT				
	OR - OUT OF NORMAL RANGE				
	RP - REPORT FAULT CODE				

END OF SECTION 25 90 02

COMMON WORK RESULTS - ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
- .2 General requirements that are common to National Master Specification (NMS) sections found in Division 26 – Electrical and 28 - Electronic Safety and Security.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .2 CSA C22.1, Canadian Electrical Code, Part 1 (Current Edition), Safety Standard for Electrical Installations.
- .3 CSA C22.2 No. 248.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .5 Material Safety Data Sheets (MSDS).

1.3 DRAWINGS AND SPECIFICATIONS

- .1 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.
- .2 The drawings and specifications are complementary, and what is required by any one shall be as binding as if required by all.
- .3 It shall be the responsibility of the Contractor to supply and install all material necessary to complete the work.
- .4 Field verification of scale dimensions on drawings is directed, since actual locations, distances and levels will be governed by actual field conditions.
- .5 If discrepancies or omissions in the drawings or specifications are found, or if intent or meaning is not clear, advise the Departmental Representative for clarification before submitting tender (bid).
- .6 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.
- .7 Refer to General Requirements.
- .8 Where the term "Provide" is used it shall be understood to include labour, materials and services necessary to supply and install items or work referred to.
- .9 The drawings and specifications 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, or 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 this responsibility of properly completing his trade to the approval of Departmental Representative.

1.4 RELATED WORK

- .1 Division 26 specifications shall form part of the contract documents and shall be read, interpreted and coordinated with all other Divisions. The Instructions to Bidders, General Conditions, General Requirements, Supplementary General Conditions and Amendments and Supplements thereto form a part of this Division and contain items related to the electrical work.

1.5 METRIC CONVERSIONS

- .1 Care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, material and site services in both new and existing installations.

COMMON WORK RESULTS - ELECTRICAL

-
- .2 Conform to the Canadian Metric Practice Guide CSA-CAN3-2234-1-89.

1.6 SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

- .1 The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.
- .2 Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Conditions and conform to all requirements.
- .3 Refer to the security and protection requirements in the General Conditions and conform to all requirements. There shall be no smoking, and the site shall always be kept clean.

1.7 QUALITY ASSURANCES

- .1 Codes, Rules, Permits and Fees
- .1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.
- .2 Complete installation to comply with all rules of the current edition of the Canadian Electrical Code (as amended by the authority having jurisdiction) and the bylaws of the city or municipal electrical energy inspection department whose authority covers the area in which the work is being done. In addition, the complete installation is to comply with local municipal codes and the current edition of the local Building Code and By-Laws.
- .3 Comply with CSA Electrical Bulletins in force at time of tender (bid) submission.
- .4 Quality of work specified and/or shown on the drawings shall not be reduced by the foregoing requirements.
- .5 Submit to the Electrical Inspection Department having jurisdiction necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .6 Pay associated fees and obtain all permits, licenses, etc. required for the work.
- .2 Inspections
- .1 Furnish a Certificate of Acceptance from Inspection Department on completion of work.
- .2 Incorporate a copy of the Certificate of Acceptance in the operating and maintenance manual. Review by Departmental Representative.
- .3 Give Departmental Representative advance notice of shop fabrication, field erection and other phases of the Work to afford him reasonable opportunity to inspect the Work for compliance with contract requirements. Failure to meet this requirement may be cause for the Departmental Representative to classify the Work as defective.
- .4 If the 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 the inspections or tests satisfactorily completed and make good such Work.
- .5 Departmental Representative may order any part of the Work to be examined if such Work is suspected to be not in accordance with the Contract Documents. If, upon examination such Work is found not in accordance with the Contract Documents, correct such Work and pay the cost of examination and correction. If such Work is found in accordance with the Contract Documents, the Contractor will be compensated the cost of examination and replacement.
- .3 Standards of Workmanship
- .1 Execute all work in a competent manner and to present an acceptable appearance when completed.
- .2 Employ a competent supervisor and all necessary licensed tradesmen to complete the work in the required time.
- .3 Arrange and install products to fit properly into designated building spaces.

COMMON WORK RESULTS - ELECTRICAL

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- .4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.
 - .4 Tests
 - .1 The installation shall be free of opens and grounds. On completion, measure insulation resistances and comply with Table 24 of Canadian Electrical Code.
 - .2 Test all wiring and connections for continuity and grounds before equipment is energized.
 - .3 Before energizing system, check all connections and set and calibrate all relays and instruments for proper operation, obtain necessary clearances, approval and instructions from utility company.
 - .4 Carry out all tests and furnish all equipment required to demonstrate safe and proper completion of the work, without cost to Owner.
 - .5 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report - phase and neutral currents on panelboards and dry-core transformers operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
 - .4 Conduct tests on the following systems:
 - .1 Circuits originating from branch distribution panel "S".
 - .2 Elevator Motors, and associated equipment including sequenced operation of systems where applicable.
 - .6 Guarantees
 - .1 Guarantee all work for one year, following final acceptance. This guarantee shall include all problems caused by improper installation or equipment failure.

1.8 SUBMITTALS

- .1 Breakdown of Costs
 - .1 Immediately upon notice of contract award, submit to Departmental Representative a further break down of the tendered price under the following headings:
 - .1 Site set-up, permits, etc.
 - .2 Distribution equipment
 - .3 Luminaires and accessories
 - .4 Fire alarm equipment
 - .5 Telephone/data system
 - .6 Conduit, wire, cable, etc.
 - .7 Boxes, wiring devices, etc.
 - .8 Miscellaneous equipment
 - .9 Labour
 - .2 Submit progressive breakdown under these headings with each progress claim.

COMMON WORK RESULTS - ELECTRICAL

.2 Product Delivery Schedule

- .1 Within 30 days of award of contract, a schedule must be submitted by the Contractor to the Departmental Representative showing projected ordering and delivery dates of all products to meet required construction schedule.

.3 List of Products

- .1 Within 30 days of award of contract, a list of products and sub-contractors (if applicable) must be submitted to the Departmental Representative showing manufacturers for each type of product and for each luminaire type.

.2 Samples

- .1 Submit samples as required where specified in Division 26 and 28.

.3 Shop Drawings

- .1 After receiving approval of list of products, and prior to delivery of any products to job site and sufficiently in advance of requirements to allow ample time for checking, submit PDF of shop drawings for review as specified in Division 1.
- .2 Show details, dimensions, construction, size, arrangement, operating clearances, performance characteristics and capacities of products and parts of the work.
- .3 Manufacture of products shall conform to reviewed shop drawings.
- .4 Where applicable include wiring, single line and schematic diagrams.
- .5 Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .6 Keep one complete set of Shop Drawings at job site during construction.
- .7 Each shop drawing shall be stamped and signed by the Electrical Contractor to indicate that the drawing has been checked for conformance with all requirements of the drawings and specifications, that the equipment has been coordinated with other equipment to which it is attached or connected, and that all dimensions have been verified to ensure the proper installation of equipment within the available space without interference with the work of other trades. Ensure that mechanical and structural co-ordination is complete before submitting drawings for approval. Shop drawings submitted to Departmental Representative for approval that are not checked and submitted in accordance with the preceding requirements will be rejected for resubmittal.

.4 Project Record Drawings

- .1 Before commencing work, obtain two sets white prints of all drawings pertinent to the work. Keep drawings on site and, daily or weekly as necessary, record in red ink all changes, alterations, or additions in runs of conduit, numbers and location of panels, luminaires and devices that may occur during progress of the work.
- .2 At the conclusion of the job, Contractor to provide marked up drawings.

COMMON WORK RESULTS - ELECTRICAL

.5 Maintenance Manuals

- .1 Before requesting final certificate, submit 1 copies of the maintenance manual as specified in Division 1, in PDF format.
- .2 Include in the manual's information based on the following requirements:
 - .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features and component function and maintenance requirements to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
 - .2 Technical data to be in form of approved shop drawings, supplemented by bulletins, technical descriptions of items, and parts lists. Advertising or sales literature will not be acceptable.
 - .3 Provide wiring and schematic diagrams and performance curves where necessary.
 - .4 Include names and addresses of nearest supplier for all items included in the maintenance manuals.
 - .5 Include copies of electrical safety inspection branch final certificate and fire alarm verification test report and certificate.
 - .6 Provide manual and seminar with Departmental Representative forces to ensure proper operation of building prior to Substantial Performance.

.6 Test Data

- .1 In addition to test data submitted as part of the maintenance manuals, submit test results of equipment and cables to the Departmental Representative as tests are completed.

1.9 PRODUCT HANDLING

- .1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.
- .2 Immediately make good any damage by repair or replacement at no additional cost to the Contract and to the approval of the Departmental Representative.
- .3 Remove dirt, rubbish, grease, etc. resulting from all equipment surfaces.

1.10 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control Devices except for wiring and connections below 75 Volts which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

1.11 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction or inspection authorities.

COMMON WORK RESULTS - ELECTRICAL

1.12 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors as shown on the Drawings.

1.13 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.

PART 2 - PRODUCTS

2.1 SELECTED PRODUCTS AND EQUIVALENTS

- .1 Selected products are specified and/or shown on the drawings, and identified by manufacturer's name, type and catalogue number.
- .2 Equivalent products may be considered if enough information is submitted at least five working days before tender (bid) closure, to enable Departmental Representative to determine acceptability of such products. Submit list of proposed equivalent products in duplicate to the Departmental Representative in PDF format. Submittals by fax will not be accepted.
- .3 Where materials, equipment and apparatus or other products are noted as being "equal to" the specified manufacturer, products of equal or superior quality by other manufacturers may be substituted without approval of Departmental Representative.

2.2 REVIEW OF PRODUCTS

- .1 Immediately after notification of award of contract, review with the Departmental Representative a list of products proposed.
- .2 After approval of product list, no subsequent changes will be permitted except as specified hereafter.

2.3 SUBSTITUTION OF PRODUCTS

- .1 After approval of the list of products, no substitution of any item either specified, preapproved or approved during tender (bid) will be permitted without written approval of the Departmental Representative.
- .2 To receive approval, proposed substitutions must equal or exceed the quality, finish and performance of those specified and/or shown and must not exceed the space requirements allotted on the drawings.
- .3 Provide documentary proof of date of original order, equality, difference in price (if any) and delivery dates in the form of certified quotations from suppliers of both specified items proposed substitutions to the Departmental Representative.

2.4 QUALITY OF PRODUCTS

- .1 All products provided shall be CSA and/or ULC approved and new, unless otherwise specified.
- .2 If products specified are not CSA and/or ULC approved, obtain approval of provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.
- .3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by Departmental Representative.

COMMON WORK RESULTS - ELECTRICAL

2.5 UNIFORMITY OF MANUFACTURE

- .1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.

2.6 PRODUCT FINISHES

- .1 Finish all cabinets, panelboards, switchboards, equipment cabinets, cable trays, etc. in ANSI 61 grey enamel unless otherwise specified.
- .2 Apply primer on all items which are to be finished on the job.
- .3 Touch up all damaged painted finishes with matching lacquer, or, if required by the Departmental Representative, completely repaint or replace damaged surface.

2.7 SEISMIC RESTRAINT – EQUIPMENT

- .1 Use products as indicated herein and as per seismic bracing Engineer's recommendations.

2.8 FIRESTOPPING

- .1 Wiring penetrating any horizontal or vertical assembly required to have a fire-resistance rating shall be in accordance with local building code. Conduits or cables shall be tightly fitted, and fire stopped where necessary to maintain fire rating, as follows:
- .2 For penetrations through a Fire Separation wall provide a firestop system with a "F" Rating as determined by ULC or cUL as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL "F" Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours
3 hours	2 hours
4 hours	3 hours

- .3 For combustible penetrations through a Fire Separation provide a firestop system with an "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated. Combustible cables and raceways shall be max. 25 mm diameter.
- .4 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .5 Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory.
- .6 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.
- .7 Submit shop drawings of all fire stopping assemblies.

2.9 CUTTING, CORING AND PATCHING

- .1 All cutting and core drilling required in structure to install electrical equipment shall be carried out under direct supervision of the electrical contractor.

COMMON WORK RESULTS - ELECTRICAL

- .2 Prior to cutting of walls or floors, review the proposed location, size and method with the Departmental Representative. This includes notification when cutting or coring into any fire rated assemblies.
- .3 Arrange for all patching to be done in such a manner as to return finishes to the same standard as surrounding finishes or to the original design.
- .4 Advise appropriate trades and/or to General Contractor of all required or anticipated cutting, patching and coring prior to close of tender.

2.10 ACCESS PANELS AND DOORS

- .1 Ensure that access panels are provided so that concealed electrical equipment requiring adjustment or maintenance in all locations is easily accessible. Having to remove recessed luminaires in order to gain access to unrelated services will not be deemed easily accessible.
- .2 Generally, access panels required for electrical equipment are not shown on Drawings. Arrange for the supply and installation of any access panels required to maintain accessibility to electrical services that are not specifically called for.

PART 3 - EXECUTION

3.1 SITE EXAMINATION

- .1 Examine the site and existing conditions prior to tendering on this work and make do allowance for these conditions in the tender. Confirm all locations and routings of any existing services, which might be affected by this installation and allow in the tender for such additional work
- .2 No additional compensation will be given for extra work due to existing conditions which such examination should have disclosed.
- .3 Report to Departmental Representative any unsatisfactory conditions which may adversely affect the proper completion of this work.
- .4 Indications on the drawings of existing conduit, outlets and other electrical apparatus is based on casual field observations and records of past contracts. As such, this information represents the best data available but is not guaranteed to be full or accurate. Verify that filed measurements and circuiting diagrams are as indicated on Drawings and that abandoned wiring and equipment serve only abandoned facilities. Report any discrepancies to Departmental Representative before disturbing existing installation.
- .5 Submission of a tender of this work shall indicate that the Contractor has made a thorough examination of the site and has accepted the existing conditions

3.2 COORDINATION WITH OTHER DIVISIONS

- .1 Examine the drawings and all divisions of the specifications. Before commencing work, obtain a ruling from the Departmental Representative if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.
- .2 Install anchors, bolts, pipe sleeves, hangar inserts, etc. in ample time to prevent delays.
- .3 Lay out the work and equipment with due regard to Architectural, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding locations of wall, doors and equipment.
- .4 Do not cut structural members without approval and prior consultation with Departmental Representative.
- .5 Examine previously constructed work and notify Departmental Representative of any conditions, which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

COMMON WORK RESULTS - ELECTRICAL

3.3 TEMPORARY LIGHTING AND POWER

- .1 Provide grounded extension cords and temporary lights required for electrical work.
- .2 Temporary power service, temporary lighting and power distribution systems will be provided under Division 1.

3.4 SEPARATION OF SERVICES

- .1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.
- .2 Contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.
- .3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from ceiling installer, and approved clips or hangers are used.

3.5 LOCATION OF OUTLETS AND LUMINAIRES

- .1 Electrical drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.
- .2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised to suit construction and equipment arrangements without additional cost to the Contract, provided that no additional labour or material is required, and installation has not been completed.
- .3 No extra charge for materials and labour shall be added to the Contract for outlets moved within 10 feet from the location shown on the plans prior to rough-in.
- .4 Maintain luminaire locations wherever possible. Notify Departmental Representative of conflicts with other services.

3.6 IDENTIFICATION

- .1 Provide engraved laminated plastic (lamicoid) nameplates with black lettering on white background with approved wording on all motor starters, disconnect switches (other than in panelboards), switchgear, panels, and on other electrical equipment where needed to aid servicing and upkeep and to inform maintenance staff.
 - .1 Nameplates:
 - .1 Lamacoid 3 mm (1/8 in.) thick plastic engraved sheet, black or red face, white core, mechanically attached with self tapping screws.
 - .2 White letters 20 mm (3/4 in.) high for panelboards.
 - .3 White letters 12 mm (1/2 in.) high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.
 - .4 Allow for an average of twenty-five (25) letters per nameplate.
 - .5 Identification to be in English.
 - .6 Black nameplates for normal power.
 - .7 Red nameplates for emergency power.
 - .8 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

COMMON WORK RESULTS - ELECTRICAL

- .9 Identification to be in English.
- .10 Nameplates for junction boxes are to indicate the system and/or voltage characteristics.
- .11 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .2 Clearly mark all exposed conduit, pull boxes, junction boxes, etc., to indicate the nature of service.
- .3 Provide neatly typed circuit directories on panelboards to indicate the area or equipment controlled by each branch circuit.

3.7 INSTRUCTIONS TO MAINTENANCE PERSONNEL

- .1 Instruct Maintenance personnel in operation and maintenance of electrical equipment and systems.
- .2 Pay all costs for such instruction, including any costs related to instruction by manufacturer's representatives.
- .3 Instruct and demonstrate to the Departmental Representative. The opening and maintenance procedures for all electrical systems using the assistance of the specialist sub-trades and manufacturer's representatives for instruction and include all such costs in the tender. Systems to be demonstrated shall include, but not be limited to, the following:
 - .1 Operation of circuit breakers, meters, etc.
 - .2 Motor control controllers and associated components
 - .3 Routing and Installation of main feeders
 - .4 Fire alarm systems
 - .5 Labeling and identification schemes
 - .6 Sound systems
 - .7 Communication systems
 - .8 Use of Maintenance Manuals
 - .9 Intruder alarm systems
- .4 Arrange an acceptable time with Departmental Representative and submit a program of instruction and demonstration of the Departmental Representative's approval. Assume that the Departmental Representative is not familiar with any of the special equipment and/or systems installed.
- .5 Submit to the Departmental Representative, at the time of Substantial Performance inspection, a complete list of systems starting for each system:
 - .1 Date instructions were given to the Departmental Representative.
 - .2 Duration of instruction.
 - .3 Name of persons instructed.
 - .4 Other parties present.
 - .5 Signature of the Departmental Representative stating that they properly understood the system installation, operation, and maintenance equipment and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated

3.8 RENOVATIONS IN EXISTING BUILDINGS

- .1 Remove all existing luminaires, panels, feeders, outlet boxes, switches, receptacles, etc. not required for the renovated layout shown. All equipment removed and not reused shall become the property of the Departmental Representative. Unless otherwise noted, all equipment installed in renovated areas shall be new. All wiring shall be installed concealed.

COMMON WORK RESULTS - ELECTRICAL

- .2 Supply and install new breakers where required in existing panels to pick up additional circuits indicated on the drawings.
- .3 All existing luminaires that are relocated shall be removed, checked, serviced, cleaned and relamped prior to reinstallation. Provide new ballasts where necessary and as noted on the drawings.
- .4 In areas undergoing exterior upgrading requiring removal and replacement of wall covering, remove existing devices and extend circuitry, provide extension rings and reinstall devices as required.
- .5 Existing outlets within 5'0" of the location of the devices shown on the drawings may be used for those devices. Provide blank cover plates of all existing outlets not reused.
- .6 Where alterations and/or additions to existing equipment or apparatus are required to be made by these documents. Ensure that all changes are made in accordance with the current edition of the Canadian Electrical Code, Part 2, obtain re-certification, and include re-certification costs in the tender.
- .7 Permit no interruptions to the electric power, fire alarm, telephone, or other similar systems in the existing building during normal working hours. Advise Departmental Representative in writing of any intended interruptions outside of these normal hours, including the time and duration of outage. Obtain permission from Departmental Representative at least 7 days before partially or completely disabling any of the systems. The Departmental Representative may cancel such permission in emergencies at the last minute without penalty or extra cost. Minimize duration of outage.
- .8 Assume full responsibility for any disruption to existing services and systems. Provide all necessary material and equipment and provide all labor at no extra cost for any temporary connections to be required to maintain services during work in the existing buildings. Include the removal of such temporary connections at completion of the work in the tender price.

3.9 SEISMIC RESTRAINT - INSTALLATION

- .1 The qualified Professional Engineer shall complete and submit signed and sealed Schedule S Letters of Assurance and letter of compliance for all equipment that requires seismic restraint in accordance with latest codes, standards and requirements of the authorities having jurisdiction. The said Professional Engineer shall include additional documentation to identify the equipment and device types and quantities that were reviewed to ensure that all components requiring seismic restraint were completed.
- .2 Where drilling of the structure is required for anchorage requirements, the drilling shall be subject to the approval of the Departmental Representative.
- .3 Provide all required seismic bracing, supports, bolts, washers, nuts, etc. for conduits and conduit supports, cable tray and cable tray supports, teck cable, etc.
- .4 Provide a system to secure all recessed luminaires independently from the suspended ceiling system. Luminaires shall be supported directly and laterally from the building structure above, using No. 12 gauge wire minimum.

3.10 SUBSTANTIAL COMPLETION

- .1 Prior to requesting substantial completion inspection, the following items must be complete:
- .2 Fire alarm verification certificate and technician's test report must be submitted.
- .3 Emergency lighting system must be operational and tested by electrical contractor and demonstrated to the Departmental Representative (if requested).
- .4 All exit lights must be installed and be operational and tested.
- .5 Provide Certificate of Acceptance from Electrical Inspection Department.

COMMON WORK RESULTS - ELECTRICAL

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- .6 Project Record drawings must be submitted to Departmental Representative for review.
 - .7 Maintenance manuals must be submitted to Departmental Representative for review.
 - .8 All outlets must have coverplates installed.
 - .9 Continuity of fire separations at electrical penetrations must be complete.
 - .10 All seismic restraint requirements must be complete.
 - .11 If any of the above items have not been completed at the time of substantial completion inspection, and the letter of "Assurance of Professional Field Review and Compliance" cannot be issued, any costs for subsequent inspections will be charged to the electrical contractor.

END OF SECTION 26 05 00

WIRE AND BOX CONNECTORS 0-1000 V

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated
 - .2 CSA C22.2No.65-93(R1999), 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).

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .3 Divert unused wiring materials from landfill to an approved metal recycling facility.

PART 2 - PRODUCTS

2.1 MATERIALS

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

WIRE AND BOX CONNECTORS 0-1000 V

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.

END OF SECTION 26 05 20

PART 1 - GENERAL

1.1. Work Included

- .1 Conform to Section 26 05 00 – COMMON WORK RESULTS - ELECTRICAL.

1.2. References

- .1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.
.2 CSA C22.2 No.38-05, Thermoset-Insulated Wires and Cables
.3 CSA C22.2 No. 75-03, Thermoplastic-Insulated Wires and Cables
.4 CSA-C22.2 No. 51-95, Armoured Cables
.5 CSA-C22.2 No.131-M89 (R1994), Type TECK 90 Cable.
.6 ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes- Annealed and Intermediate Tempers

1.3. Product Data

- .1 Submit product data in accordance with Section 26 05 00 – COMMON WORK RESULTS - ELECTRICAL

2. PRODUCTS

2.1. Building Wires

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
.2 All conductors are to be copper.
.3 All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA C22.2 No.38 rated as follows:
.1 Insulation rated at 1000V for 600V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current
.2 Insulation rated at 600V for the other 600V and 347/600V distribution systems not covered under item #1 above.
.3 Insulation rated at 600V for all systems rated at 480V and less.

2.2. Teck Cable

- .1 Cables to CAN/CSA-C22.2 No.131.
.2 Conductors:

WIRES & CABLES 1000V

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- .1 Grounding conductor copper.
 - .2 Circuit conductors: copper, size as indicated
 - .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.
 - .4 Inner jacket: polyvinyl chloride material.
 - .5 Armour: interlocking aluminum.
 - .6 Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4. Provide FT-6 jacket when TECK cables are run in return air plenum.

2.3. Armoured Cables

- .1 Cables to: CSA-C22.2 No. 51-95.
- .2 Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
- .3 Type: AC90 (BX).
- .4 Armour: interlocking type fabricated from aluminum strip.
- .5 Type: ACWU90 - PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No.0.3 with maximum flame travel of 1.2 m (3 ft. 11 in.).

3. EXECUTION

3.1. General

- .1 Provide a minimum of one grounding wire for each three ungrounded conductors on all cable runs. Size grounding to Table 16 of the Canadian Electrical Code. Provide separate ground conductors for ground fault circuit interrupter circuits. All ground conductors to be copper and insulated with a green coloured insulation.
- .2 All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be grounded through ground wires.
- .3 Provide separate neutral conductor for each 120-volt circuit for all circuits feeding receptacles and power outlets.
- .4 All cable terminations to be compression type fittings for wire sizes greater than #8AWG. All compression type fittings to be two-hole long barrel type. Where mechanical screw type lugs are allowed by the Consultant, they will be suitable for quantity of parallel runs of wire that are to be terminated under.
- .5 Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to surface or recessed mounted light fixtures or where noted on the drawings where wiring is required to be installed within an existing wall. The maximum allowable distance of armoured cable is 3m. Contractor to receive written approval from the Consultant to run armoured cable further than 3m.

WIRES & CABLES 1000V

Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels.

- .6 Branch circuit wiring to be upsized as follows to address voltage drop when:
 - .1 The entire length of the circuit wiring exceeds 25m – branch wiring to be a minimum of No. 10 AWG.
 - .2 The entire length of the circuit wiring exceeds 40m – branch wiring to be a minimum of No. 8 AWG.
 - .3 The entire length of the circuit wiring exceeds 60m – branch wiring to be a minimum of No. 6 AWG.
- .7 Wire Splicing
 - .1 Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.
 - .2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. Installation of Building Wires

- .1 Install all building wiring in conduit unless otherwise noted. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.
- .2 All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. Installation of Teck90 Cable, Armoured Cable

- .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with manufacturer's instructions.
- .3 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm (2 in.) and smaller. Two hole steel straps for cables larger than 50 mm (2 in.).
 - .2 Channel type supports for two or more cables.
 - .3 Galvanized threaded rods: 6 mm (1/4 in.) dia. minimum to support suspended channels.
- 4. Tie wires, ty-wraps or similar method is not acceptable.**

- .1 Connectors:
 - .1 Watertight, approved for respective cables.

4.2. Installation of Control Cables

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION 26 05 21

CONNECTORS AND TERMINATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 34 – Conduits, Conduit Fastening and Conduit Fittings.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.
 - .2 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to an approved metal recycling facility.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper and Aluminum, long barrel or short barrel compression connectors to CSA C22.2 No. as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 2, 3 and 4 way joint boxes submarine or dry location type in accordance with Section 26 05 34 - Conduits, Conduit Fastening and Conduit Fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2No.41.

END OF SECTION 26 05 22

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA International)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to an approved metal recycling facility.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Grounding conductors: bare stranded copper, soft annealed, size as required.
- .3 Insulated grounding conductors: green, type AWG.
- .4 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 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 All connections which are located below ground level shall be made by an exothermic welding process as made by Cadweld or Burndy or by compression type ground grid connections as made by Thomas and Betts. If compression type connectors are used, a joint compound shall be used as recommended by the manufacturer.

GROUNDING - SECONDARY

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- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
 - .6 Soldered joints not permitted.
 - .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 Connect building structural steel and metal siding to ground by welding copper to steel.
 - .10 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

3.2 EQUIPMENT BONDING

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, switchgear, frames of motors, starters, control panels, building steel work, distribution panels.

3.3 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, fire alarm systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Fire alarm system as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .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.

END OF SECTION 26 05 28

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 None

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to an approved metal recycling facility.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 1⁵/₈" x 1⁵/₈" (41 x 41 mm), 1/₈" (2.5 mm) thick, surface mounted or suspended or set in poured concrete walls and ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to 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 2" (50 mm) and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 2" (50 mm).
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 1/4" (6 mm) dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 1/4" (6 mm) dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 5 ft. (1.5 m) on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .13 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 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

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

2.2 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle and catch, for surface mounting.

PART 3 - EXECUTION

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 6' 6" (2 m) above finished floor.
- .3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 100 ft. (30 m) of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION 26 05 31

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA C22.1-2002, Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
.2 4" (102 mm) square or larger outlet boxes as required for special devices.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 347 V outlet boxes for 347 V switching devices.
.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 3" x 2" x 1 1/2" (76 x 50 x 38 mm) or as indicated. 4" (102 mm) square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 4" x 2 1/8" x 1 7/8" (102 x 54 x 48 mm).
.3 4" (102 mm) square or octagonal outlet boxes for lighting fixture outlets.
.4 4" (102 mm) square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

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

2.5 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches or receptacles.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
.2 Knock-out fillers to prevent entry of debris.
.3 Conduit outlet bodies for conduit up to 1 1/4" (32 mm) and pull boxes for larger conduits.
.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 **INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 1/4" (6 mm) of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Mount single gang receptacles and switch boxes with their greatest dimension in the vertical direction unless otherwise noted.

END OF SECTION 36 05 32

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-1977(R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.

1.2 WASTE MANAGEMENT AND DISPOSAL

- 1. Place materials defined as hazardous or toxic waste in designated containers.
- 2. Ensure emptied containers are sealed and stored safely for disposal away from children.
- 3. Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel or hot dipped galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum and liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 2" (50 mm) and smaller. Two hole steel straps for conduits larger than 2" (50 mm).
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 5 ft. (1.5 m) oc.
- .4 Threaded rods, 1/4" (6 mm) dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90E bends are required for 1" (25 mm) and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 FISH CORD

- .1 Polypropylene.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Exposed conduit located in areas where prone to mechanical injury shall be rigid galvanized steel up to 5 ft.(1.5m) above finished floor.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

- .3 Use electrical metallic tubing (EMT) unless noted otherwise. Galvanized metallic tubing (EMT): Shall be used in masonry, partitions, ceiling spaces and exposed indoor runs.
- .4 Use flexible metal conduit for connection to motors in dry areas connection to surface or recessed fluorescent fixtures.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Minimum conduit size for lighting and power circuits: 3/4" (19 mm).
- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 3/4" (19 mm) dia.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.
- .13 Internal raceways in the building:
 - .1 Securely cap or plug all openings in conduit and ducts during the execution of the Work to prevent obstruction entering the openings.
 - .2 At completion of the installation, the service entry ducts and the conduit system in the building shall be fished to clear all blocks.
 - .3 Outlet and pull boxes shall be cleaned out and the system left free from water and moisture.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 5 ft. (1.5 m) clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 1" (25 mm) concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN FIRE SEPARATIONS

- .1 All conduits penetrating floor slabs or fire walls shall be sealed with CSA approved flame retardant compounds to maintain adequate fire ratings.

PANEL BOARDS BREAKER TYPE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to an approved metal recycling facility.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboard "S" is to be retrofitted.
- .2 Panelboards: Are existing by Federal Pioneer.
- .3 250 and 600 V panelboards: bus and breakers rated for 22 K A (symmetrical) interrupting capacity or as indicated.
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated. Provide drip shields for sprinkler-proofing on all surface mounted panels. Ensure that double-tub and triple-tub panels are factory approved for the application.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 08 99 Rough Carpentry for Minor Works.
- .3 Where practical, group panelboards on common backboard.
- .4 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .5 Connect loads to circuits.
- .6 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION 26 24 17

Part 1 GENERAL

1.1 **SECTION INCLUDES**

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results - Electrical.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

1.4 **SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to an approved metal recycling facility.

Part 2 PRODUCTS

2.1 **SWITCHES**

- .1 15 and 20 A, 120 V, single pole and three-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
- .2 Shall be of the AC quiet type, specification grade with totally enclosed framed toggle. All switches shall be supplied with white finish, unless otherwise noted. Switches shall be equal to Hubbell 1200-W series (120V) and 18200-W series (347 V), 15A. Provide 20A switches where indicated. Pilot light switches shall be Hubbell 1200-PL series (lighted handle type).
- .3 Manually-operated general purpose ac switches with following features:
- .4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .5 Switches of one manufacturer throughout project.

2.2 **RECEPTACLES**

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, to: CSA-C22.2 No.42 with following

WIRING DEVICES

features:

- .1 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .2 Shall be specification grade, duplex, 3 wire U ground, "finder face" type, with screw type terminals, double wiping spring bronze contacts. Where weatherproof receptacles are specified, they shall be complete with gasket and spring loaded, twin hinged receptacle covers with built-in gasket. Duplex receptacles shall be equal to Hubbell 5252-WHI, 15A.
- .3 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
 - .4 Ground fault circuit interrupting (GFI) duplex receptacles shall be equal to Hubbell GF-5252-WHI (specification grade). Mount outside GFI receptacles in horizontal position and provide weatherproof polycarbonate covers.
- .5 Other receptacles with ampacity and voltage as indicated.
- .6 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project Bryant, G.E. Hubbell, or Leviton.
- .3 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .5 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical unless noted otherwise.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical unless noted otherwise.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION 26 27 24

1. GENERAL

1.1. Work Included

- 1.1.1. Conform to Section 26 05 00 – Common Work Results - Electrical.

1.2. References

- 1.2.1. CSA C22.2 No. 248-00 – Low Voltage Fuses.

1.3. Shop Drawings And Product Data

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 00 – Common Work Results - Electrical
- 1.3.2. Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics, I²T (for fuse coordination), and peak let-through current.

1.4. Maintenance Materials

- 1.4.1. Three spare fuses of each type and size installed 600 A and above.
- 1.4.2. Six spare fuses of each type and size installed up to and including 400 A.

1.5. Delivery and Storage

- 1.5.1. Ship fuses in original containers.
- 1.5.2. Do not ship fuses installed in the equipment.
- 1.5.3. Store fuses in original containers in moisture free location.

2. PRODUCTS

2.1. Fuses General

- 2.1.1. Fuse type references L1, L2, J1, R1 etc. have been adopted for use in this specification.
- 2.1.2. Fuses: product of one manufacturer.
- 2.1.3. Fuses to have an indicating window to identify when the fuse has been blown.

2.2. Fuse Types

2.2.1. Fuses for Motors:

- .1 All fuses for motor loads are to be time-delay type. Fuses protecting motors rated 15A through 600A shall be HRC-J time delay type LPJ-SP, unless otherwise noted.

2.3. Fuse Storage Cabinet

- 2.3.1. Fuse storage cabinet, manufactured from 2.0 mm (5/64 in.) thick aluminum 750 mm (2 ft. 6 in.) high, 600 mm (2 ft.) wide, 300 mm (1 ft.) deep, hinged, lockable front access door finished in accordance with Section 26 05 00 – Common Work Results - Electrical

2.3.2. Fuse Puller

- 2.3.3. Provide a fuse puller for each size of fuse to be located in the fuse storage cabinet. Fuse puller to be clearly labelled for the appropriate building and fuse cabinet. Fuse puller to be equal to the Ideal Safe-T-Grip Fuse Puller

2.4. Manufacturers

- 2.4.1. The following are acceptable manufacturers:

- .1 Ferraz Shawmutt
- .2 Cooper-Bussman
- .3 Littelfuse

3. EXECUTION

3.1. Installation

- 3.1.1. Install fuses in mounting devices immediately before energizing circuit.
- 3.1.2. Ensure correct fuses fitted to physically matched mounting devices.
- 3.1.3. Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION 26 28 14

MOULDED CASE CIRCUIT BREAKERS

Part 1 GENERAL

1.1 **SECTION INCLUDES**

- .1 Materials for moulded-case circuit breakers, and circuit breakers.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 24 17 – Panelboards Breaker Type

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 **SUBMITTALS**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 60 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.5 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.
- .2 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

Part 2 PRODUCTS

1.1 **BREAKERS GENERAL**

- .1 Moulded-case circuit breakers and Circuit breakers to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
- .5 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Ground fault circuit interrupters where required shall be C.S.A. Class A with 5mA tripping level and shall have push-to-test button on front.
- .7 Lock-on devices for fire alarm, emergency, exit and night light circuits.

PART 2 - EXECUTION

- .1 Install circuit breakers as indicated.

END OF SECTION 26 28 21

DISCONNECT SWITCHES

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 33 - Health and Safety Requirements.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
 - .2 CSA C22.2 No.39-M89 (R2003), Fuse-holder Assemblies.

1.4 SUBMITTALS

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

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal all paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins (where applicable) for recycling in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible, non-fusible and horsepower rated disconnect switch in CSA Enclosure to CAN/CSA C22.2 No.4 size as indicated.
- .2 Provision for padlocking in off switch position.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage.
- .5 Fuseholders: to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.

DISCONNECT SWITCHES

- .7 ON-OFF switch position indication on switch enclosure cover.
- .8 Disconnect switches shall be equal to Cutler-Hammer type 1HD, or type 3HD (weatherproof) where noted.
- .9 Bryant 30000/40000/60000 series motor starters without overload protection may be used for loads rated 30/40/60 A or less.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on a nameplate.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION 26 28 23

LIGHTING

Part 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3 Federal Communications Commission (FCC)
 - .1 FCC (CFR47) EM and RF Interference Suppression.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings of all luminaires supplied by electrical contractor in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.

1.1 SUBSTITUTION

- .1 The Departmental Representative reserves the right not to accept any alternates or substitutions. If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide all information required demonstrating the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. The Contractor/Supplier is responsible to ensure the light levels provided in the alternate submittal package are achieved. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a fixture that will meet the required levels with no increase in energy use at no cost to the Owner.

Part 2 PRODUCTS

2.1 LUMINAIRES

- .1 luminaires shall be of manufacturer.
- .2 Due to the changes in catalogue numbers, all numbers indicated must be verified with the luminaire description and confirmed with the vendor prior to ordering. Catalogue numbers are not necessarily complete and may not indicate all options that are detailed in the documents. Options specified must be provided.
- .3 Provide custom colours when noted on the drawings.
- .4 TYPE A - LED strip light. Channel and cover to be formed from code-gauge cold-rolled steel. high-gloss, baked white enamel (WH) finish. Snap on/snap of lens. LEDs integrated on a two-layer circuit board. multi-volt input and 0-10V dimming. This fixture is designed to withstand a maximum line surge of 2.5kV at 0.75kA combination wave for indoor locations. CSA certified to US and Canadian safety standards. For use in damp locations between -40 °F (-40 °C) and 86 °F (30 °C). DesignLights Consortium® (DLC) qualified product. Length – 1200mm; Lumens 3200; Maximum wattage 31; CRI 90. Chain mount the luminaire to match the existing mounting height. Lithonia Z L1D series or equal by Philips and Eaton.
- .5 TYPE B - LED strip light. Channel and cover to be formed from code-gauge cold-rolled steel. high-gloss, baked white enamel (WH) finish. Snap on/snap of lens. LEDs integrated on a two-

LIGHTING

layer circuit board. multi-volt input and 0-10V dimming. This fixture is designed to withstand a maximum line surge of 2.5kV at 0.75kA combination wave for indoor locations. CSA certified to US and Canadian safety standards. For use in damp locations between -40 °F (-40 °C) and 86 °F (30 °C). DesignLights Consortium® (DLC) qualified product. Length – 1200mm; Lumens 3200; Maximum wattage 31; CRI 90. Luminaire to be complete with wire guard. Wall mount the luminaire. Lithonia Z L1D series or equal by Philips and Eaton.

2.2 LAMPS

1. All luminaires are LED, integral to the luminaire.

2.3 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning of metal before painting:
 - .1 For corrosion resistance conversion coating to ASTM F1137.
 - .2 For paint base, conversion coating to ASTM F1137.
 - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel or polyester powder coat to give smooth, uniform appearance, free from pinholes or defects.
 - .3 Reflector and other inside surfaces finished as follows:
 - .1 White, minimum reflection factor 85%.
 - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.
 - .3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
 - .4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.
 - .5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

Part 3 EXECUTION

3.1 RESPONSIBILITY

- .1 Supply and install luminaires, lamps, ballasts, stems, flexible conduit and mounting trims and accessories required for a complete lighting system. Supply all luminaires and lamps except those which are specifically mentioned as being supplied by others.
- .2 Provide all supports and wiring required to make the lighting system operational as indicated on the drawings.

3.2 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Install luminaires accurately in line and level. Co-ordinate this work with other trades at the site to ensure that their work is not held up by the work of this Section and that the luminaires are installed on schedule.
- .3 Install luminaires in the standard manner for the type of luminaire and in accordance with the manufacturer's instructions. Secure methods of attachment shall be used throughout or as called for in Luminaire Schedule.
- .4 Any luminaires, which are not installed properly, shall be taken down and re-installed without expense to the Departmental Representative.
- .5 Luminaires shall not be mounted above pipes, ducts or equipment. In event of unavoidably tight locations, hangers shall be provided to clear obstructions. Layouts of other trades shall be checked on job and planned co-operatively. Departmental Representative's approval shall be obtained before any changes are made to layouts shown.
- .8 Clean luminaires upon substantial completion. Use methods and materials recommended by the

LIGHTING

manufacturer. Protect all luminaires after installation.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 REPLACEMENT

- .1 All flickering or otherwise faulty led boards and drivers are to be replaced at the time of building acceptance.

3.6 WARRANTY

- .1 Provide a 12-month warranty period for all luminaires from date of substantial completion.

END OF SECTION 26 50 00

Part 1 GENERAL

1.1 WORK INCLUDED

- .1 Comply with Division 1, General Requirements and documents referred to therein.
- .2 Comply with Division 14 specifications.
- .3 Conform to Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCE

- .1 ASME A17.1/CSA-B44 – Safety Code for Elevators and Escalators.

1.3 WORK INCLUDED

- .1 Comply with Division 1, General Requirements and documents referred to therein.
- .2 Provide labour, materials, products, equipment and services to complete all work noted herewith.

1.4 DESCRIPTION OF SYSTEM

- .1 Provide elevator machine power supply, wiring, lighting, life safety and receptacle systems for machine room, pits and secondary levels, power, security, music, communication and life safety provisions for cab(s), and conduit and wiring to and for associated control and equipment.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Individual lockable fusible disconnect switches or panelboards, with rating, number of poles, and configuration as indicated for:
 - .1 Machine power.
 - .2 Lighting for machine room, and pits and secondary levels.
 - .3 Machine room and pit receptacles.
 - .4 Machine room exhaust fan and A/C unit.
 - .5 Group controller power.
 - .6 Power for cab exhaust fan and cab lighting.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Interface between work for Electrical Division and Division 14. For all systems Electrical Contractor to terminate all wiring at the terminals of elevator or escalator controller(s) in the respective machine rooms or pits.
- .2 Coordinate the locations of all equipment with Division 14 prior to installation.
- .3 Install disconnect switches or panelboards in the machine rooms as indicated.
- .4 Install 25 mm (1 in.) conduit from nearest communication/telephone room to a 600 mm x 600 mm (2 ft. x 2 ft.) plywood backboard in each elevator machine room. Install 19 mm (3/4 in.) conduit system for telephones to each elevator controller from the backboard.

ELEVATOR SERVICES

-
- .5 Install lights, switches and receptacles for machine room, pit and shaft as indicated.
 - .6 Provide wiring in 19 mm (3/4 in.) conduit from each elevator controller to the fire alarm system to initiate elevator recall when a fire alarm is initiated. All fire alarm wiring to be as per fire alarm specification and approved for the installation.
 - .1 For conventional/hard wired fire alarm systems, provide wiring from the main fire alarm panel to each elevator controller. Provide wiring in 19 mm (3/4 in.) conduit from the auxiliary contact on the detectors located in the elevator shaft, in the main floor elevator lobby and in the elevator machine room to each of the elevator controllers.
 - .2 For addressable fire alarm systems, provide an addressable output relay for each elevator controller and provide wiring from each the respective relay to the elevator controller.
 - .7 If hydraulic elevators utilize battery-pack emergency power lowering feature, provide on the main disconnect switch, a CSA approved, positive action auxiliary interlock switch that prevents "down" operation, when opened, as required by and as approved by the governing body having jurisdiction. Provide wiring from auxiliary switch in 13mm (1/2") conduit to the respective elevator controller.
 - .8 Provide wiring in conduit from each automatic transfer switch (ATS) in the building to all of the elevator controllers fed from the respective ATS to connect the pre-transfer, post-transfer and inhibit signals. Include for 2 spare wiring pairs in this run of conduit.
 - .9 Electrical contractor to coordinate all sleeving requirements with Division 14.

END OF SECTION 26 60 01

1. GENERAL

1.1. Work Included

- 1.1.1. Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 26 – as shown on drawings) to distribute the cables throughout the facility. Where cables leave the pathways provided by Division 26, the Cabling Contractor shall supply and install cable slings and/or j-hooks to support cabling up to point of termination.

1.2. Indoor Cable Distribution

- 1.2.1. Utilise all indicated and available cable pathways such as conduits, Communications cable tray, ducts, surface raceways (by Division 26) and furniture system channels except where otherwise noted.
- 1.2.2. Inside buildings minimise any possibilities of disruption by maintaining the following minimum clearances from electrical and heat sources when routing cables.

<u>Item</u>	<u>Minimum Clearance</u>
Motors	1.20 m (4'-0")
Transformers	1.20 m (4'-0")
Conduit and cables used for electrical distribution less than 1kVA	0.30 m (1'-0")
Conduit and cables used for electrical distribution greater than 1kVA	1.00 m (3'-0")
Fluorescent Luminaries	12 cm (0'-5")
Pipes (gas, oil, water, etc.)	30 cm (1'-0")
HVAC (equipment, ducts, etc.)	15 cm (0'-6")

2. PRODUCTS

- 2.1.1. The Electrical Contractor shall supply a conduit system as per section 26 05 34 - CONDUITS, CONDUIT FASTENING AND CONDUIT FITTINGS for the distribution of horizontal cables.

2.2. Grounding Wire

- 2.2.1. Supply and install #6 AWG green grounding wire for all metallic components that shall be grounded.

3. EXECUTION

3.1. Cable Distribution

- 3.1.1. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.1.2. All cables and components shall be installed and terminated in accordance with applicable Codes, Standards and Regulations.

3.2. Cable Distribution

- 3.2.1. Ensure ANSI/EIA/TIA-568-B installation practices are followed for Indoor cable.
- 3.2.2. Minimum bend radius shall be as per manufacturer's recommendations.
- 3.2.3. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.
- 3.2.4. Protect exposed cable ends from moisture ingress.

3.3. Duct And Conduit

- 3.3.1. Clean out each section of duct or conduit by pulling a steel wire brush and mandrel of the correct size through the duct or conduit before pulling cables. Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Departmental Representative of the problems encountered.
- 3.3.2. Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. Apply manufacturer's recommended lubricant to cables to reduce friction between the cable and the duct. Cable grip shall be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

END OF SECTION 27 05 28

COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

1. GENERAL

1.1. Horizontal Cable IDC Termination / Modular Jack Connectors

- 1.1.1. The Horizontal cable IDC Termination Connectors ('Termination Connectors') shall have an insulation resistance of 100 mega ohms between clips.
- 1.1.2. The 'Termination Connectors' shall have a durability of 200 insertions/withdrawals of any combination of wire gauge.
- 1.1.3. The 'Termination Connectors' shall be FCC Part 68, subpart F compliant.

2. PRODUCTS

2.1. IDC Termination Blocks

- 2.1.1. All horizontal cables shall be terminated as noted in the Telecom/Elect. Room for that floor, as specified on the drawings.
- 2.1.2. All cables shall be terminated using IDC termination mounts. The IDC connectors shall be able to terminate 22-26 AWG conductors. The IDC mount shall be capable of feeding the cables to the IDC connectors from behind the connector.
- 2.1.3. Cable management in the form of Distribution Rings shall be provided between columns and rows of IDC mounts to support cross connect management. Refer to Detail Drawings for typical drawings of Voice Backboard layouts.

3. EXECUTION

- 3.1.1. NOT USED

END OF SECTION 27 11 19

1. GENERAL

1.1. Work Included

- 1.1.1. Supply and install cabling as detailed in Contract Documents. The Contractor shall use conduit pathways to distribute the cables.
- 1.1.2. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Cabling Contractor without any additional compensation shall replace damaged cables.
- 1.1.3. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.2. Cable Routing

- 1.2.1. Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Departmental Representative prior to installation.
- 1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Departmental Representative and documented on as-built drawings.

2. PRODUCTS

2.1. Horizontal UTP Copper Cable

- 2.1.1. All horizontal cabling shall be Unshielded Twisted Pair (UTP), 4 pair, 22-26 AWG, with cable Category and Rating as indicated below. The cable must be CSA certified and stamped accordingly. All UTP cables shall have an outer jacket colour as identified below.

Cat.	Rating	Colour	ADC*	Amp*	BeldenCDT	Panduit	Systimax	Uniprise
6	CMR/FT4	White	6TRT	219560	2412	TX6000	1071E XL	75N4

Notes: * Product Codes shown indicate only Series numbers and are not colour specific.

Cat. 6 shall be characterized for a minimum bandwidth of **400MHz**.

3. EXECUTION

3.1. General Conditions

- 3.1.1. When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5/5e/6 cables and 25 mm (1") for Category 3 cables.

DATA COMMUNICATIONS HORIZONTAL CABLING

3.2. Horizontal Cable Distribution

- 3.2.1. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack.
- 3.2.2. Neatly bundle and tie-wrap all cables using Velcro tie-wraps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes.
- 3.2.3. Follow proper installation and termination practices for Category 3, 5, 5e, 6 and Optical Fibre cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius. For Optical Fibre cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.
- 3.2.4. When bundling Category 3, 5, 5e, 6 and Optical Fibre cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

END OF SECTION 27 15 00

COMMUNICATIONS FACEPLATES AND CONNECTORS

1. GENERAL

1.1. Outlet Locations

- 1.1.1. Horizontal Cable outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3.05m (10'-0') without adjustment to the Contract price.

1.2. UTP Modules

- 1.2.1. All UTP Data and Voice modules shall have the following minimum performance parameters:

Modular Jack Current rating:	1.5 amperes maximum
Modular Jack Durability:	1,000 mating cycles
Modular Jack Contact Pressure:	100 grams, minimum per contact
Dielectric Voltage Strength:	1,000 V RMS at 60 Hz for 1 minute
Insulation Resistance:	200 MΩ minimum
Contact Resistance:	1 MΩ per contact

1.3. Horizontal Cable Modular Jack IDC Connectors

- 1.3.1. The Horizontal cable IDC Termination Connectors ('Termination Connectors') shall have an insulation resistance of 100 mega ohms between clips.
- 1.3.2. The 'Termination Connectors' shall be FCC Part 68, subpart F compliant.
- 1.3.3. The durability of the jack in a Modular Jack connector shall be 1000 mating cycles.
- 1.3.4. The contact material of the jack in a Modular Jack connector shall be phosphor bronze with 50 micro-inches of gold over nickel.
- 1.3.5. The maximum current rating of the jack in a Modular Jack connector shall be 1.5 amperes.
- 1.3.6. The dielectric strength of the jack in a Modular Jack connector shall be 1000V RMS at 60 Hz for one minute.

2. PRODUCTS

2.1. UTP Modules

- 2.1.1. The UTP modules must be matched appropriately with the cables to ensure that end to end Vendor Warranties will be applicable. All Horizontal UTP cables shall be terminated with the jack colours as described below. Where the specified copper patch panels are modular, the same jack colours shall be used at both ends of each cable.

Cat.	Type	Colour	ADC*	Amp*	BeldenCDT	Panduit	Systimax	Uniprise
6	Data / Voice	White	68301830-01	1375187-3	AX101065	CJ688T3WH	700206725	UNJ600-WH

COMMUNICATIONS FACEPLATES AND CONNECTORS

2.2. Workstation Outlets

2.2.1. Wall Faceplate

Where wall boxes for Communications Contractor's use are not ganged with electrical outlet boxes, all wall outlets shall utilise 4-port modular style flush-mounted faceplate adapters. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

3. EXECUTION

3.1. General Conditions

- 3.1.1. When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5/5e/6 cables and 25 mm (1") for Category 3 cables.

END OF SECTION 27 15 43

COMMUNICATIONS PATCH CORDS AND CROSS CONNECT WIRE

1. GENERAL

1.1. Work Included

- 1.1.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Cabling Contractor without any additional compensation shall replace damaged cables.

2. PRODUCTS

2.1. Cross-Connect Wire

- 2.1.1. For the multipair Category 6 backbone cable, the Cabling Contractor shall supply and install Category 6 Cross-Connect wire. All Cross-Connect Wire supplied and installed must maintain the Structured Cabling Solution.
- 2.1.2. Cross-connects shall be made with wire of equal gauge and Category to that of the highest Category cable, which it is being connected.

3. EXECUTION

3.1. Cross-Connect Wire

- 3.1.1. Assume all pairs of backbone are cross-connected at both ends.

END OF SECTION 27 16 19

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 NBC-2015, National Building Code of Canada.
- .2 Government of Canada
 - .1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
 - .2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524- (current edition), Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S536- (current edition), Inspection and Testing of Fire Alarm Systems.
 - .3 CAN/ULC-S537- (current edition), Verification of Fire Alarm Systems.

1.3 DESCRIPTION OF SYSTEM

- .1 Modify and extend the existing Simplex fire alarm system. All components shall be approved for use on this system and manufactured by Simplex.
- .2 Elevators will have smoke detector located in the lobbies and the machine rooms. Each elevator shafts will have a weather proof heat detector located in the pit along with a Fixed temperature heat detector located at the top of the shaft.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- .1 System:
 - .1 Subject to local fire department approval.
 - .2 Subject to review for final acceptance.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Thermal detectors: to CAN/ULC-S530.
- .3 Smoke detectors: to CAN/ULC-S529.

2.2 SYSTEM OPERATION

- .1 Provide programming for the addition fire alarm system operation(s) as required for the elevators.
- .2 Actuation of any alarm initiating device to:
 - .1 Cause elevators to return to floor of egress, or to alternate floor, as required.

2.3 CONTROL PANEL

- .1 Fire Alarm Control Panel:
 - .1 Simplex 4100ES.

2.4 AUTOMATIC ALARM INITIATING DEVICES

- .1 Heat detectors, fixed temperature, non-restorable, rated 88 degrees C.
- .2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88 degrees C, rate of rise 8.3 degrees C per minute.
- .3 Rate of rise heat detectors shall be Simplex 4098-9733 c/w 4098-9792 non-relay base as programmed.
- .4 Smoke detector: photoelectric type. Smoke detectors shall be Simplex 4098-9714 addressable photoelectric type c/w 4098-9792 non-relay bases.

2.5 WIRE GUARDS

- .1 Cell Wire Guards, tan in colour, baked enamel, 22-gauge steel, single wall, four tamper resistant screws.
- .2 Simplex 4098-9846 complete with mounting base.

2.6 AUXILIARY CIRCUITS

- .1 Auxiliary contacts for control functions.
- .2 Actual status indication (positive feedback) from controlled device.
- .3 Alarm or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
- .4 Five sets of separate contacts for elevator capture
 - .1 Elevator recall to main floor, from general alarm condition.
 - .2 Elevator top of shaft detection signal to elevator controller.
 - .3 Elevator bottom of pit detection signal to elevator controller.

FIRE ALARM SYSTEM

- .4 Elevator machine room detector signal to elevator controller.
- .5 Elevator alternate floor signal from alarm signal at the egress floor smoke detector.

2.7 ANNUNCIATOR

- .1 Fire alarm zone passive graphic Annunciator (map)
 - .1 Layout
 - .1 The fire alarm zones indicated for each floor shall be clearly defined with borders to indicate zone separation.
 - .2 The general font style shall be Helvetica upper case. Text size:
 - .1 6mm in height for building name and 4.5mm for municipal address and floor labels.
 - .2 Main entrance arrow 3mm in height.
 - .3 Fire alarm zones and equipment notes shall be 4.5mm in height coloured red.
 - .3 Graphic display:
 - .1 Outline of building plan to be black line on white background.
 - .2 All egress corridors shall be clearly defined.
 - .3 All stairs and elevators shall be indicated using hatch pattern.
 - .4 Include the following information on the graphic display:
 - .1 A north arrow on the upper left corner of the zone graphic.
 - .2 "You are here" location in Red and properly orientated to the viewer when standing in front of the graphic.
 - .3 A drawing scale graph and drawing file number located in the lower right of the zone graphic.
 - .4 Building name and number at the bottom centre of the graphic display with municipal address indicated on the next line below.
 - .5 The main building entrance.
 - .6 Location of fire alarm control panel and annunciators, fire department connections, fire pumps, and sprinkler valves.
 - .7 Location of duct smoke detectors indicating zone number.
 - .8 Substation and transformer locations indicating primary and secondary voltages.
 - .2 Construction
 - .1 The graphic display shall be:
 - .1 Printed laminated plastic (Lamacoid) 4 mm (1/8 in.) thick. Height and width to match existing.
 - .3 Location
 - .1 Install graphic display adjacent to each fire alarm LED annunciator panel at the main door.
 - .4 Approval Drawings

FIRE ALARM SYSTEM

- .1 Submit PDF copy of the passive display annunciator for review by the Departmental Representative and the local fire department.
- .2 Include the final approved zone graphic drawing in electronic format with the as-built drawings.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Wiring shall be run in conduit (minimum 19mm) and shall be colour coded and identified at each connection point.
- .2 Flexible armoured cable or conduit may be used for drops to devices on suspended ceiling or in frame walls.
- .3 Wiring sizes shall be in accordance with manufacturers recommendations.
- .4 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.
- .5 Locate and install detectors and connect to alarm circuit wiring.
- .6 Do not mount detectors within 3 ft. (1 m) of air outlets. Maintain at least 24" (600 mm) radius clear space on ceiling, below and around detectors.
- .7 Connect alarm circuits to main control panel.
- .8 Locate and install bells, horns and visual signal devices and connect to signalling circuits.
- .9 Connect signalling circuits to main control panel.
- .10 Install end-of-line devices at end of alarm and signalling circuits.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and CAN/ULC-S537.
- .2 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, sprinkler system, fire suppression system, transmit alarm to control panel and actuate general alarm.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
 - .4 Class A circuits.
 - .1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .3 On completion of the systems and when all the conditions have been complied with; system component is to be tested. On completion of inspection, the Contractor shall issue to the Departmental Representative:
 1. A copy of the inspecting technician's report showing location of each device and certifying the test results of each device.
 2. A Certificate of Verification confirming that the inspection has been completed and showing the conditions upon which, such inspection and Certification have been rendered. The Certificate of Verification shall include statements to certify:

FIRE ALARM SYSTEM

-
3. That the type of equipment installed is that designated by the Departmental Representative's specifications.
 4. That the wiring connections to all equipment components show that the installer undertook to have observed ULC and CSA requirements.
 5. That the manufacturers' equipment has been installed in accordance with their recommendations, and that all signaling devices of whatever manufacture have been operated or tested to verify their operation.
 6. That the supervisory wiring of those items of equipment connected to a supervised circuit is operating and that the governmental regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials.
 7. Proof of liability insurance for the Inspection.
4. All costs involved in this inspection from the manufacturer and the Electrical Contractor shall be included with the Electrical Contractor's total Tender price.

END OF SECTION 28 31 10

**ELEVATOR REPLACEMENT AT
SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE
SUMMERLAND, BC**

**APPENDIX 1
SITE PHOTOS**

HALLWAY



PHOTO A



PHOTO B



LEVEL 4



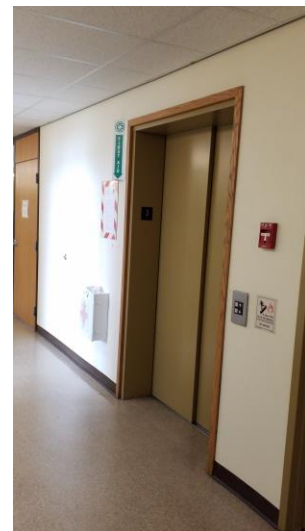
LEVEL 3



LEVEL 2



LEVEL 4



LEVEL 4



LEVEL 3

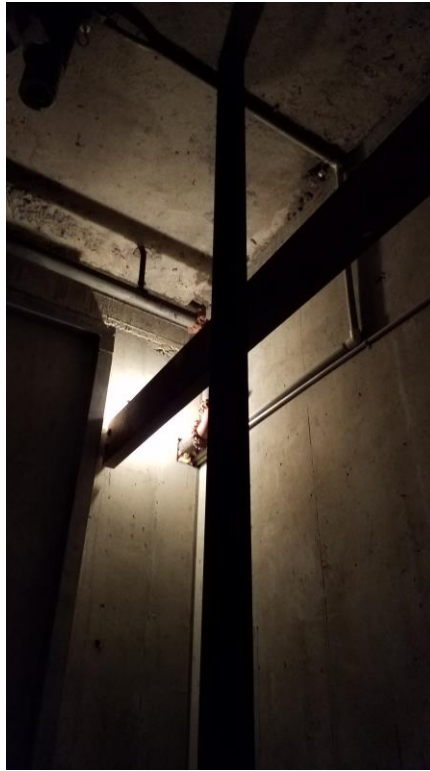


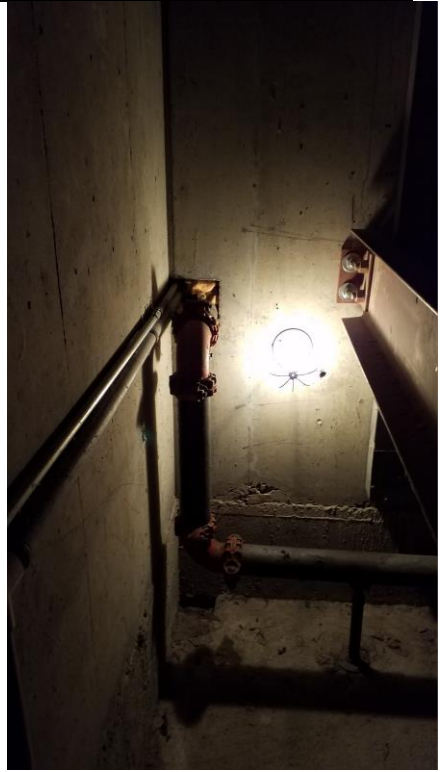
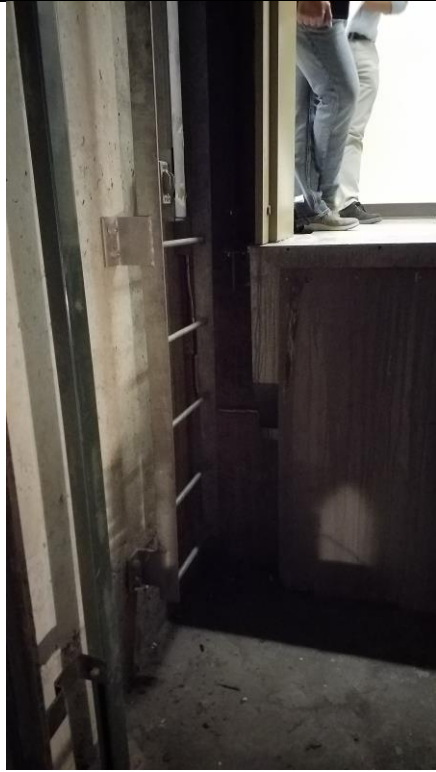
LEVEL 3

















LEVEL 4



MECHANICAL
PENTHOUSE



MECHANICAL
PENTHOUSE



MECHANICAL PENTHOUSE



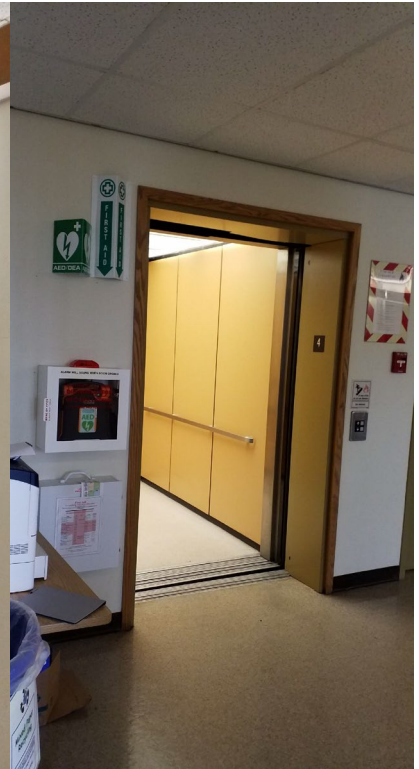
LEVEL 2



LEVEL 2



LEVEL 1



LEVEL 2

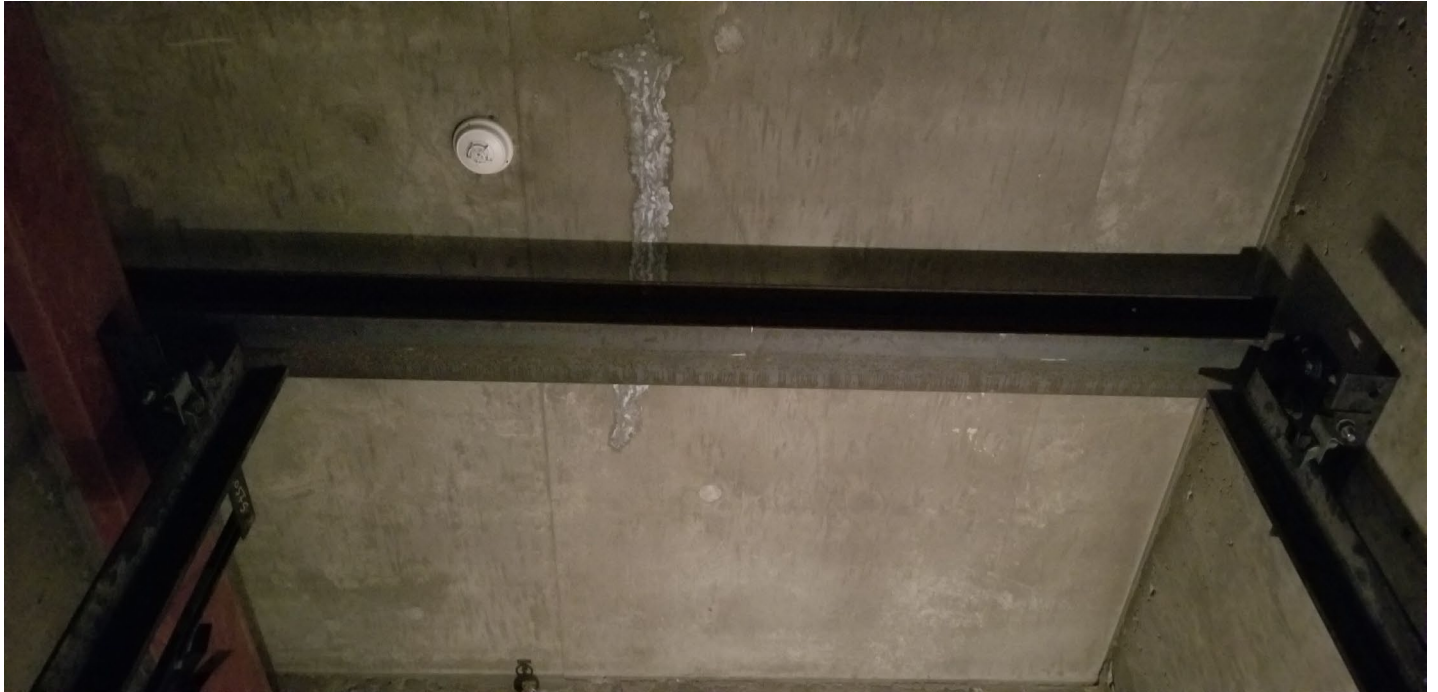


LEVEL 3









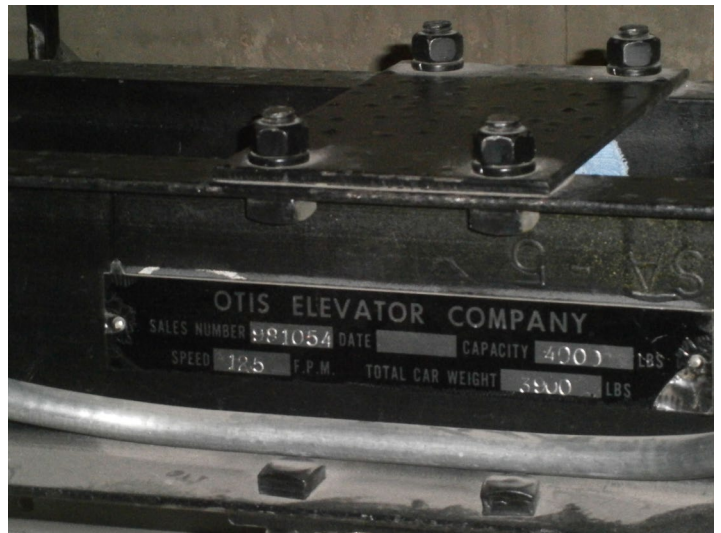
SERVICE ELEVATOR SHAFT







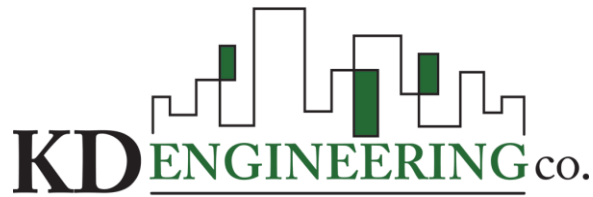






**ELEVATOR REPLACEMENT AT
SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE
SUMMERLAND, BC**

**APPENDIX 2
COMMISSIONING PLAN
FOR
COMMISSIONING AUTHORITY SERVICE
PARC SUMMERLAND ELEVATOR UPGRADE PROJECT**



MECHANICAL ENGINEERS AND TECHNOLOGISTS

***COMMISSIONING SERVICES - MECHANICAL SYSTEMS TESTING AND BALANCING -
OPERATING AND MAINTENANCE MANUALS***

3735 Myrtle Street
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Commissioning Plan

for

Commissioning Authority Service PARC Summerland Elevator Upgrade Project

Date: March 25, 2019

for:

Chernoff Thompson Architects

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Commissioning Plan

PARC Elevator Upgrade Project

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1.0 Project Overview

The Pacific Agri-Food Research Centre is an Agriculture and Agri-Food Canada facility located in Summerland B.C. This project involves the upgrading of two elevators that will be done in two phases. As Commissioning Authority KD Engineering Co. will oversee the commissioning process on the upgraded elevators associated mechanical and electrical systems. The Commissioning Authority will oversee the commissioning process on the project starting at the design stage and continuing through the warranty period, as per PWGSC Commissioning Guidelines. KD Engineering Co. has been retained by Chernoff Thompson Architects.

2.0 Introduction to the Commissioning Plan

This Commissioning Plan describes the commissioning process (including procedures and documentation) for this project.

It is the intent of this commissioning plan to inform all of the commissioning team members so that they fully understand the required commissioning process of which they will be a part of.

It is noted that this Commissioning Plan has been written by the Commissioning Authority (Cx.A) in conjunction with the specification requirements. The role of the Commissioning Authority is to oversee mechanical, electrical and elevator systems commissioning work by the Commissioning Agents and/or contractors of those specific disciplines. Commissioning Agent (CA) work on all other systems listed in this plan are to be the responsibility of the applicable contractors (commissioning and supporting documentation), specified by the applicable consultant.

The following standard content requirements for this commissioning plan have been included herein:

- a brief overview of the commissioning process
- a list of all systems and assemblies included in the Commissioning Authority's scope of work
- identification of Commissioning Team and its responsibilities
- description of the management, communication and reporting of the commissioning process
- overview of the commissioning process activities for the construction, occupancy and operations phases, including
 - construction phase verification (construction phase)
 - functional performance test development (construction phase)
 - functional performance test implementation (construction phase), and
- a list of the expected work products
- a list of key commissioning process milestones
- demonstration and training requirements

Note that this commissioning plan will be revised and re-issued over the course of the project so that it is as accurate and as useful as is possible, during the design and construction of the project.

2.1 Brief Overview of the Commissioning Process

Commissioning is a planned program of activities that advances the built works from the early stages of the Planning Phase to a condition of full operation.

For this project, KD Engineering has been retained as the Commissioning Authority (Chernoff Thompson Architects), to be the person responsible {for} ensuring the commissioning process is in compliance with the commissioning specification section 01 91 00. This section of the specification states the extent of the systems to be commissioned but each specification division (14,21, 22, 23, 25, 26, and 28) will have a more defined scope.

The Commissioning Authority provides advice to others on the Project Team on the commissioning process.

It is understood that as the Commissioning Authority we would be "responsible for the planning and development, and coordination of the implementation of a Commissioning Plan for the Project."

It is also understood that, "commissioning related activities" shall form a fundamental part of basic services provided by the identified Commissioning Team led by the Commissioning Authority.

2.2 The Commissioning Authority

As Commissioning Authority, KD Engineering will function to coordinate commissioning throughout the final construction/occupancy phases of the project.

During the final construction of the building we will oversee a commissioning team of owner's representatives, consultants and contractors. We will work with the commissioning team to ensure that the final construction is verified to have met the requirements of the contract documents. We will liaise with the owner's representatives on all aspects of commissioning such that the owner is satisfied with the process.

It is noted that the Commissioning Authority (Cx.A) leads the commissioning team but that the commissioning work is divided among the commissioning team members. It is important that this delineation of work be kept in mind throughout the project. In this plan we have made every effort to highlight the distinction between the various roles of the commissioning team members.

The Commissioning Authority (Cx.A) provides the services in support of the commissioning requirements of the project. The Cx.A is to provide technical comments or advice to the Project team during the commissioning process and to assemble the plan for the project commissioning. The Cx.A is to then implement the plan to achieve the Project objectives.

2.3 Commissioning Defined (for this project)

The commissioning process is a quality assurance method adopted to consistently achieve successful construction projects. It is not an additional layer of construction or project management – it is the owner's means of verifying that the planning, design, construction and operational processes are achieving their goals, and ensures the delivery of a well-performing building.

Refer to Appendix C (Commissioning Services for this Project) of this plan for the Project commissioning requirements expected. Expected contributions from the various commissioning team members are also described.

Commissioning is an essential, multi-discipline process, which provides a structured well-defined method of ensuring that the inter-related systems of a project are completed and operate with expected and acceptable results. Clear communication is critical regardless of the communication instrument or purpose. The owner's requirements must be passed to the design intent, into design, into construction, into testing, and O&M documentation.

2.4 Glossary

Abbreviation	Description
BMM	Building Management Manual
EMSC	Energy Monitoring and Control System (aka DDC or BMS)
O(-PL)	Owner – Project Leader
O(-PM)	Owner – Project Manager
O(-PM / CU / SP)	Owner – Property Manager Client / User
O	Owner
O&M	Owner's Service Provider
DC's	All related Design Consultants
DC-A	Design Consultant - Architectural
DC-E	Design Consultant - Electrical
DC-M	Design Consultant - Mechanical
Cx	Commissioning
CP	Commissioning Plan
CAG's	All Commissioning Agents (or alternate parties)
ECA	Commissioning Agent - Electrical (or alternate party)
MCA	Commissioning Agent - Mechanical
G-C	General Contractor
M-C	Mechanical Contractor
E-C	Electrical Contractor
EV-C	Elevator Contractor
C-C	Controls Contractor
B-C	Balancing Contractor
C's	All (related) Contractors
PI	Product Information Sheets
PV	Performance Verification Sheet
TAB	Testing and Balancing
ICL	Installation Check List

3.0 Scope –Systems to be Commissioned

Commissioning as per the specification 01 91 00 General Commissioning Requirements

Mechanical Systems:

- HVAC Systems
- DDC Controls
- Fire Protection (sprinklers)

Scope - Systems to be Commissioned: (continued)

Elevator Systems:

- Passenger and Service Elevators

Electrical Systems:

- Electrical services associated with above systems
- Fire Alarm Systems
- Lighting and Lighting Controls

Commissioning Services Not Included:

- Building Envelope
- Security
- Communication Systems
- Process Systems
- Architectural Systems
- Any other systems not listed in the Scope of Systems to be Commissioned.
-

3.1 Scope – Commissioning Authority Services

Please refer to Appendix C (Commissioning Services for this Project) of this plan for the tasks the CxA will lead and participate in. Also listed in that section is the expected contributions from the various commissioning team members.

4.0 Identification of the Commissioning Team and its Responsibilities

Commissioning is a methodical, team-based process. Each member of the commissioning team must fulfill his or her commissioning functions, as described herein, in order for this process to be successful.

Refer to Appendix A, which lists the commissioning team and its responsibilities.

5.0 Management, Communication and Reporting of the Commissioning Process

The post-tender commissioning team is comprised of the Owner Personnel, Design Consultants, CA's and Contractors/Suppliers as will be listed in a revised Commissioning Plan Appendix A (to be revised after the first commissioning meeting).

Commissioning is a team-based process. The Commissioning Team is responsible for accomplishing the commissioning process activities. The Commissioning Authority provides leadership in identifying and resolving all commissioning process issues.

All commissioning related documentation is to be copied to the Commissioning Authority. All commissioning issues are to be brought to the attention of the Commissioning Authority in a timely manner. All commissioning team members are to assist in the creation of all commissioning and commissioning-related documentation.

Commissioning meetings, which we chair, will be minuted by us. Minutes get sent to the commissioning team shortly after these meetings

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Appendix A - Identification of the Commissioning Team and its Responsibilities

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Commissioning is a methodical, team-based process. Each member of the commissioning team must fulfill the following listed commissioning-related responsibilities in order for the commissioning process to be successful.

The Commissioning Team Members:

Commissioning Team Member	Abbr.	Person	Organization/Company
1. Owner Personnel			
1.1 Owner – Project Leader	O(-PL)		
1.3 Owner – Project Manager	O(-PM)		
2. Consultants			
2.1 Architect	DC-A		
2.2 Mechanical Consultant	DC-M		
2.3 Electrical Consultant	DC-E		
2.4 Commissioning Authority	CM	Roger Hedman	K.D. Engineering Co.
3. Contractors/Suppliers			
3.1 General Contractor	G-C		
3.2 Mechanical Contractor	M-C		
3.3 Electrical Contractor	E-C		
3.4 Mechanical Commissioning Agent	MCA		
3.5 Electrical Commissioning Agent	ECA		
3.6 Elevator Contractor	EV-C		
3.6 Elevator Commissioning Agent	EVCA		
3.7 Controls Contractor	C-C		
3.8 Balancing Contractor	B-C		

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Appendix A - Identification of the Commissioning Team and its Responsibilities

The roles and responsibilities of the commissioning team members:

0. All Commissioning Team Members

All Commissioning Team Members to perform the following tasks:

- Perform tasks and submit documentation as outlined in this Commissioning Plan.
- Provide any required documentation promptly.
- Attend commissioning meetings (as required).
- Attend commissioning testing/verification sessions (as required).
- Identify and announce any commissioning-related issues discovered by your own forces in a timely manner.
- Be responsible for accomplishing your own commissioning process activities and assist in identifying and resolving all commissioning-related issues.
- Provide accurate information as requested such that a realistic commissioning schedule can be developed.
- Provide schedule-tracking information including reasons for any foreseen delays.
- Direct own forces such the commissioning schedule can be maintained.
- Cooperate with other commissioning team members to further the commissioning process and to complete the project as efficiently as possible.
- Minimize construction delays due to the process of initiating, pricing and approving any changes in the contract (i.e. site instructions, change orders, and addenda).
- Be available during the warranty period to address any commissioning-related issues.

1. Owner Personnel

All Owner Personnel to perform the following tasks:

- (see also "All Commissioning Team Members" section above)
- Advise Commissioning Authority of any changes in building occupancy and/or usage.

1.1 Owner's Representative

Owner's Representative to perform the following listed tasks in addition to the tasks listed under "Owner Personnel" above:

- (see also "Owner Personnel" section above)
- Provide Owner's Project Requirements (OPR) documentation (as required).
- Assign a staff member to be responsible for overall project knowledge, communications and decision-making.
- Assign a staff member to be responsible for detailed DDC system knowledge and operation.
- Organize own forces to be demonstrated to and trained.
- Sign-off the "Demonstration to the Owner".
- Operate "commissioned systems" after project "hand-over".

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Appendix A - Identification of the Commissioning Team and its Responsibilities

1.2 User(s)/Occupant(s) & O&M Staff

User(s)/Occupant(s) and O&M Staff to perform the following listed tasks in addition to the tasks listed under "Owner Personnel" above:

- (see also "Owner Personnel" section above)
- Operate "commissioned systems" after project "hand-over".
- Join the commissioning process when requested or when project is nearing completion.
- Ensure that own actions do not delay the construction process.
- Use established protocol when providing input into the commissioning process.

2. Key Commissioning Personnel

All Key Commissioning Personnel to perform the following tasks:

- (see also "All Commissioning Team Members" section above)

2.1 Commissioning Authority

Commissioning Authority to perform the following listed tasks:

- (see also "Key Commissioning Personnel" section above)
- Oversee the commissioning process.
- Function to coordinate commissioning throughout the, construction and occupancy periods of the project.
- Accomplish commissioning tasks (as per the Commissioning Plan).

2.1 Mechanical Commissioning Agent (responsible for commissioning of HVAC Systems, DDC Controls and Fire Protection)

Mechanical Commissioning Agent to perform the following listed tasks in addition to the tasks listed under "Key Commissioning Personnel" above:

- (see also "Key Commissioning Personnel" section above)
- Prepare and submit Mechanical Commissioning Plan
- Complete detailed pre-startup, startup, and functional verification forms which have been specifically developed for each of the mechanical "commissioned systems" and equipment installed on the project. These forms must be utilized in testing and documentation of component, system and integrated system performance verifications. PI/ICL/PV forms are to be reviewed and approved by the CxA. Product Information Verification Form (PI) , Installation Check Lists (ICL) and Performance Verification Forms
- Minute Design Intent Meeting with consultant and appropriate other parties to review "commissioned systems" to be installed such that design intent is understood and supported in the installed systems and such that the commissioning agent knows what is to be commissioned.
- Ensure entire mechanical commissioning process of the "commissioned systems" is documented with copies sent to the Commissioning Manager.
- Assist the mechanical contractor in mechanical contractor's overall responsibility of commissioning the mechanical "commissioned systems".

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Appendix A - Identification of the Commissioning Team and its Responsibilities

2.3 Mechanical Commissioning Agent (continued)

- Advise mechanical contractor of mechanical (commissioned systems) commissioning issues and their resolution as they occur.
- Derive the mechanical commissioning schedule as part of the overall project construction schedule and monitor for accuracy. MCA is not responsible for “driving” commissioning schedules due to contractor delays.
- Hold mechanical commissioning meetings (as required) for the “commissioned systems”, and generate and distribute minutes to the commissioning team.
- Conduct and document mechanical “commissioned systems” verifications.
- Ensure that any documentation by others related to the mechanical “commissioned systems” is obtained (copy to the Commissioning Authority).
- Coordinate and attend demonstration of mechanical (commissioned systems) to the Commissioning Authority, the engineer and the owner.
- Issue mechanical commissioning report.

2.4 Electrical Commissioning Agent (Motor control systems, Fire alarm systems, Lighting and Lighting Controls)

Electrical Commissioning Agent (to be hired or provided by the electrical contractor) to perform the following listed tasks in addition to the tasks listed under “Key Commissioning Personnel” above:

- (see also “Key Commissioning Personnel” section above)
- Prepare and submit Electrical Commissioning Plan
- Complete detailed functional verification forms specifically developed for each of the electrical “commissioned systems” and equipment installed on the project. Electrical Contractor / Consultant to assist in providing and/or reviewing required PI , ICL and PV forms.
- Hold and minute Design Intent Meeting with consultant and appropriate other parties to review “commissioned systems” to be installed such that design intent is understood and supported in the installed systems and such that the commissioning agent knows what is to be commissioned.
- Ensure entire electrical commissioning process of the “commissioned systems” is documented with copies sent to the Commissioning Authority
- Derive the electrical commissioning schedule as part of the overall project construction schedule and monitor for accuracy.
- Hold electrical commissioning meetings for the “commissioned systems”, as is required, and generate and distribute minutes.
- Conduct and document electrical “commissioned systems” verifications. Notify the Commissioning Authority in advance of all verifications.
- Ensure that any documentation by others related to the electrical “commissioned systems” is obtained (copy to the Commissioning Authority).
- Coordinate and attend demonstration of and training on electrical “commissioned systems” to the Commissioning Authority, the engineer and the owner.
- Issue electrical commissioning report.

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Appendix A - Identification of the Commissioning Team and its Responsibilities

2.4 Elevator Commissioning Agent (Elevator Systems)

Elevator Commissioning Agent (to be hired or provided by the elevator contractor) to perform the following listed tasks in addition to the tasks listed under “Key Commissioning Personnel” above:

- (see also “Key Commissioning Personnel” section above)
- Prepare and submit Elevator Commissioning Plan
- Complete detailed functional verification forms specifically developed for each of the elevator “commissioned systems” and equipment installed on the project. Elevator Contractor / Consultant to assist in providing and/or reviewing required PI , ICL and PV forms.
- Hold and minute Design Intent Meeting with consultant and appropriate other parties to review “commissioned systems” to be installed such that design intent is understood and supported in the installed systems and such that the commissioning agent knows what is to be commissioned.
- Ensure entire elevator commissioning process of the “commissioned systems” is documented with copies sent to the Commissioning Authority
- Derive the elevator commissioning schedule as part of the overall project construction schedule and monitor for accuracy.
- Hold elevator commissioning meetings for the “commissioned systems”, as is required, and generate and distribute minutes.
- Conduct and document elevator “commissioned systems” verifications. Notify the Commissioning Authority in advance of all verifications.
- Ensure that any documentation by others related to the elevator “commissioned systems” is obtained (copy to the Commissioning Authority).
- Coordinate and attend demonstration of and training on elevator “commissioned systems” to the Commissioning Authority, the engineer and the owner.
- Issue an elevator commissioning report.

3.0 Design Consultants

All Design Consultants to perform the following tasks:

- (see also “All Commissioning Team Members” section above)
- Provide design intent and basis of design documentation such as design narratives to the Commissioning Authority.
- Take part in design intent review process with appropriate contractor and commissioning agent.
- Produce and clarify, as is necessary, contract documents (drawings and specifications) as required.
- Conduct periodic inspections of work in progress to ensure that all systems and equipment of “commissioned systems” are installed according to specifications.
- Provide exclusive review of “commissioned systems” from project beginning to startup (static completion review).
- Provide additional review of “commissioned systems” from startup to full functionality.

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Appendix A - Identification of the Commissioning Team and its Responsibilities

3.0 Design Consultants (Continued)

- Ensure tests associated with static completion have been performed and documented.
- Regardless of the commissioning process, retain ultimate responsibility for evaluation and inspections of the “commissioned systems” as well as the adequacy of these systems to meet the owner’s requirements, the design intent and all applicable codes.

3.1 Architect

Architect to perform the following listed tasks in addition to the tasks listed under “Design Consultants” above:

- (see also “Design Consultants” section above)
- Oversee and administer contracts.
- Be aware of the state of the commissioning process and provide direction as is required to ensure process remains active.
- Direct other consultants as is required.

3.2 Mechanical Consultant

Mechanical Consultant to perform the following listed tasks in addition to the tasks listed under “Design Consultants” above:

- (see also “Design Consultants” section above)
- Sign-off the "Demonstration to the Consultant".
- Review balancing as is required – especially after balancing report has been issued.
- Review O&M manuals for all mechanical systems.

3.3 Electrical Consultant

Electrical Consultant to perform the following listed tasks in addition to the tasks listed under “Design Consultants” above:

- (see also “Design Consultants” section above)
- Sign-off the "Demonstration to the Consultant".
(see also “Design Consultants” section above)
- Review O&M manuals for all electrical systems.

4.0 Contractors/Suppliers

All Contractor/Suppliers to perform the following tasks:

- (see also “All Commissioning Team Members” section above)
- Ensure agreed to commissioning schedule is maintained (commissioning schedule forms part of the overall project construction schedule).
- Include cost for commissioning requirements in the contract price.
- Perform corrective work for issues identified through the commissioning process as required in a timely manner.
- Sub-contractors and suppliers for the “commissioned systems” to cooperate and participate in the commissioning process as is required.

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Appendix A - Identification of the Commissioning Team and its Responsibilities

4.0 Contractors/Suppliers (Continued)

- Major equipment manufacturers/suppliers to participate in appropriate testing and training activities.
- Installing trade to assist the appropriate commissioning agent (mechanical, electrical) in all verifications and functional performance checks by completing all appropriate checklists and forward these checklists to the appropriate commissioning agent for review. Address any issues that may be indicated on the checklists. Address any concerns the appropriate commissioning agent may have with the checklists.
- Gather and assemble operation and maintenance data on all equipment of the “commissioned systems” and provide to the appropriate commissioning agent (mechanical, electrical). Also provide same to the Commissioning Authority. Include all review stamps and cover letters/sheets with this documentation.
- Participate in and schedule vendors and sub-contractors of the “commissioned systems” within your scope to participate in any training sessions for these systems.

4.1 General Contractor

General Contractor to perform the following listed tasks in addition to the tasks listed under “Contractors/Suppliers” above:

- (see also “Contractors/Suppliers” section above)
- Oversee completion of contract.
- Direct all contracted trades.
- Incorporate an agreed-to commissioning schedule (by commissioning agents) into an agreed-to overall project construction schedule and ensure that this overall project schedule is maintained. Contractor to note that CxA or CA’s are not responsible for continually re-issuing commissioning schedule due to construction delays.
- Ensure prerequisite work allowing testing of “commissioned systems” is scheduled and completed such that testing of “commissioned systems” can occur as scheduled.
- Ensure cooperation of all sub-contractors and suppliers with each other and all commissioning team members such that the commissioning process can be efficiently and effectively carried out.

4.2 Mechanical Contractor

Mechanical Contractor to perform the following listed tasks in addition to the tasks listed under “Contractors/Suppliers” above:

- (see also “Contractors/Suppliers” section above)
- Keep mechanical commissioning agent fully informed on all aspects of the project (change orders, supplier delays, scheduling problems, system/equipment operational problems, etc.).
- Perform mechanical equipment startups (with suppliers as required).
- Be responsible for the commissioning of plumbing systems, including site services as per the commissioning specifications and commissioning plan

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Appendix A - Identification of the Commissioning Team and its Responsibilities

4.2 Mechanical Contractor (Continued)

- Operate mechanical equipment during tests and as is necessary (for balancing for example) until hand-over.
- Act on issues identified through the commissioning process which are related to the “commissioned systems” installed by your forces or sub-trades.
- Perform required contractor commissioning activities as described in the project specifications and commissioning plan.
- Organize, hold and document the mechanical demonstration to the mechanical consultant and the owner’s representatives.
- Provide training to the Owner as required.

4.3 Electrical Contractor

Electrical Contractor to perform the following listed tasks in addition to the tasks listed under “Contractors/Suppliers” above:

- (see also “Contractors/Suppliers” section above)
- Perform electrical equipment startups related to the “commissioned systems” (with suppliers as required).
- Contract or provide an Electrical Commissioning Agent (refer to above) to lead the commissioning of the various electrical systems described in the commissioning plan.
- Operate electrical equipment during tests and as is necessary until hand-over.
- Act on issues identified through the commissioning process which are related to the “commissioned systems” installed by your forces or sub-trades.
- Perform required contractor commissioning activities as described in the project specifications and commissioning plan.
- Organize, hold and document the electrical demonstration to the electrical consultant and to the owner’s representatives.
- Provide training to the Owner as required.

4.4 Controls Contractor

Controls Contractor to perform the following listed tasks in addition to the tasks listed under “Contractors/Suppliers” above:

- (see also “Contractors/Suppliers” section above)
- Coordinate the engineer’s approval of a detailed sequence of operation.
- Perform own controls commissioning.
- Show mechanical commissioning agent control system in sufficient detail (including necessary simulations) to allow mechanical commissioning agent to perform necessary functional verification checks.
- Attend the demonstration to the consultant and the demonstration to the owner.
- Setup and monitor trend-logs in order to prove satisfactory system functionality.
- Provide mechanical commissioning agent sufficient trend-logs (in chart format) such that mechanical commissioning agent can verify proper system operation.
- Provide training to the Owner as required.

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Appendix A - Identification of the Commissioning Team and its Responsibilities

4.3 Elevator Contractor

Elevator Contractor to perform the following listed tasks in addition to the tasks listed under "Contractors/Suppliers" above:

- (see also "Contractors/Suppliers" section above)
- Perform elevator equipment startups related to the "commissioned systems" (with suppliers as required).
- Contract or provide an Elevator Commissioning Agent (refer to above) to lead the commissioning of the various electrical systems described in the commissioning plan.
- Operate elevator equipment during tests and as is necessary until hand-over.
- Act on issues identified through the commissioning process which are related to the "commissioned systems" installed by your forces or sub-trades.
- Perform required contractor commissioning activities as described in the project specifications and commissioning plan.
- Organize, hold and document the elevator demonstration to the electrical consultant and to the owner's representatives.
- Provide training to the Owner as required.

4.6 Balancing Contractor

Balancing Contractor to perform the following listed tasks in addition to the tasks listed under "Contractors/Suppliers" above:

- (see also "Contractors/Suppliers" section above)
- Report commissioning-related balancing issues as they are encountered to the Mechanical Commissioning Agent and the Commissioning Authority.
- Produce an independent balancing report to the approval of the mechanical consultant.

4.7 Other Contractors & Suppliers (not specifically listed in this section)

- All other contractors and suppliers involved with the "commissioned systems" are to perform the listed tasks under "4.0 Contractors/Suppliers" above.

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Appendix B - List of Key Commissioning Process Milestones

Appendix B - List of Key Commissioning Process Milestones

Commissioning is a methodical, team-based process. Each step of the commissioning process must be completed progressively in order for the commissioning process to be successful. This appendix lists the four basic phases of the project and the commissioning steps within each of those phases.

Commissioning Phase	Date	Parties Involved	Completed
1. Concept Phase			
2. Design Phase			
3. Construction Phase			
Contract a Commissioning Authority	March 2, 2019	DC-A	<input checked="" type="checkbox"/>
1 st Draft Master Commissioning Plan Creation	March 25, 2019	CxA	<input checked="" type="checkbox"/>
		CxA, CA's, DCs, C-C	<input type="checkbox"/>
Design Intent Review			<input type="checkbox"/>
Finalized Master Commissioning Plan Creation		CxA, CA's	<input type="checkbox"/>
Pre-Startup Verifications		CxA, CA's	<input type="checkbox"/>
Startup Verifications		CxA, CA's	<input type="checkbox"/>
Functional Performance Verifications		CxA, CA's , C-C	<input type="checkbox"/>
4. Occupancy and Operations Phase			
Orientation/Training Plan Creations		CxA, CA's, C's	<input type="checkbox"/>
Orientation/Training Conducted		CxA, CA's, C's	<input type="checkbox"/>
Compile a Commissioning Record		CxA, CA's	<input type="checkbox"/>

APPENDIX C: COMMISSIONING AUTHORITY SERVICES

The table in this appendix describes the work that the CxA. is responsible for. It also describes the roles of the commissioning team members. It is noted that the Commissioning Authority leads the commissioning team but that the commissioning work is divided among the commissioning team members. In this proposal we have made every effort to highlight the distinction between the various commissioning roles of the commissioning team members with special emphasis on what the Commissioning Authority does and does not do.

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
Implementation Phase-Conceptual Design			
<ul style="list-style-type: none"> Reviews design intent at beginning of CD phase in order to establish design intent based on functional and operational requirements. 	<ul style="list-style-type: none"> The CxA reviews the design intent with the Owner and the Consultant to ensure that the CxA fully understands the Owner's operational needs and how these needs are being addressed by the Consultant in the system design. 		<ul style="list-style-type: none"> Owner and Consultant to participate in this process as required. Owner to prepare and provide Owner's Project Requirements Consultant(s) to provide Basis of Design.
<ul style="list-style-type: none"> Develops Cx Plan 	<ul style="list-style-type: none"> The CxA would prepare a Master Commissioning Plan which outlines and explains the commissioning process that will need to be adhered to by the commissioning team. Ultimately, the preliminary version of this plan would be included with the project specifications. The CxA would update this plan throughout the project. 		<ul style="list-style-type: none"> Consultants to include commissioning plan in contract documents
<ul style="list-style-type: none"> Reviews preliminary O&M requirements by reviewing CD documents near completion of construction document development, prior to issuing contract documents for construction. 	<ul style="list-style-type: none"> The CxA reviews the construction documents to ensure that design intent is being addressed. The CxA also reviews the commissioning related sections of the specifications and provides comment. 		<ul style="list-style-type: none"> Consultants to provide construction documents as required to the CxA Consultants to ensure that commissioning specifications support the commissioning plan Consultant's to respond to CxA's comments and requests.
Implementation Phase-Design Development and Working Drawings Conceptual Design			

Appendix C

Commissioning Authority (Cx.A) Services for the Summerland Pacific Agri-food Research Centre Elevator Upgrade Project

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
<ul style="list-style-type: none"> Reviews Cx specifications for sub-systems, systems and integrated systems. 	<ul style="list-style-type: none"> The CxA works with the Consultant to ensure that adequate commissioning clauses are included in the specifications. All sections that relate to the commissioning as described in the PWGSC Terms of Reference (i.e. pre-functional and functional testing, TAB, controls, manuals, training etc.) would be reviewed and edited so that all commissioning requirements are addressed in the design. 		<ul style="list-style-type: none"> Consultants to include CxA's Master Commissioning Plan in the project specifications Consultants to work with CxA to ensure that adequate commissioning clauses to support the Commissioning Plan are included in the specifications.
<ul style="list-style-type: none"> Reviews and develops check lists PI and PV forms. 	<ul style="list-style-type: none"> At the appropriate time, the CxA, along with the design team, would develop the Product Information and Product Verification Forms to be filled out by the Contractor's Commissioning Agent. In the case where the Commissioning Agent submits forms, the CxA would review the forms and approve or reject as required. It is understood that PI/PV forms may change as the project progresses. 	<ul style="list-style-type: none"> The Commissioning Agent(s)/Contractor to submit sample forms for review by the CxA as required. 	<ul style="list-style-type: none"> Consultant to include samples of PI/PV forms provided by the CxA as part of the Master Commissioning Plan in the project specifications.

Appendix C

Commissioning Authority (Cx.A) Services for the Summerland Pacific Agri-food Research Centre
Elevator Upgrade Project

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
<ul style="list-style-type: none"> Reviews and develops training plan. 	<ul style="list-style-type: none"> The CxA, along with the design team, would prepare a written training plan for the facilities maintenance staff and ensure that the plan is followed by the Contractor, the Commissioning Agent(s) and the specialized equipment suppliers. The CxA would provide a draft of this plan as part of the Master Commissioning Plan. 		<ul style="list-style-type: none"> Consultant to include sample of the training plan provided by the CxA as part of the Master Commissioning Plan in the project specifications.
<ul style="list-style-type: none"> Reviews Building Management Manual (BMM) requirements. 	<ul style="list-style-type: none"> The CxA ensures that the specifications allow for the creation of a complete and comprehensive building Management Manual that the operator will utilize to properly maintain the commissioned systems throughout the life of the facility. 		<ul style="list-style-type: none"> Consultant to include specification sections in the master spec that support the creation of the Building Management Manual.
<ul style="list-style-type: none"> Coordinates and updates Cx Plan. 	<ul style="list-style-type: none"> The CxA would update the Commissioning Plan during the final design phases of the project. 		<ul style="list-style-type: none"> Consultants to include the latest version of the CxA's Master Commissioning Plan in the project specifications.
<u>Construction Phase</u>			
<ul style="list-style-type: none"> Reviews/Prepares Cx schedule. 	<ul style="list-style-type: none"> The CxA would review and provide comment on the Cx schedule, developed by the Commissioning Agent 	<ul style="list-style-type: none"> Develops Cx schedule for related discipline. 	<ul style="list-style-type: none"> G.C. to ensure trades provide information so that a Cx schedule can be prepared.

Appendix C

Commissioning Authority (Cx.A) Services for the Summerland Pacific Agri-food Research Centre Elevator Upgrade Project

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
<ul style="list-style-type: none"> Reviews selected shop drawings. 	<ul style="list-style-type: none"> The CxA reviews shop drawings on the commissioned systems, after the review of the Consultants. The CxA ensures that the information on the shop drawings is entered onto the PI forms by the Commissioning Agent(s)/Contractor 	<ul style="list-style-type: none"> Contractors and CxAg's to ensure information from shop drawings is entered into the PI forms as applicable. 	<ul style="list-style-type: none"> Consultants to review and approve shop drawings. Consultants to respond to the CxA's comments.
<ul style="list-style-type: none"> Presents latest version of Commissioning Plan to Commissioning Team for comment and input. 	<ul style="list-style-type: none"> The CxA would update the Commissioning Plan during the construction phase of the project. The updated plan would include all of the Sub-Contractors who complete the make-up of the commissioning team. 	<ul style="list-style-type: none"> Refines Cx Plan. 	<ul style="list-style-type: none"> Consultant's provide comment on the Commissioning Plan.
<ul style="list-style-type: none"> Reviews and certifies completed PI forms. 	<ul style="list-style-type: none"> The CxA reviews the completed PI forms, prepared by the Commissioning Agent. 	<ul style="list-style-type: none"> Inputs data into PI forms. 	<ul style="list-style-type: none"> Consultants review completed PI forms as required as part of their regular quality assurance process.
<ul style="list-style-type: none"> Develops installation / start-up check lists. 	<ul style="list-style-type: none"> The CxA ensures that start-up checklists are prepared or reviews the Commissioning Agent's start-up check-sheets. Often the PI forms, Start-up Checklists and the PV forms are often combined into one document for each piece of equipment. 	<ul style="list-style-type: none"> Verifies and utilizes installation start-up check list. 	<ul style="list-style-type: none"> Consultants review completed installation start-up check lists as required as part of their regular quality assurance process.
<ul style="list-style-type: none"> Completes TAB. 	<ul style="list-style-type: none"> The CxA ensures TAB is completed. 		
<ul style="list-style-type: none"> Reviews TAB reports for acceptance. 	<ul style="list-style-type: none"> The CxA ensures that the TAB report is reviewed by the consultant and provides comment on any commissioning related issues. 		<ul style="list-style-type: none"> Consultants review and approve TAB report.
<u>Commissioning Phase</u>			

Appendix C

Commissioning Authority (Cx.A) Services for the Summerland Pacific Agri-food Research Centre Elevator Upgrade Project

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
<ul style="list-style-type: none"> Reviews O&M Manual. 	<ul style="list-style-type: none"> The CxA reviews the O&M manual and ensures that all commissioned systems are included in the manual. 	<ul style="list-style-type: none"> Assembles Maintenance Manual. Assists in completion of operating manual. 	<ul style="list-style-type: none"> Consultants review and approve O&M manual(s).
<ul style="list-style-type: none"> Monitors Cx activities. 	<ul style="list-style-type: none"> The CxA holds/attends regular Cx meetings (4 maximum) to ensure that the commissioning plan and schedule are being adhered to. The CxA documents commissioning problems that are holding up progress or preventing the completion of the commissioning process. 	<ul style="list-style-type: none"> Coordinates all Cx activities. Works to resolve commissioning deficiencies. 	<ul style="list-style-type: none"> Consultants expected to attend scheduled commissioning meetings as required. Works to resolve commissioning deficiencies.
<ul style="list-style-type: none"> Certifies system and integrated systems tests. 	<ul style="list-style-type: none"> The CxA ensures that integrated systems tests are planned, executed and documented by the Commissioning Agent(s)/Contractor. The CxA will review the test procedures. If the test procedures are deemed unacceptable, the CxA will rewrite or modify as required. 	<ul style="list-style-type: none"> Conducts component equipment, sub system, system and integrated systems tests. 	<ul style="list-style-type: none"> Consultants review completed installation start-up check lists and functional tests as required as part of their regular quality assurance process.
<ul style="list-style-type: none"> Certifies complete PV and Cx reports. 	<ul style="list-style-type: none"> The CxA reviews the completed PV forms and Cx reports for each piece of equipment prior to including them in the final commissioning record. 	<ul style="list-style-type: none"> Prepares PV and Cx reports. 	<ul style="list-style-type: none"> Consultants review commissioning documentation as required as part of their regular quality assurance process.
<ul style="list-style-type: none"> Provide training on design intent and system design. 	<ul style="list-style-type: none"> The CxA ensures that the training plan is implemented by the Contractor, the Commissioning Agent and the specialized suppliers. 	<ul style="list-style-type: none"> Coordinates and implements training. 	<ul style="list-style-type: none"> Consultants to participate in training as required to explain design intent of systems. Owner ensures that maintenance and operations staff participate in training.

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
<ul style="list-style-type: none"> • Certifies rectification of outstanding deficiencies. 	<ul style="list-style-type: none"> • The CxA will document and follow up on any outstanding commissioning deficiencies. • The CxA will assign responsibility to the deficiency item and also note the expected time frame for it to be resolved. 	<ul style="list-style-type: none"> • Addresses outstanding deficiencies. 	<ul style="list-style-type: none"> • Consultants to respond to design related issues as identified by the CxA.
<ul style="list-style-type: none"> • Assists in resolving all issues relating to Cx. 	<ul style="list-style-type: none"> • The CxA will provide expertise and support to the Commissioning Team to expedite resolution of deficiencies as required. 	<ul style="list-style-type: none"> • Addresses all issues relating to Cx. 	<ul style="list-style-type: none"> • Consultants to respond to design related issues as identified by the CxA.
<ul style="list-style-type: none"> • Provide final Cx documentation. 	<ul style="list-style-type: none"> • The CxA will collect the final documentation and assemble it into a final commissioning record (report). 	<ul style="list-style-type: none"> • Maintains accurate project records and assists in production of record. • Assist in preparation of final Cx documentation. • Contractors to ensure test and start-up reports are provided as requested by the Commissioning Agent and the CxA. 	<ul style="list-style-type: none"> • Owner to provide update to OPR if required. • Consultant to provide update to Basis of Design. documentation as required.
<u>Close-Out Phase</u>			
<ul style="list-style-type: none"> • Assist in fine tuning of systems and equipment as required. 	<ul style="list-style-type: none"> • The CxA will cooperate with and support the commissioning team to fine tune system(s) as needed to ensure that the expected performance of the system(s) is achieved. 	<ul style="list-style-type: none"> • Fine tunes systems and equipment as required. 	
<ul style="list-style-type: none"> • Witnesses deferred Cx tests. 	<ul style="list-style-type: none"> • The CxA will attend any deferred seasonal testing by the Commissioning Agent(s)/Contractor as required. 	<ul style="list-style-type: none"> • Perform deferred Cx tests. 	<ul style="list-style-type: none"> • Owner to accommodate deferred testing in occupied facility.
<ul style="list-style-type: none"> • Performs near/post warranty review. 	<ul style="list-style-type: none"> • The CxA meets with Owner and Commissioning team, prior to the expiration of the warranty, to discuss the operation of the building and assembles a written plan to address any operational deficiencies. 	<ul style="list-style-type: none"> • Addresses warranty issues. 	<ul style="list-style-type: none"> • Consultants to respond to design related issues as identified by the CxA in the near/post-warranty review

Appendix C

Commissioning Authority (Cx.A) Services for the Summerland Pacific Agri-food Research Centre
Elevator Upgrade Project

Commissioning Authority Task	Description of work by the Commissioning Authority	Work by Commissioning Agent(s)/ Contractors (Note: KD is the Mech. CxAg.)	Notable Involvement by others
<ul style="list-style-type: none">• Prepares final Cx Report.	<ul style="list-style-type: none">• The CxA will update the Commissioning Report to include post warranty review information and any updated commissioning test forms.	<ul style="list-style-type: none">• Provide input into final Cx Report.	

**ELEVATOR REPLACEMENT AT
SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE
SUMMERLAND, BC**

**APPENDIX 3
CERTIFICATE OF EXEMPTION CONTRACTOR**



BRITISH
COLUMBIA

Ministry of
Finance

CERTIFICATE OF EXEMPTION CONTRACTOR

under the *Provincial Sales Tax Act*

Responsibilities for Sellers and Eligible Contractors:

Sellers – this certificate allows you to collect the information and declaration required under the *Provincial Sales Tax Act* (the Act) in order to provide a PST exemption to your customer.

If you do not receive a completed and signed certificate or the required information and declaration before the sale, you must charge and collect PST. Failure to do so may result in an assessment, penalty and interest.

Eligible Contractors – you are responsible for ensuring that you meet all the requirements for the exemption under the Act. If you complete the certificate but you do not qualify for the exemption, you are responsible for paying the PST.

General Instructions:

- Refer to Page 2 for detailed instructions.

Freedom of Information and Protection of Privacy Act (FOIPPA)

The personal information on this form is collected for the purpose of administering the *Provincial Sales Tax Act* under the authority of both this Act and section 26 of the FOIPPA. Questions about the collection or use of this information can be directed to the Manager, Program Services, PO Box 9442 Stn Prov Govt, Victoria, BC V8W 9V4.
(Telephone: toll-free at 1 877 388-4440)

PART A – CERTIFICATION OF ELIGIBLE PERSON (see Page 2)

NAME OF CORPORATION, ASSOCIATION, PARTNERS, INDIAN BAND OR INDIVIDUAL MAILING ADDRESS (including postal code)

Public Works Gov. Canada

219 - 800 Burrard Street Vancouver, B.C. V6Z 0B9

I certify that I have entered into a contract with the eligible contractor named below for the supply and installation of affixed machinery or improvements to real property and if I were to purchase the tangible personal property identified below I would be exempt from PST because (check (✓) one and complete the appropriate section):

1. ☐ I am eligible for the **Production Machinery and Equipment (PM&E)** exemption under the Act.

2. ☐ I am a **status Indian** or authorized representative of an Indian band and the items being purchased would be exempt from PST under section 87 of the *Indian Act* (Canada). If you are representing an Indian band, attach written authorization from an official of the band that you are authorized to act on behalf of the Indian band.

Indian and Indian Bands

BAND NAME

STATUS CARD NUMBER

Indian Bands Only

NAME OF REPRESENTATIVE

3. ☐ I am a **qualifying aquaculturist** under the Act.

AQUACULTURE LICENCE NUMBER

4. ☐ I am a **qualifying farmer** under the Act.

PROPERTY TAX FOLIO NUMBER / ADDRESS OF FARM

5. ☐ I am eligible for a PST exemption under the **Consular Tax Exemption Regulation**.

DIPLOMATIC / CONSULAR IDENTITY CARD NUMBER

EXPIRY DATE
YYYY / MM / DD

I certify that the Government of Canada has entered into a contract with the eligible contractor named below for the supply and installation of affixed machinery or improvements to real property.

6. ☒ I am an **authorized representative of the Government of Canada**.

PST NUMBER

PST-1000-5001

By signing this form, I certify that the above information is correct.

FULL LEGAL NAME OF INDIVIDUAL SIGNING FORM

Patrick Truong

SIGNATURE

X

DATE SIGNED

YYYY / MM / DD

2015/12/15

PART B – CERTIFICATION OF ELIGIBLE CONTRACTOR (see Page 2)

FULL LEGAL NAME

MAILING ADDRESS (including postal code)

Description of all items of tangible personal property (goods) being purchased (if you require more space, attach an additional document):

I certify that the tangible personal property (TPP) identified above is being acquired to fulfill a contract for the supply and installation of affixed machinery or improvements to real property that meets the requirements of (check (✓) one):

7. ☐ **Customer is the eligible person identified in Part A:** the contract is with the eligible person identified in Part A, or

ELIGIBLE CONTRACTOR'S PST NUMBER

8. ☐ **Customer pays the PST:** you have a written agreement with your customer that they will pay PST on the TPP described above and the agreement sets out the purchase price of the TPP. You must be registered for PST before supplying this TPP to your customer. You may only use this certificate in advance of receiving your PST number.

By signing this form, I certify to the best of my knowledge that the above information and any attached information is correct. I acknowledge that if I make a false statement to avoid paying tax, the *Provincial Sales Tax Act* charges a fine of up to \$10,000 and/or imprisonment up to two years, in addition to a penalty of 25% of the tax due and an assessment for the tax that should have been paid.

FULL LEGAL NAME OF INDIVIDUAL SIGNING FORM

SIGNATURE

X

DATE SIGNED

YYYY / MM / DD

**ELEVATOR REPLACEMENT AT
SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE
SUMMERLAND, BC**

APPENDIX 4

HAZARDOUS BUILDING MATERIALS ASSESSMENT

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016

Appendix B FINDINGS AND RECOMMENDATIONS— BUILDING 1—ADMINISTRATION/LABORATORY

The administration/laboratory building was reportedly constructed in 1986. The typical structural components and finishes associated with this building consist of concrete block/stucco exterior walls, cement/vinyl sheet floor tile/carpet flooring and interior drywall walls with suspended ceiling tile and drywall ceilings.

The results of the assessment for each of the considered hazardous materials within the subject building are provided in the following sub-sections.

Floor plan drawings, which include locations of the samples collected during this assessment and locations of identified hazardous building materials (where practical), are attached to this Appendix.

B.1 ASBESTOS

Stantec identified and sampled various suspected ACMs. The samples collected were submitted to EMSL for analysis of asbestos content and nature.

A summary of the sampled materials, sample locations and analytical results is presented in Table B-1, below. A copy of the certificate of analysis provided by EMSL for the suspected ACM samples submitted is attached at the end of this Appendix.

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-CL-01A	Black concrete liner	Penthouse East (north wall)	None Detected
1-CL-01B	Black concrete liner	Penthouse East (south wall)	None Detected
1-CL-01C	Black concrete liner	Penthouse East (south wall)	None Detected
1-PS-01A	Grey/red penetration sealant applied around exhaust vent	West, upper roof	None Detected
1-PS-01B	Grey/red penetration sealant applied around exhaust vent	West, upper roof	None Detected
1-PS-01C	Grey/red penetration sealant applied around exhaust vent	West, upper roof	None Detected
1-DJC-01A	Joint compound applied to gypsum board throughout Penthouse walls and ceilings	Penthouse East, room 5000 (fan room) outside service tower 7	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-DJC-01B	Joint compound applied to gypsum board throughout Penthouse walls and ceilings	Penthouse East, room 5000 (fan room) outside stairs	None Detected
1-DJC-01C	Joint compound applied to gypsum board throughout Penthouse walls and ceilings	Penthouse East, room 5001 (fan room)	None Detected
1-DJC-01D	Joint compound applied to gypsum board throughout Penthouse walls and ceilings	Penthouse West, room 5003 (hot water heater)	None Detected
1-DJC-01E	Joint compound applied to gypsum board throughout Penthouse walls and ceilings	Penthouse West, room 5004 (gas cylinder storage)	None Detected
1-DJC-02A	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor west, outside stair 3	None Detected
1-DJC-02B	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor west, outside room 4121	None Detected
1-DJC-02C	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor west, outside room 4135	None Detected
1-DJC-02D	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor east, outside room 4140	None Detected
1-DJC-02E	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor east, outside room 4181	None Detected
1-DJC-02F	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor east, outside stair 2	None Detected
1-DJC-02G	Joint compound applied to gypsum board throughout 4 th floor walls and ceilings	4 th floor east, inside room 4171	None Detected
1-DJC-03A	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor west, room 3025	None Detected
1-DJC-03B	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor west, outside stair 3	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-DJC-03C	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor east, room 3352	None Detected
1-DJC-03D	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor east, room 3027	None Detected
1-DJC-03E	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor west, room 3333	None Detected
1-DJC-03F	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor east, room 3116	None Detected
1-DJC-03G	Joint compound applied to gypsum board throughout 3 rd floor walls and ceilings	3 rd floor west, ceiling by main stairs to lobby	None Detected
1-DJC-04A	Joint compound applied to gypsum board throughout 1 st floor walls and ceilings	1 st floor, room 1010	None Detected
1-DJC-04B	Joint compound applied to gypsum board throughout 1 st floor walls and ceilings	1 st floor, room 1302	None Detected
1-DJC-04C	Joint compound applied to gypsum board throughout 1 st floor walls and ceilings	1 st floor room 1011	None Detected
1-DJC-05A	Joint compound applied to gypsum board throughout 2 nd floor walls and ceilings	2 nd floor east, room 2010	None Detected
1-DJC-05B	Joint compound applied to gypsum board throughout 2 nd floor walls and ceilings	2 nd floor east, room 2109	None Detected
1-DJC-05C	Joint compound applied to gypsum board throughout 2 nd floor walls and ceilings	2 nd floor west, outside room 2211	None Detected
1-DJC-05D	joint compound applied to gypsum board throughout 2 nd floor walls and ceilings	2 nd floor east, room 2286	None Detected
1-DJC-05E	joint compound applied to gypsum board throughout 2 nd floor walls and ceilings	2 nd floor east, outside service tower 5	None Detected
1-IM-01A	Black fiberglass insulation mastic	Penthouse East, service tower 7	4% Chrysotile

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-IM-01B	Black fiberglass insulation mastic	Penthouse East, service tower 7	Positive Stop (Not Analyzed)
1-IM-01C	Black fiberglass insulation mastic	Penthouse East, room 5000 (fan room)	Positive Stop (Not Analyzed)
1-IM-02A	Yellow fiberglass insulation mastic	First floor, room 1300, ceiling	None Detected
1-IM-02B	Yellow fiberglass insulation mastic	First floor, room 1300, ceiling	None Detected
1-IM-02C	Yellow fiberglass insulation mastic	First floor, room 1300, ceiling	None Detected
1-FM-01A	Clear flashing mastic on seams of perimeter flashing	West, upper roof	None Detected
1-FM-01B	Clear flashing mastic on seams of perimeter flashing	West, upper roof	None Detected
1-FM-01C	Clear flashing mastic on seams of perimeter flashing	West, upper roof	None Detected
1-FM-02A	White flashing mastic on seams of exhaust vent metal pad	West, upper roof	None Detected
1-FM-02B	White flashing mastic on seams of exhaust vent metal pad	West, upper roof	None Detected
1-FM-02C	White flashing mastic on seams of exhaust vent metal pad	West, upper roof	None Detected
1-FM-03A	Cream mastic applied to exhaust vent penetration	East, upper roof	None Detected
1-FM-03B	Cream mastic applied to exhaust vent penetration	East, upper roof	None Detected
1-FM-03C	Cream mastic applied to exhaust vent penetration	East, upper roof	None Detected
1-AS-01A	Black asphalt roofing material under concrete pad	West, upper roof	None Detected
1-AS-01B	Black asphalt roofing material under concrete pad	West, upper roof	None Detected
1-AS-01C	Black asphalt roofing material under concrete pad	West, upper roof	None Detected
1-FS-01A	Grey expanding floor sealant on expansion joint	Penthouse east, room 5000 (fan room)	None Detected
1-FS-01B	Grey expanding floor sealant on expansion joint	Penthouse east, room 5000 (fan room)	None Detected
1-FS-01C	Grey expanding floor sealant on expansion joint	Penthouse east, room 5000 (fan room)	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-HS-01A	Grey sealant on HVAC unit door	Penthouse east, room 5000 (fan room), east wall	None Detected
1-HS-01B	Grey sealant on HVAC unit door	Penthouse east, room 5000 (fan room), east wall	None Detected
1-HS-01C	Grey sealant on HVAC unit door	Penthouse east, room 5000 (fan room), east wall	None Detected
1-DM-01A	Red duct mastic around HVAC seams	Penthouse east, service tower 7	0.79% Chrysotile
1-DM-01B	Red duct mastic around HVAC seams	Penthouse west, outside service tower 4	Positive Stop (Not Analyzed)
1-DM-01C	Red duct mastic around HVAC seams	Penthouse west, outside service tower 2	Positive Stop (Not Analyzed)
1-DM-02A	Grey duct mastic around HVAC seams	Penthouse east, service tower 7	None Detected
1-DM-02B	Grey duct mastic around HVAC seams	Penthouse east, outside of stair 2	None Detected
1-DM-02C	Grey duct mastic around HVAC seams	Penthouse east, outside service tower 5	None Detected
1-DM-03A	Brown duct mastic around HVAC seams	Penthouse West, outside service tower 4	None Detected
1-DM-03B	Brown duct mastic around HVAC seams	Penthouse west, east of room 5003 (Hot water heaters)	None Detected
1-DM-03C	Brown duct mastic around HVAC seams	Penthouse east, outside service tower 5	None Detected
1-DM-04A	Tan duct mastic applied on back-up generator ducting	1 st floor, back-up generator room	None Detected
1-DM-04B	Tan duct mastic applied on back-up generator ducting	1 st floor, back-up generator room	None Detected
1-DM-04C	Tan duct mastic applied on back-up generator ducting	1 st floor, back-up generator room	None Detected
1-DM-05A	White duct mastic	3 rd floor east, mezzanine of room 3027	None Detected
1-DM-05B	White duct mastic	3 rd floor east, mezzanine of room 3027	None Detected
1-DM-05C	White duct mastic	3 rd floor east, mezzanine of room 3027	None Detected
1-PAS-01A	Grey sealant on HVAC concrete pad	Penthouse east, room 5000 (fan room)	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-PAS-01B	Grey sealant on HVAC concrete pad	Penthouse east, room 5000 (fan room)	None Detected
1-PAS-01C	Grey sealant on HVAC concrete pad	Penthouse east, room 5000 (fan room)	None Detected
1-PFI-01	Grey pipe fitting insulation	Penthouse east, room 5000 (fan room) on 'air handling unit #9 hot deck east' return coil	None Detected
1-PFI-02	Grey pipe fitting insulation	Penthouse east, room 5000 (fan room), green label "cold water" pipe	None Detected
1-PFI-03	Grey pipe fitting insulation	Penthouse west, outside service tower 3 on yellow label 'glycol supply' pipe	None Detected
1-PFI-04	Grey pipe fitting insulation	Penthouse west, hallway between room 5000 and room 5002, on solar radiation pipe	None Detected
1-PFI-05	Grey pipe fitting insulation	Greenhouse, ceiling of corridor, yellow label 'steam' pipe	None Detected
1-PFI-06	Grey pipe fitting insulation	Greenhouse, ceiling of corridor, green label 'domestic hot water return' pipe	None Detected
1-PFI-07	Grey pipe fitting insulation	1 st floor, mechanical room, green label 'cold water' pipe	None Detected
1-PFI-08	Grey pipe fitting insulation	1 st floor, mechanical room, yellow label 'hot water return'	None Detected
1-PFI-09A	Grey pipe fitting insulation	1 st floor, chiller room on black mechanical system	None Detected
1-PFI-09B	Grey pipe fitting insulation	1 st floor, chiller room on black mechanical system	None Detected
1-PFI-09C	Grey pipe fitting insulation	1 st floor, chiller room on black mechanical system	None Detected
1-WFC-01A	Brown window frame caulking	4th floor east, men's washroom	0.64 % Chrysotile
1-WFC-01B	Brown window frame caulking	4th floor east, room 4179	Positive Stop (Not Analyzed)
1-WFC-01C	Brown window frame caulking	4th floor east, room 4177	Positive Stop (Not Analyzed)
1-WPC-01A	Black window pane caulking on door and floor-to-ceiling window	4th floor west, main stair and landing	1.2% Chrysotile

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-WPC-01B	Black window pane caulking on door and floor-to-ceiling window	4th floor west, main stair and landing	Positive Stop (Not Analyzed)
1-WPC-01C	Black window pane caulking on door and floor-to-ceiling window	4th floor west, main stair and landing	Positive Stop (Not Analyzed)
1-WPC-02A	Grey window pane caulking on stairwell glass	4 th floor west, main stair and landing	None Detected
1-WPC-02B	Grey window pane caulking on stairwell glass	4 th floor west, main stair and landing	None Detected
1-WPC-02C	Grey window pane caulking on stairwell glass	4 th floor west, main stair and landing	None Detected
1-WPC-03A	Black sticky window pane caulking between glass and frame	Greenhouse	1.8% Chrysotile
1-WPC-03B	Black sticky window pane caulking between glass and frame	Greenhouse	Positive Stop (Not Analyzed)
1-WPC-03C	Black sticky window pane caulking between glass and frame	Greenhouse	Positive Stop (Not Analyzed)
1-SF-01	Grey and white small pebble sheet flooring	4 th floor	None Detected
1-SF-02	Cream small stone pattern sheet flooring	4 th floor east, far east in renovated area	None Detected
1-SF-03	Grey and white small pebble sheet flooring	3 rd floor	None Detected
1-SF-04	Light and dark pink smears sheet flooring	3 rd floor east cafeteria	None Detected
1-SF-05	Cream small stone pattern sheet flooring	3 rd floor west, room 3423	None Detected
1-SF-06	Sand colour sheet flooring	3 rd floor west, main entrance	None Detected
1-SF-07	Grey and white small pebble sheet flooring	1 st floor	None Detected
1-SF-08	Grey and white small pebble sheet flooring	2 nd floor west, room 2200	None Detected
1-CT-01A	2'x4' Ceiling tile, standard fissure and pinhole	4 th floor west, corridor	None Detected
1-CT-01B	2'x4' Ceiling tile, standard fissure and pinhole	4 th floor west, corridor	None Detected
1-CT-01C	2'x4' Ceiling tile, standard fissure and pinhole	4 th floor west, corridor	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-CT-02A	2'x4' ceiling tile, silver flecs	3 rd floor east, kitchen	None Detected
1-CT-02B	2'x4' ceiling tile, silver flecs	3 rd floor east, kitchen	None Detected
1-CT-02C	2'x4' ceiling tile, silver flecs	3 rd floor east, kitchen	None Detected
1-CT-03A	1'x1' fissure ceiling tile	3 rd floor west, lobby	None Detected
1-CT-03B	1'x1' fissure ceiling tile	3 rd floor west, lobby	None Detected
1-CT-03C	1'x1' fissure ceiling tile	3 rd floor west, lobby	None Detected
1-CT-04A	2'x4' Ceiling tile, large fissure and pinhole	2 nd floor west, room 2200	None Detected
1-CT-04B	2'x4' Ceiling tile, large fissure and pinhole	2 nd floor west, room 2200	None Detected
1-CT-04C	2'x4' Ceiling tile, large fissure and pinhole	2 nd floor west, room 2200	None Detected
1-FS-01A	Grey fire stop applied to pipe chase penetration	4 th floor west, service tower 4	None Detected
1-FS-01B	Grey fire stop applied to pipe chase penetration	4 th floor west, service tower 4	None Detected
1-FS-01C	Grey fire stop applied to pipe chase penetration	4 th floor west, service tower 4	None Detected
1-CP-01	Grey cement panel	West lower roof below skylight	None Detected
1-CP-02	Grey cement panel	2 nd floor east, room 2010 (electrical room)	None Detected
1-S-01A	Soffit stucco	West lower roof below skylight	None Detected
1-S-01B	Soffit stucco	3 rd floor west, under main entrance bridge	None Detected
1-S-01C	Soffit stucco	3 rd floor west, under main entrance east of bridge	None Detected
1-S-01D	Soffit stucco	3 rd floor west, under main entrance west of bridge	None Detected
1-S-01E	Soffit stucco	3 rd floor west, under main entrance west of bridge	None Detected
1-ES-01A	Exterior stucco	3 rd floor west, under main entrance bridge	None Detected
1-ES-01B	Exterior stucco	3 rd floor east, exterior of room 3101	None Detected
1-ES-01C	Exterior stucco	2 nd floor, exterior of greenhouse	None Detected
1-ES-01D	Exterior stucco	3 rd floor east, exterior of stair 1	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
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**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-ES-01E	Exterior stucco	3 rd floor east, exterior of room 3470	None Detected
1-ES-01F	Exterior stucco	3 rd floor west, south west corner of building	None Detected
1-ES-01G	Exterior stucco	3 rd floor west, exterior of service tower 3	None Detected
1-GHC-01A	Dark brown sealant applied between foundation and steel wall	Greenhouse lower steel wall	None Detected
1-GHC-01B	Dark brown sealant applied between foundation and steel wall	Greenhouse lower steel wall	None Detected
1-GHC-01C	Dark brown sealant applied between foundation and steel wall	Greenhouse lower steel wall	None Detected
1-EWS-01A	Tan expanding wall sealant applied on exterior wall between concrete seams	3 rd floor west by main entrance wall	None Detected
1-EWS-01B	Tan expanding wall sealant applied on exterior wall between concrete seams	3 rd floor west by main entrance wall	None Detected
1-EWS-01C	Tan expanding wall sealant applied on exterior wall between concrete seams	3 rd floor west by main entrance wall	None Detected
1-SLC-01A	Black sticky caulking on skylight between frame and flashing	Lower west roof, upper skylight	None Detected
1-SLC-01B	Black sticky caulking on skylight between frame and flashing	Lower west roof, upper skylight	None Detected
1-SLC-01C	Black sticky caulking on skylight between frame and flashing	Lower west roof, upper skylight	None Detected
1-RCM-01A	Black roof cap mastic applied between flashing and black roof paper	Upper roof, east	<1% Chrysotile
1-RCM-01B	Black roof cap mastic applied between flashing and black roof paper	Upper roof, east	None Detected
1-RCM-01C	Black roof cap mastic applied between flashing and black roof paper	Upper roof, east	0.36% Chrysotile
1-FOM-01A	Black foundation mastic inside walls of planter	3 rd floor west, planter by display lobby stairs	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

**Table B-1 Suspected ACM Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**


Sample Number	Material Description	Sample Location	Result (%/type asbestos)
1-FOM-01B	Black foundation mastic inside walls of planter	3 rd floor west, planter by display lobby stairs	None Detected
1-FOM-01C	Black foundation mastic inside walls of planter	3 rd floor west, planter by display lobby stairs	None Detected
1-CC-01A	Grey caulking applied between wall and concrete column	3 rd floor west by display lobby stairs	None Detected
1-CC-01B	Grey caulking applied between wall and concrete column	3 rd floor west by display lobby stairs	None Detected
1-CC-01C	Grey caulking applied between wall and concrete column	3 rd floor west by display lobby stairs	None Detected
1-MG-01	Beige mechanical gasket	1 st floor, mechanical room	None Detected
1-TI-01A	Silver tank insulation	1 st floor, mechanical room	None Detected
1-TI-01B	Silver tank insulation	1 st floor, mechanical room	None Detected
1-TI-01C	Silver tank insulation	1 st floor, mechanical room	None Detected
1-CTG-01A	Grey/white ceramic tile grout (two layers)	2 nd floor, columns of room 2406 (food process)	None Detected
1-CTG-01B	Grey/white ceramic tile grout (two layers)	2 nd floor, columns of room 2406 (food process)	None Detected
1-CTG-01C	Grey/white ceramic tile grout (two layers)	2 nd floor, columns of room 2406 (food process)	None Detected
1-CTG-02A	Grey ceramic tile grout	Walls of room 2305	None Detected
1-CTG-02B	Grey ceramic tile grout	Walls of room 2305	None Detected
1-CTG-02C	Grey ceramic tile grout (two layers)	Walls of room 2305	None Detected
1-SC-01A	Black rubbery caulking on skylight seams and bolt	Lower west roof, lower skylight	None Detected
1-SC-01B	Black rubbery caulking on skylight seams and bolt	Lower west roof, lower skylight	None Detected
1-SC-01C	Black rubbery caulking on skylight seams and bolt	Lower west roof, lower skylight	None Detected
1-SC-02A	Black sticky caulking on skylight between frame and flashing	Lower west roof, lower skylight	None Detected
1-SC-02B	Black sticky caulking on skylight between frame and flashing	Lower west roof, lower skylight	None Detected
1-SC-02C	Black sticky caulking on skylight between frame and flashing	Lower west roof, lower skylight	None Detected

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of suspected ACM sample analytical results, the materials presented in Table B-2, below were identified as ACMs.



Table B-2 Summary of Identified ACMs
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre

Identified ACM Description and Condition Information		Photo
Black fiberglass insulation mastic throughout service tower walls and penthouse walls		 <p>Service tower #7 – residual mastic where fibreglass was previously removed</p> <p>Penthouse east, room 5000 (fan room) - ACM mastic applied behind fiberglass walls</p>
Friability	Non-friable	
Condition	Good	
Content	4% Chrysotile	

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

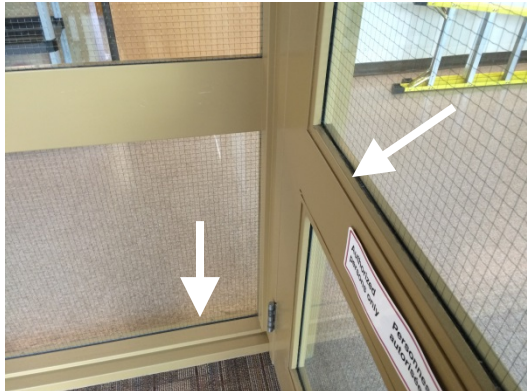


Table B-2 Summary of Identified ACMs
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre

Identified ACM Description and Condition Information		Photo
Red mastic applied to the seams of HVAC ducting throughout the penthouse and service towers		
Friability	Non-friable	
Condition	Good	
Content	0.79% Chrysotile	
Brown window frame caulking applied to interior windows throughout		No photo available.
Friability	Non-friable	
Condition	Good	
Content	0.64% Chrysotile	
Black window pane caulking applied to interior partition windows and floor-to-ceiling windows throughout		 <p>4th floor west, main stair and landing</p>
Friability	Non-friable	
Condition	Good	
Content	1.2% Chrysotile	

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016


Table B-2 Summary of Identified ACMs
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre

Identified ACM Description and Condition Information		Photo
		 <p>4th floor west, interior partition window</p>
Black sticky window pane caulking applied between glass and frame throughout the greenhouse		 <p>Greenhouse hallway</p>  <p>Greenhouse, ACM window pane caulking</p>
Friability	Non-friable	
Condition	Good	
Content	1.8% Chrysotile	

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
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Table B-2 Summary of Identified ACMs
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre

Identified ACM Description and Condition Information		Photo
Black roof cap mastic applied between flashing and black roof paper on the upper roof.		
Friability	Non-friable	
Condition	Good	
Content	<1% Chrysotile detected, limited sample available without compromising integrity of seal. Should be presumed ACM until proven otherwise by further sample analysis.	

B.1.1 Potential for Vermiculite Insulation

It should be noted that various walls of the subject building were comprised of masonry (concrete) blocks. Asbestos-contaminated vermiculite was historically used as insulating material in masonry block or brick walls, may be present. To assess for this potential ACM, destructive sampling is required, which was not conducted as part of this assessment.

B.2 LEAD

Lead is expected to be present in the following:

- Lead-acid batteries used in emergency lighting
- Older electrical wiring materials and sheathing
- Solder used on domestic water lines
- Solder used in bell fittings for cast iron pipes
- Solder used in electrical equipment
- Ceramic tile glaze
- Vent and pipe flashings

With respect to paint, chip samples were obtained from the predominant suspected LCP applications within the subject building. A summary of the sample types, locations and analytical results is presented in Table B-3, below. A copy of the certificate of analysis provided by EMSL for the suspected LCP samples submitted is attached to this Appendix.

HAZARDOUS BUILDING MATERIALS ASSESSMENT


Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
December 2016

**Table B-3 Suspected LCP Sample Collection and Analysis Summary
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Sample No.	Sample Colour/Substrate	Location	Lab Result (ppm)	Lead Containing (Yes/No)
1-P-01	Red on Steel	East Penthouse - Structural steel	<140	No
1-P-02	Beige	East Penthouse - Interior walls	<90	No
1-P-03	White	East Penthouse - Interior walls	<90	No
1-P-04	Tan on Metal	2nd floor west - Interior trims	2,100	Yes
1-P-05	Beige on Concrete Blocks	2 nd floor west - Exterior walls	<90	No

Based on our observations and on our interpretations of suspected LCP sample analytical results, the paint presented in Table B-4, below was identified as an LCP.

**Table B-4 Summary of Identified LCPs
Building 1—Administration/Laboratory
AAFC Summerland Research and Development Centre**

Identified LCP Description		Photo
Paint colour	Tan	
Substrate	metal	
Location/approx. extent	Interior trim	
Lead content	2,100 ppm	
Condition	Good	

B.3 POLYCHLORINATED BIPHENYLS

The fluorescent light fixtures throughout were observed to have high-efficiency light tubes. The ballasts within such fixtures are not suspected to contain PCBs.

HAZARDOUS BUILDING MATERIALS ASSESSMENT

Appendix B Findings and Recommendations—Building 1—Administration/Laboratory
November, 2016

B.4 MERCURY

Mercury vapour is present in the light tubes within the approximately 2,500 fluorescent light fixtures observed. Mercury may also be present in paints and adhesives.

B.5 MOULD

No mould and/or moisture impacted building materials were observed at the time of the assessment.

B.6 OZONE-DEPLETING SUBSTANCES

No building-related refrigeration or air conditioning equipment with suspected ODS-containing refrigerants was observed.

B.7 SILICA

Silica is expected to be present in ceramic tiles, asphalt, drywall, mortar, vinyl floor tiles, ceiling tiles, concrete, cement and masonry block and interior wall finishes observed in various locations.

B.8 RECOMMENDATIONS

In general, identified hazardous building materials were observed to be in good condition and do not appear to require specific action to maintain compliance with applicable regulations for continued operations and maintenance. Refer to Section 5.0 of the main body of this report for applicable material-by-material general recommendations.



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EMSL Canada Order 691601366
 Customer ID: 55JACQ30L
 Customer PO: 123220690
 Project ID:

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 Stantec Consulting, Ltd.
 500 - 4730 Kingsway
 Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 10/18/2016
Analyzed: 10/24/2016

Proj: SUMMERLAND AGRI / 123220690 / 1-ADMINISTRATIVE/LABORATORY

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-CL-01A **Lab Sample ID:** 691601366-0001

Sample Description: PENTHOUSE EAST/BLACK CONCRETE LINER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	

Client Sample ID: 1-CL-01B **Lab Sample ID:** 691601366-0002

Sample Description: PENTHOUSE EAST/BLACK CONCRETE LINER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	

Client Sample ID: 1-CL-01C **Lab Sample ID:** 691601366-0003

Sample Description: PENTHOUSE EAST/BLACK CONCRETE LINER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Black	0.0%	100%	None Detected	

Client Sample ID: 1-PS-01A **Lab Sample ID:** 691601366-0004

Sample Description: WEST, UPPER ROOF/GREY/RED PENETRATION SEALANT APPLIED AROUND EXHAUST VENT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.60%	99.4%	None Detected	

Client Sample ID: 1-PS-01B **Lab Sample ID:** 691601366-0005

Sample Description: WEST, UPPER ROOF/GREY/RED PENETRATION SEALANT APPLIED AROUND EXHAUST VENT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.50%	99.5%	None Detected	

Client Sample ID: 1-PS-01C **Lab Sample ID:** 691601366-0006

Sample Description: WEST, UPPER ROOF/GREY/RED PENETRATION SEALANT APPLIED AROUND EXHAUST VENT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.65%	99.3%	None Detected	

Client Sample ID: 1-DJC-01A **Lab Sample ID:** 691601366-0007

Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM) OUTSIDE SERVICE TOWER 7/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	



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EMSL Canada Order 691601366
 Customer ID: 55JACQ30L
 Customer PO: 123220690
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-DJC-01B		Lab Sample ID: 691601366-0008				
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM) OUTSIDE STAIRS/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-01C		Lab Sample ID: 691601366-0009				
Sample Description: PENTHOUSE EAST, ROOM 5001 (FAN ROOM)/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-01D		Lab Sample ID: 691601366-0010				
Sample Description: PENTHOUSE WEST, ROOM 5003 (HOT WATER HEATER)/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-01E		Lab Sample ID: 691601366-0011				
Sample Description: PENTHOUSE WEST, ROOM 5004 (GAS CYLINDER STORAGE)/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-02A		Lab Sample ID: 691601366-0012				
Sample Description: 4TH FLOOR WEST, OUTSIDE STAIR 3/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-02B		Lab Sample ID: 691601366-0013				
Sample Description: 4TH FLOOR WEST, OUTSIDE ROOM 4121/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-02C		Lab Sample ID: 691601366-0014				
Sample Description: 4TH FLOOR WEST, OUTSIDE ROOM 4135/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-02D		Lab Sample ID: 691601366-0015				
Sample Description: 4TH FLOOR EAST, OUTSIDE ROOM 4140/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	



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EMSL Canada Order 691601366
 Customer ID: 55JACQ30L
 Customer PO: 123220690
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-DJC-02E		Lab Sample ID: 691601366-0016				
Sample Description: 4TH FLOOR EAST, OUTSIDE ROOM 4181/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-02F		Lab Sample ID: 691601366-0017				
Sample Description: 4TH FLOOR ESAT, OUTSIDE STAIR 2/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-02G		Lab Sample ID: 691601366-0018				
Sample Description: 4TH FLOOR EAST, INSIDE ROOM 4171/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-03A		Lab Sample ID: 691601366-0019				
Sample Description: 3RD FLOOR WEST, ROOM 3025/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-03B		Lab Sample ID: 691601366-0020				
Sample Description: 3RD FLOOR WEST, OUTSIDE STAIR 3/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-03C		Lab Sample ID: 691601366-0021				
Sample Description: 3RD FLOOR EAST, ROOM 3352/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-03D		Lab Sample ID: 691601366-0022				
Sample Description: 3RD FLOOR EAST, ROOM 3027/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-03E		Lab Sample ID: 691601366-0023				
Sample Description: 3RD FLOOR WEST, ROOM 3333/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	



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EMSL Canada Order 691601366
Customer ID: 55JACQ30L
Customer PO: 123220690
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-DJC-03F			Lab Sample ID: 691601366-0024			
Sample Description: 3RD FLOOR EAST, ROOM 3116/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-03G			Lab Sample ID: 691601366-0025			
Sample Description: 3RD FLOOR WEST, CEILING BY MAIN STAIRS TO LOBBY/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-04A			Lab Sample ID: 691601366-0026			
Sample Description: 1ST FLOOR, ROOM 1010/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-04B			Lab Sample ID: 691601366-0027			
Sample Description: 1ST FLOOR, ROOM 1302/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-04C			Lab Sample ID: 691601366-0028			
Sample Description: 1ST FLOOR ROOM 1011/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-05A			Lab Sample ID: 691601366-0029			
Sample Description: 2ND FLOOR EAST, ROOM 2010/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-05B			Lab Sample ID: 691601366-0030			
Sample Description: 2ND FLOOR EAST, ROOM 2109/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-05C			Lab Sample ID: 691601366-0031			
Sample Description: 2ND FLOOR WEST, OUTSIDE ROOM 2211/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	



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Client Sample ID: 1-DJC-05D		Lab Sample ID: 691601366-0032				
Sample Description: 2ND FLOOR EAST, ROOM 2286/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	White	0%	100%	None Detected	
Client Sample ID: 1-DJC-05E		Lab Sample ID: 691601366-0033				
Sample Description: 2ND FLOOR EAST, OUTSIDE SERVICE TOWER 5/DRYWALL JOINT COMPOUND APPLIED TO GYPSUM BOARD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-IM-01A		Lab Sample ID: 691601366-0034				
Sample Description: PENTHOUSE EAST, SERVICE TOWER 7/BLACK FIBERGLASS INSULATION MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Black	0%	96%	4% Chrysotile	
Client Sample ID: 1-IM-01B		Lab Sample ID: 691601366-0035				
Sample Description: PENTHOUSE EAST, SERVICE TOWER 7/BLACK FIBERGLASS INSULATION MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016				Positive Stop (Not Analyzed)	
Client Sample ID: 1-IM-01C		Lab Sample ID: 691601366-0036				
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/BLACK FIBERGLASS INSULATION MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016				Positive Stop (Not Analyzed)	
Client Sample ID: 1-IM-02A		Lab Sample ID: 691601366-0037				
Sample Description: FIRST FLOOR, ROOM 1300, CEILING/YELLOW FIBERGLASS INSULATION MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Yellow	0.0%	100%	None Detected	
Client Sample ID: 1-IM-02B		Lab Sample ID: 691601366-0038				
Sample Description: FIRST FLOOR, ROOM 1300, CEILING/YELLOW FIBERGLASS INSULATION MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Yellow	0.0%	100%	None Detected	
Client Sample ID: 1-IM-02C		Lab Sample ID: 691601366-0039				
Sample Description: FIRST FLOOR, ROOM 1300, CEILING/YELLOW FIBERGLASS INSULATION MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Yellow	0.0%	100%	None Detected	



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Client Sample ID: 1-FM-01A		Lab Sample ID: 691601366-0040				
Sample Description: WEST, UPPER ROOF/CLEAR FLASHING MASTIC ON SEAMS OF PERIMETER FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Clear	0%	100%	None Detected	
Client Sample ID: 1-FM-01B		Lab Sample ID: 691601366-0041				
Sample Description: WEST, UPPER ROOF/CLEAR FLASHING MASTIC ON SEAMS OF PERIMETER FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-FM-01C		Lab Sample ID: 691601366-0042				
Sample Description: WEST, UPPER ROOF/CLEAR FLASHING MASTIC ON SEAMS OF PERIMETER FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Clear	0%	100%	None Detected	
Client Sample ID: 1-FM-02A		Lab Sample ID: 691601366-0043				
Sample Description: WEST, UPPER ROOF/WHITE FLASHING MASTIC ON SEAMS OF EXHAUST VENT METAL PAD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Beige	0%	100%	None Detected	
Client Sample ID: 1-FM-02B		Lab Sample ID: 691601366-0044				
Sample Description: WEST, UPPER ROOF/WHITE FLASHING MASTIC ON SEAMS OF EXHAUST VENT METAL PAD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Beige	0%	100%	None Detected	
Client Sample ID: 1-FM-02C		Lab Sample ID: 691601366-0045				
Sample Description: WEST, UPPER ROOF/WHITE FLASHING MASTIC ON SEAMS OF EXHAUST VENT METAL PAD						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-FM-03A		Lab Sample ID: 691601366-0046				
Sample Description: EAST, UPPER ROOF/CREAM MASTIC APPLIED TO EXHAUST VENT PENETRATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	White	0.0%	100%	None Detected	
Client Sample ID: 1-FM-03B		Lab Sample ID: 691601366-0047				
Sample Description: EAST, UPPER ROOF/CREAM MASTIC APPLIED TO EXHAUST VENT PENETRATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	White	0.0%	100%	None Detected	



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Client Sample ID: 1-FM-03C **Lab Sample ID:** 691601366-0048

Sample Description: EAST, UPPER ROOF/CREAM MASTIC APPLIED TO EXHAUST VENT PENETRATION

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	White	0.0%	100%	None Detected	

Client Sample ID: 1-AS-01A **Lab Sample ID:** 691601366-0049

Sample Description: WEST, UPPER ROOF/BLACK ASPHALT ROOFING MATERIAL UNDER CONCRETE PAD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	

Client Sample ID: 1-AS-01B **Lab Sample ID:** 691601366-0050

Sample Description: WEST, UPPER ROOF/BLACK ASPHALT ROOFING MATERIAL UNDER CONCRETE PAD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	

Client Sample ID: 1-AS-01C **Lab Sample ID:** 691601366-0051

Sample Description: WEST, UPPER ROOF/BLACK ASPHALT ROOFING MATERIAL UNDER CONCRETE PAD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Black	0.0%	100%	None Detected	

Client Sample ID: 1-FS-01A **Lab Sample ID:** 691601366-0052

Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/GREY EXPANDING FLOOR SEALANT ON EXPANSION JOINT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-FS-01B **Lab Sample ID:** 691601366-0053

Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/GREY EXPANDING FLOOR SEALANT ON EXPANSION JOINT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-FS-01C **Lab Sample ID:** 691601366-0054

Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/GREY EXPANDING FLOOR SEALANT ON EXPANSION JOINT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-HS-01A **Lab Sample ID:** 691601366-0055

Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM), EAST WALL/GREY SEALANT ON HVAC UNIT DOOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	



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Client Sample ID: 1-HS-01B		Lab Sample ID: 691601366-0056				
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM), EAST WALL/GREY SEALANT ON HVAC UNIT DOOR						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-HS-01C		Lab Sample ID: 691601366-0057				
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM), EAST WALL/GREY SEALANT ON HVAC UNIT DOOR						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-DM-01A		Lab Sample ID: 691601366-0058				
Sample Description: PENTHOUSE EAST, SERVICE TOWER 7/RED DUCT MASTIC AROUND HVAC SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Red	0.0%	99.2%	0.79% Chrysotile	
Client Sample ID: 1-DM-01B		Lab Sample ID: 691601366-0059				
Sample Description: PENTHOUSE WEST, OUTSIDE SERVICE TOWER 4/RED DUCT MASTIC AROUND HVAC SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/21/2016		Positive Stop (Not Analyzed)			
Client Sample ID: 1-DM-01C		Lab Sample ID: 691601366-0060				
Sample Description: PENTHOUSE WEST, OUTSIDE SERVICE TOWER 2/RED DUCT MASTIC AROUND HVAC SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016		Positive Stop (Not Analyzed)			
Client Sample ID: 1-DM-02A		Lab Sample ID: 691601366-0061				
Sample Description: PENTHOUSE EAST, SERVICE TOWER 7/GREY DUCT MASTIC AROUND HVAC SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-DM-02B		Lab Sample ID: 691601366-0062				
Sample Description: PENTHOUSE EAST, OUTSIDE OF STAIR 2/GREY DUCT MASTIC AROUND HVAC SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-DM-02C		Lab Sample ID: 691601366-0063				
Sample Description: PENTHOUSE EAST, OUTSIDE SERVICE TOWER 5/GREY DUCT MASTIC AROUND HVAC SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	



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Client Sample ID: 1-DM-03A

Lab Sample ID: 691601366-0064

Sample Description: PENTHOUSE WEST, OUTSIDE SERVICE TOWER 4/BROWN DUCT MASTIC AROUND HVAC SEAMS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Brown	1.4%	98.6%	None Detected	

Client Sample ID: 1-DM-03B

Lab Sample ID: 691601366-0065

Sample Description: PENTHOUSE WEST, EAST OF ROOM 5003 (HOT WATER HEATERS)/BROWN DUCT MASTIC AROUND HVAC SEAMS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Brown	2.2%	97.8%	None Detected	

Client Sample ID: 1-DM-03C

Lab Sample ID: 691601366-0066

Sample Description: PENTHOUSE EAST, OUTSIDE SERVICE TOWER 5/BROWN DUCT MASTIC AROUND HVAC SEAMS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Brown	1.2%	98.8%	None Detected	

Client Sample ID: 1-DM-04A

Lab Sample ID: 691601366-0067

Sample Description: 1ST FLOOR, BACK-UP GENERATOR ROOM/TAN DUCT MASTIC APPLIED ON BACK-UP GENERATOR DUCTING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-DM-04B

Lab Sample ID: 691601366-0068

Sample Description: 1ST FLOOR, BACK-UP GENERATOR ROOM/TAN DUCT MASTIC APPLIED ON BACK-UP GENERATOR DUCTING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-DM-04C

Lab Sample ID: 691601366-0069

Sample Description: 1ST FLOOR, BACK-UP GENERATOR ROOM/TAN DUCT MASTIC APPLIED ON BACK-UP GENERATOR DUCTING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-DM-05A

Lab Sample ID: 691601366-0070

Sample Description: 3RD FLOOR EAST, MEZZANINE OF ROOM 3027/WHITE DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	White	0.0%	100%	None Detected	

Client Sample ID: 1-DM-05B

Lab Sample ID: 691601366-0071

Sample Description: 3RD FLOOR EAST, MEZZANINE OF ROOM 3027/WHITE DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	White	0.0%	100%	None Detected	



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Client Sample ID: 1-DM-05C **Lab Sample ID:** 691601366-0072
Sample Description: 3RD FLOOR EAST, MEZZANINE OF ROOM 3027/WHITE DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	White	0.0%	100%	None Detected	

Client Sample ID: 1-PAS-01A **Lab Sample ID:** 691601366-0073
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/GREY SEALANT ON HVAC CONCRETE PAD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-PAS-01B **Lab Sample ID:** 691601366-0074
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/GREY SEALANT ON HVAC CONCRETE PAD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-PAS-01C **Lab Sample ID:** 691601366-0075
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM)/GREY SEALANT ON HVAC CONCRETE PAD

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-PFI-01 **Lab Sample ID:** 691601366-0076
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM) ON 'AIR HANDLING UNIT #9 HOT DECK EAST' RETURN COIL/GREY PIPE FITTING INSULATION

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Gray	30%	70%	None Detected	

Client Sample ID: 1-PFI-02 **Lab Sample ID:** 691601366-0077
Sample Description: PENTHOUSE EAST, ROOM 5000 (FAN ROOM), GREEN LABEL "COLD WATER" PIPE/GREY PIPE FITTING INSULATION

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Gray	10%	90%	None Detected	

Client Sample ID: 1-PFI-03 **Lab Sample ID:** 691601366-0078
Sample Description: PENTHOUSE WEST, OUTSIDE SERVICE TOWER 3 ON YELLOW LABEL 'GLYCOL SUPPLY' PIPE/GREY PIPE FITTING INSULATION

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Gray	10%	90%	None Detected	

Client Sample ID: 1-PFI-04 **Lab Sample ID:** 691601366-0079
Sample Description: PENTHOUSE WEST, HALLWAY BETWEEN ROOM 5000 AND ROOM 5002, ON SOLAR RADIATION PIPE/GREY PIPE FITTING INSULATION

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/20/2016	Gray	15%	85%	None Detected	



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EMSL Canada Order 691601366
 Customer ID: 55JACQ30L
 Customer PO: 123220690
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID:		1-PFI-05				Lab Sample ID:		691601366-0080	
Sample Description:		GREENHOUSE, CEILING OF CORRIDOR, YELLOW LABEL 'STEAM' PIPE/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/20/2016	Gray	10%	90%	None Detected				
Client Sample ID:		1-PFI-06				Lab Sample ID:		691601366-0081	
Sample Description:		GREENHOUSE, CEILING OF CORRIDOR, GREEN LABEL 'DOMESTIC HOT WATER RETURN' PIPE/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/20/2016	Gray	12%	88%	None Detected				
Client Sample ID:		1-PFI-07				Lab Sample ID:		691601366-0082	
Sample Description:		1ST, MECHANICAL ROOM, GREEN LABEL 'COLD WATER' PIPE/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/20/2016	Gray	10%	90%	None Detected				
Client Sample ID:		1-PFI-08				Lab Sample ID:		691601366-0083	
Sample Description:		1ST FLOOR, MECHANICAL ROOM, YELLOW LABEL 'HOT WATER RETURN'/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/20/2016	Gray	8%	92%	None Detected				
Client Sample ID:		1-PFI-09A				Lab Sample ID:		691601366-0084	
Sample Description:		1ST FLOOR, CHILLER ROOM ON BLACK MECHANICAL SYSTEM/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/20/2016	Gray	13%	87%	None Detected				
Client Sample ID:		1-PFI-09B				Lab Sample ID:		691601366-0085	
Sample Description:		1ST FLOOR, CHILLER ROOM ON BLACK MECHANICAL SYSTEM/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/20/2016	Gray	13%	87%	None Detected				
Client Sample ID:		1-PFI-09C				Lab Sample ID:		691601366-0086	
Sample Description:		1ST FLOOR, CHILLER ROOM ON BLACK MECHANICAL SYSTEM/GREY PIPE FITTING INSULATION							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM	10/24/2016	Gray	5%	95%	None Detected				
Client Sample ID:		1-WFC-01A				Lab Sample ID:		691601366-0087	
Sample Description:		4TH FLOOR EAST, MEN'S WASHROOM/BROWN WINDOW FRAME CAULKING							
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment			
			Fibrous	Non-Fibrous					
PLM Grav. Reduction	10/21/2016	Gray	0.0%	99.4%	0.64% Chrysotile				



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Client Sample ID: 1-WFC-01B **Lab Sample ID:** 691601366-0088
Sample Description: 4TH FLOOR EAST, ROOM 4179/BROWN WINDOW FRAME CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016				Positive Stop (Not Analyzed)	

Client Sample ID: 1-WFC-01C **Lab Sample ID:** 691601366-0089
Sample Description: 4TH FLOOR EAST, ROOM 4177/BROWN WINDOW FRAME CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016				Positive Stop (Not Analyzed)	

Client Sample ID: 1-WPC-01A **Lab Sample ID:** 691601366-0090
Sample Description: 4TH FLOOR WEST, MAIN STAIR AND LANDING/BLACK WINDOW PANE CAULKING ON DOOR AND FLOOR TO CEILING WINDOW

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	98.8%	1.2% Chrysotile	

Client Sample ID: 1-WPC-01B **Lab Sample ID:** 691601366-0091
Sample Description: 4TH FLOOR WEST, MAIN STAIR AND LANDING/BLACK WINDOW PANE CAULKING ON DOOR AND FLOOR TO CEILING WINDOW

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016				Positive Stop (Not Analyzed)	

Client Sample ID: 1-WPC-01C **Lab Sample ID:** 691601366-0092
Sample Description: 4TH FLOOR WEST, MAIN STAIR AND LANDING/BLACK WINDOW PANE CAULKING ON DOOR AND FLOOR TO CEILING WINDOW

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016				Positive Stop (Not Analyzed)	

Client Sample ID: 1-WPC-02A **Lab Sample ID:** 691601366-0093
Sample Description: 4TH FLOOR WEST, MAIN STAIR AND LANDING/GREY WINDOW PANE CAULKING ON STAIRWELL GLASS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-WPC-02B **Lab Sample ID:** 691601366-0094
Sample Description: 4TH FLOOR WEST, MAIN STAIR AND LANDING/GREY WINDOW PANE CAULKING ON STAIRWELL GLASS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-WPC-02C **Lab Sample ID:** 691601366-0095
Sample Description: 4TH FLOOR WEST, MAIN STAIR AND LANDING/GREY WINDOW PANE CAULKING ON STAIRWELL GLASS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	



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Client Sample ID: 1-WPC-03A		Lab Sample ID: 691601366-0096				
Sample Description: GREENHOUSE/BLACK STICKY WINDOW PANE CAULKING BETWEEN GLASS AND FRAME						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	98.2%	1.8% Chrysotile	
Client Sample ID: 1-WPC-03B		Lab Sample ID: 691601366-0097				
Sample Description: GREENHOUSE/BLACK STICKY WINDOW PANE CAULKING BETWEEN GLASS AND FRAME						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016		Positive Stop (Not Analyzed)			
Client Sample ID: 1-WPC-03C		Lab Sample ID: 691601366-0098				
Sample Description: GREENHOUSE/BLACK STICKY WINDOW PANE CAULKING BETWEEN GLASS AND FRAME						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016		Positive Stop (Not Analyzed)			
Client Sample ID: 1-SF-01		Lab Sample ID: 691601366-0099				
Sample Description: 4TH FLOOR/GREY AND WHITE SMALL PEBBLE SHEET FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray/Tan	0.0%	100%	None Detected	
Client Sample ID: 1-SF-02		Lab Sample ID: 691601366-0100				
Sample Description: 4TH FLOOR EAST, FAR EAST IN RENOVATED AREA/CREAM SMALL STONE PATTERN SHEET FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Beige	0.0%	100%	None Detected	
Client Sample ID: 1-SF-03		Lab Sample ID: 691601366-0101				
Sample Description: 3RD FLOOR/GREY AND WHITE SMALL PEBBLE SHEET FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray/Tan	0.0%	100%	None Detected	
Client Sample ID: 1-SF-04		Lab Sample ID: 691601366-0102				
Sample Description: 3RD FLOOR EAST CAFETERIA/LIGHT AND DARK PINK SMEARS SHEET FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Pink	0.0%	100%	None Detected	
Client Sample ID: 1-SF-05		Lab Sample ID: 691601366-0103				
Sample Description: 3RD FLOOR WEST, ROOM 3423/CREAM SMALL STONE PATTERN SHEET FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	



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Client Sample ID: 1-SF-06 **Lab Sample ID:** 691601366-0104
Sample Description: 3RD FLOOR WEST, MAIN ENTRANCE/SAND COLOUR SHEET FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	

Client Sample ID: 1-SF-07 **Lab Sample ID:** 691601366-0105
Sample Description: 1ST FLOOR/GREY AND WHITE SMALL PEBBLE SHEET FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray/White	0.0%	100%	None Detected	

Client Sample ID: 1-SF-08 **Lab Sample ID:** 691601366-0106
Sample Description: 2ND FLOOR WEST, ROOM 2200/GREY AND WHITE SMALL PEBBLE SHEET FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray/Beige	0.0%	100%	None Detected	

Client Sample ID: 1-CT-01A **Lab Sample ID:** 691601366-0107
Sample Description: 4TH FLOOR WEST, CORRIDOR/2'X4' CEILING TILE, STANDARD FISSURE AND PINHOLE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-01B **Lab Sample ID:** 691601366-0108
Sample Description: 4TH FLOOR WEST, CORRIDOR/2'X4' CEILING TILE, STANDARD FISSURE AND PINHOLE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-01C **Lab Sample ID:** 691601366-0109
Sample Description: 4TH FLOOR WEST, CORRIDOR/2'X4' CEILING TILE, STANDARD FISSURE AND PINHOLE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-02A **Lab Sample ID:** 691601366-0110
Sample Description: 3RD FLOOR EAST, KITCHEN/2'X4' CEILING TILE, SILVER FLECS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-02B **Lab Sample ID:** 691601366-0111
Sample Description: 3RD FLOOR EAST, KITCHEN/2'X4' CEILING TILE, SILVER FLECS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	



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Client Sample ID: 1-CT-02C **Lab Sample ID:** 691601366-0112
Sample Description: 3RD FLOOR EAST, KITCHEN/2'X4' CEILING TILE, SILVER FLECS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-03A **Lab Sample ID:** 691601366-0113
Sample Description: 3RD FLOOR WEST, LOBBY/1'X1' FISSURE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-03B **Lab Sample ID:** 691601366-0114
Sample Description: 3RD FLOOR WEST, LOBBY/1'X1' FISSURE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-03C **Lab Sample ID:** 691601366-0115
Sample Description: 3RD FLOOR WEST, LOBBY/1'X1' FISSURE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	80%	20%	None Detected	

Client Sample ID: 1-CT-04A **Lab Sample ID:** 691601366-0116
Sample Description: 2ND FLOOR WEST, ROOM 2200/2'X4' CEILING TILE, LARGE FISSURE AND PINHOLE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	82%	18%	None Detected	

Client Sample ID: 1-CT-04B **Lab Sample ID:** 691601366-0117
Sample Description: 2ND FLOOR WEST, ROOM 2200/2'X4' CEILING TILE, LARGE FISSURE AND PINHOLE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	81%	19%	None Detected	

Client Sample ID: 1-CT-04C **Lab Sample ID:** 691601366-0118
Sample Description: 2ND FLOOR WEST, ROOM 2200/2'X4' CEILING TILE, LARGE FISSURE AND PINHOLE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	82%	18%	None Detected	

Client Sample ID: 1-FS-01A **Lab Sample ID:** 691601366-0119
Sample Description: 4TH FLOOR WEST, SERVICE TOWER 4/GREY FIRE STOP APPLIED TO PIPE CHASE PENETRATION

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	



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Client Sample ID: 1-FS-01B		Lab Sample ID: 691601366-0120				
Sample Description: 4TH FLOOR WEST, SERVICE TOWER 4/GREY FIRE STOP APPLIED TO PIPE CHASE PENETRATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-FS-01C		Lab Sample ID: 691601366-0121				
Sample Description: 4TH FLOOR WEST, SERVICE TOWER 4/GREY FIRE STOP APPLIED TO PIPE CHASE PENETRATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-CP-01		Lab Sample ID: 691601366-0122				
Sample Description: WEST LOWER ROOF BELOW SKYLIGHT/GREY CEMENT PANEL						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-CP-02		Lab Sample ID: 691601366-0123				
Sample Description: 2ND FLOOR EAST, ROOM 2010 (ELECTRICAL ROOM)/GREY CEMENT PANEL						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-S-01A		Lab Sample ID: 691601366-0124				
Sample Description: WEST LOWER ROOF BELOW SKYLIGHT/SOFFIT STUCCO						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-S-01B		Lab Sample ID: 691601366-0125				
Sample Description: 3RD FLOOR WEST, UNDER MAIN ENTRANCE BRIDGE/SOFFIT STUCCO						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-S-01C		Lab Sample ID: 691601366-0126				
Sample Description: 3RD FLOOR WEST, UNDER MAIN ENTRANCE EAST OF BRIDGE/SOFFIT STUCCO						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-S-01D		Lab Sample ID: 691601366-0127				
Sample Description: 3RD FLOOR WEST, UNDER MAIN ENTRANCE WEST OF BRIDGE/SOFFIT STUCCO						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	



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Client Sample ID: 1-S-01E **Lab Sample ID:** 691601366-0128
Sample Description: 3RD FLOOR WEST, UNDER MAIN ENTRANCE WEST OF BRIDGE/SOFFIT STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-ES-01A **Lab Sample ID:** 691601366-0129
Sample Description: 3RD FLOOR WEST, UNDER MAIN ENTRANCE BRIDGE/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-ES-01B **Lab Sample ID:** 691601366-0130
Sample Description: 3RD FLOOR, EXTERIOR OF ROOM 3101/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-ES-01C **Lab Sample ID:** 691601366-0131
Sample Description: 2ND FLOOR, EXTERIOR OF GREENHOUSE/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-ES-01D **Lab Sample ID:** 691601366-0132
Sample Description: 3RD FLOOR EAST, EXTERIOR OF STAIR 1/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-ES-01E **Lab Sample ID:** 691601366-0133
Sample Description: 3RD FLOOR ESAT, EXTERIOR OF ROOM 3470/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Tan	0%	100%	None Detected	

Client Sample ID: 1-ES-01F **Lab Sample ID:** 691601366-0134
Sample Description: 3RD FLOOR WEST, SOUTH WEST CORNER OF BUILDING/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-ES-01G **Lab Sample ID:** 691601366-0135
Sample Description: 3RD FLOOR WEST, EXTERIOR OF SERVICE TOWER 3/EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	



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Client Sample ID: 1-GHC-01A		Lab Sample ID: 691601366-0136				
Sample Description: GREENHOUSE LOWER STEEL WALL/DARK BROWN SEALANT APPLIED BETWEEN FOUNDATION AND STEEL WALL						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Brown/Gray	0.0%	100%	None Detected	
Client Sample ID: 1-GHC-01B		Lab Sample ID: 691601366-0137				
Sample Description: GREENHOUSE LOWER STEEL WALL/DARK BROWN SEALANT APPLIED BETWEEN FOUNDATION AND STEEL WALL						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Brown/Gray	0.0%	100%	None Detected	
Client Sample ID: 1-GHC-01C		Lab Sample ID: 691601366-0138				
Sample Description: GREENHOUSE LOWER STEEL WALL/DARK BROWN SEALANT APPLIED BETWEEN FOUNDATION AND STEEL WALL						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Brown/Gray	0.0%	100%	None Detected	
Client Sample ID: 1-EWS-01A		Lab Sample ID: 691601366-0139				
Sample Description: 3RD FLOOR WEST BY MAIN ENTRANCE WALL/TAN EXPANDING WALL SEALANT APPLIED ON EXTERIOR WALL BETWEEN CONCRETE SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Tan	0.0%	100%	None Detected	
Client Sample ID: 1-EWS-01B		Lab Sample ID: 691601366-0140				
Sample Description: 3RD FLOOR WEST BY MAIN ENTRANCE WALL/TAN EXPANDING WALL SEALANT APPLIED ON EXTERIOR WALL BETWEEN CONCRETE SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Tan	0.0%	100%	None Detected	
Client Sample ID: 1-EWS-01C		Lab Sample ID: 691601366-0141				
Sample Description: 3RD FLOOR WEST BY MAIN ENTRANCE WALL/TAN EXPANDING WALL SEALANT APPLIED ON EXTERIOR WALL BETWEEN CONCRETE SEAMS						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Tan	0.0%	100%	None Detected	
Client Sample ID: 1-SLC-01A		Lab Sample ID: 691601366-0142				
Sample Description: LOWER WEST ROOF, UPPER SKYLIGHT/BLACK STICKY CAULKING ON SKYLIGHT BETWEEN FRAME AND FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Black	0%	100%	None Detected	
Client Sample ID: 1-SLC-01B		Lab Sample ID: 691601366-0143				
Sample Description: LOWER WEST ROOF, UPPER SKYLIGHT/BLACK STICKY CAULKING ON SKYLIGHT BETWEEN FRAME AND FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	



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EMSL Canada Order 691601366
 Customer ID: 55JACQ30L
 Customer PO: 123220690
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-SLC-01C		Lab Sample ID: 691601366-0144				
Sample Description: LOWER WEST ROOF, UPPER SKYLIGHT/BLACK STICKY CAULKING ON SKYLIGHT BETWEEN FRAME AND FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	
Client Sample ID: 1-RCM-01A		Lab Sample ID: 691601366-0145				
Sample Description: UPPER ROOF, EAST/BLACK ROOF CAP MASTIC APPLIED BETWEEN FLASHING AND BLACK ROOF PAPER						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Black	0%	100%	<1% Chrysotile	
Client Sample ID: 1-RCM-01B		Lab Sample ID: 691601366-0146				
Sample Description: UPPER ROOF, EAST/BLACK ROOF CAP MASTIC APPLIED BETWEEN FLASHING AND BLACK ROOF PAPER						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Black	0%	100%	None Detected	
Client Sample ID: 1-RCM-01C		Lab Sample ID: 691601366-0147				
Sample Description: UPPER ROOF, EAST/BLACK ROOF CAP MASTIC APPLIED BETWEEN FLASHING AND BLACK ROOF PAPER						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	99.6%	0.36% Chrysotile	
Client Sample ID: 1-FOM-01A		Lab Sample ID: 691601366-0148				
Sample Description: 3RD FLOOR WEST, PLANTER BY DISPLAY LOBBY STAIRS/BLACK FOUNDATION MASTIC INSIDE WALLS OF PLANTER						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Black	0%	100%	None Detected	
Client Sample ID: 1-FOM-01B		Lab Sample ID: 691601366-0149				
Sample Description: 3RD FLOOR WEST, PLANTER BY DISPLAY LOBBY STAIRS/BLACK FOUNDATION MASTIC INSIDE WALLS OF PLANTER						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	
Client Sample ID: 1-FOM-01C		Lab Sample ID: 691601366-0150				
Sample Description: 3RD FLOOR WEST, PLANTER BY DISPLAY LOBBY STAIRS/BLACK FOUNDATION MASTIC INSIDE WALLS OF PLANTER						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	
Client Sample ID: 1-CC-01A		Lab Sample ID: 691601366-0151				
Sample Description: 3RD FLOOR WEST BY DISPLAY LOBBY STAIRS/GREY CAULKING APPLIED BETWEEN WALL AND CONCRETE COLUMN						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	



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 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-CC-01B		Lab Sample ID: 691601366-0152				
Sample Description: 3RD FLOOR WEST BY DISPLAY LOBBY STAIRS/GREY CAULKING APPLIED BETWEEN WALL AND CONCRETE COLUMN						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-CC-01C		Lab Sample ID: 691601366-0153				
Sample Description: 3RD FLOOR WEST BY DISPLAY LOBBY STAIRS/GREY CAULKING APPLIED BETWEEN WALL AND CONCRETE COLUMN						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-MG-01		Lab Sample ID: 691601366-0154				
Sample Description: 1ST FLOOR, MECHANICAL ROOM/BEIGE MECHANICAL GASKET						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	80%	20%	None Detected	
Client Sample ID: 1-TI-01A		Lab Sample ID: 691601366-0155				
Sample Description: 1ST FLOOR, MECHANICAL ROOM/SILVER TANK INSULATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-TI-01B		Lab Sample ID: 691601366-0156				
Sample Description: 1ST FLOOR, MECHANICAL ROOM/SILVER TANK INSULATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-TI-01C		Lab Sample ID: 691601366-0157				
Sample Description: 1ST FLOOR, MECHANICAL ROOM/SILVER TANK INSULATION						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	
Client Sample ID: 1-CTG-01A-Grout 1		Lab Sample ID: 691601366-0158				
Sample Description: COLUMNS OF ROOM 2406 (FOOD PROCESS)/GREY/WHITE CERAMIC TILE GROUT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	
Client Sample ID: 1-CTG-01A-Grout 2		Lab Sample ID: 691601366-0158A				
Sample Description: COLUMNS OF ROOM 2406 (FOOD PROCESS)/GREY/WHITE CERAMIC TILE GROUT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	



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EMSL Canada Order 691601366
Customer ID: 55JACQ30L
Customer PO: 123220690
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-CTG-01B-Grout 1 **Lab Sample ID:** 691601366-0159

Sample Description: COLUMNS OF ROOM 2406 (FOOD PROCESS)/GREY/WHITE CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-CTG-01B-Grout 2 **Lab Sample ID:** 691601366-0159A

Sample Description: COLUMNS OF ROOM 2406 (FOOD PROCESS)/GREY/WHITE CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	

Client Sample ID: 1-CTG-01C-Grout 1 **Lab Sample ID:** 691601366-0160

Sample Description: COLUMNS OF ROOM 2406 (FOOD PROCESS)/GREY/WHITE CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-CTG-01C-Grout 2 **Lab Sample ID:** 691601366-0160A

Sample Description: COLUMNS OF ROOM 2406 (FOOD PROCESS)/GREY/WHITE CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	White	0%	100%	None Detected	

Client Sample ID: 1-CTG-02A **Lab Sample ID:** 691601366-0161

Sample Description: WALLS OF ROOM 2305/GREY CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Brown	0%	100%	None Detected	

Client Sample ID: 1-CTG-02B **Lab Sample ID:** 691601366-0162

Sample Description: WALLS OF ROOM 2305/GREY CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Brown	0%	100%	None Detected	

Client Sample ID: 1-CTG-02C-Grout 1 **Lab Sample ID:** 691601366-0163

Sample Description: WALLS OF ROOM 2305/GREY CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Gray	0%	100%	None Detected	

Client Sample ID: 1-CTG-02C-Grout 2 **Lab Sample ID:** 691601366-0163A

Sample Description: WALLS OF ROOM 2305/GREY CERAMIC TILE GROUT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	10/24/2016	Brown	0%	100%	None Detected	



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EMSL Canada Order 691601366
 Customer ID: 55JACQ30L
 Customer PO: 123220690
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 1-SC-01A		Lab Sample ID: 691601366-0164				
Sample Description: LOWER WEST ROOF, LOWER SKYLIGHT/BLACK RUBBERY CAULKING ON SKYLIGHT SEAMS AND BOLT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-SC-01B		Lab Sample ID: 691601366-0165				
Sample Description: LOWER WEST ROOF, LOWER SKYLIGHT/BLACK RUBBERY CAULKING ON SKYLIGHT SEAMS AND BOLT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-SC-01C		Lab Sample ID: 691601366-0166				
Sample Description: LOWER WEST ROOF, LOWER SKYLIGHT/BLACK RUBBERY CAULKING ON SKYLIGHT SEAMS AND BOLT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Gray	0.0%	100%	None Detected	
Client Sample ID: 1-SC-02A		Lab Sample ID: 691601366-0167				
Sample Description: LOWER WEST ROOF, LOWER SKYLIGHT/BLACK STICKY CAULKING ON SKYLIGHT BETWEEN FRAME AND FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	
Client Sample ID: 1-SC-02B		Lab Sample ID: 691601366-0168				
Sample Description: LOWER WEST ROOF, LOWER SKYLIGHT/BLACK STICKY CAULKING ON SKYLIGHT BETWEEN FRAME AND FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/21/2016	Black	0.0%	100%	None Detected	
Client Sample ID: 1-SC-02C		Lab Sample ID: 691601366-0169				
Sample Description: LOWER WEST ROOF, LOWER SKYLIGHT/BLACK STICKY CAULKING ON SKYLIGHT BETWEEN FRAME AND FLASHING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	10/24/2016	Black	0.0%	100%	None Detected	



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EMSL Canada Order 691601366
Customer ID: 55JACQ30L
Customer PO: 123220690
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Analyst(s):

Kathleen Cruz PLM (48)
PLM Grav. Reduction (17)
Nicole Yeo PLM (44)
PLM Grav. Reduction (54)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 10/25/2016 09:20:02

**EMSL Canada Inc.**

2756 Slough Street, Mississauga, ON L9T 5N4

Phone/Fax: 289-997-4602 / (289) 997-4607

<http://www.EMSL.com>torontolab@emsl.com

EMSL Canada Or 551611205
CustomerID: 55JACQ30L
CustomerPO: 123220690
ProjectID:

Attn: **Steve Chou**
Stantec Consulting, Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 10/18/16 10:41 AM
Collected:

Project: **SUMMERLANDAGRI/123220690 - 1- ADMINISTRATIVE/LABORATORY****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

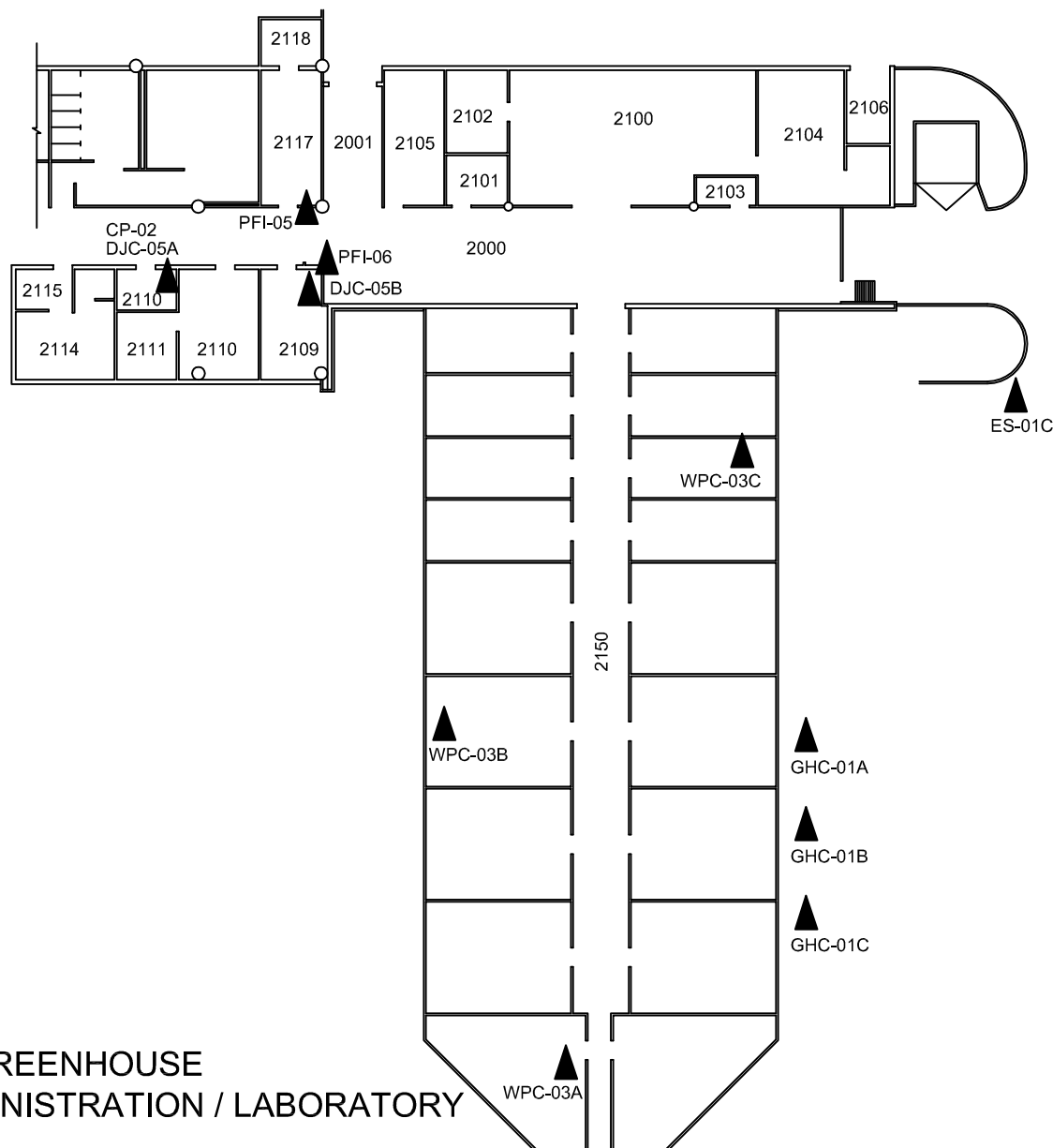
<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
1-P-01	551611205-0001 Site: Structural Steel Desc: Red Insufficient sample to reach reporting limit.	10/24/2016		<140 ppm
1-P-02	551611205-0002 Site: Interior Walls Desc: Beige	10/24/2016		<90 ppm
1-P-03	551611205-0003 Site: Interior Walls Desc: White	10/24/2016		<90 ppm
1-P-04	551611205-0004 Site: Interior Trim Desc: Tan	10/24/2016		2100 ppm
1-P-05	551611205-0005 Site: Exterior Walls Desc: Beige	10/24/2016		<90 ppm

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 10/25/2016 09:05:06



GREENHOUSE BUILDING 1 - ADMINISTRATION / LABORATORY

LEGEND

▲ ASBESTOS BULK SAMPLE

NOTES: 1. BLACK STICKY WINDOW PANE CAULKING APPLIED BETWEEN GLASS AND FRAME THROUGHOUT GREENHOUSE IS ASBESTOS-CONTAINING.
2. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE, 4200 97 HIGHWAY, SUMMERLAND BC

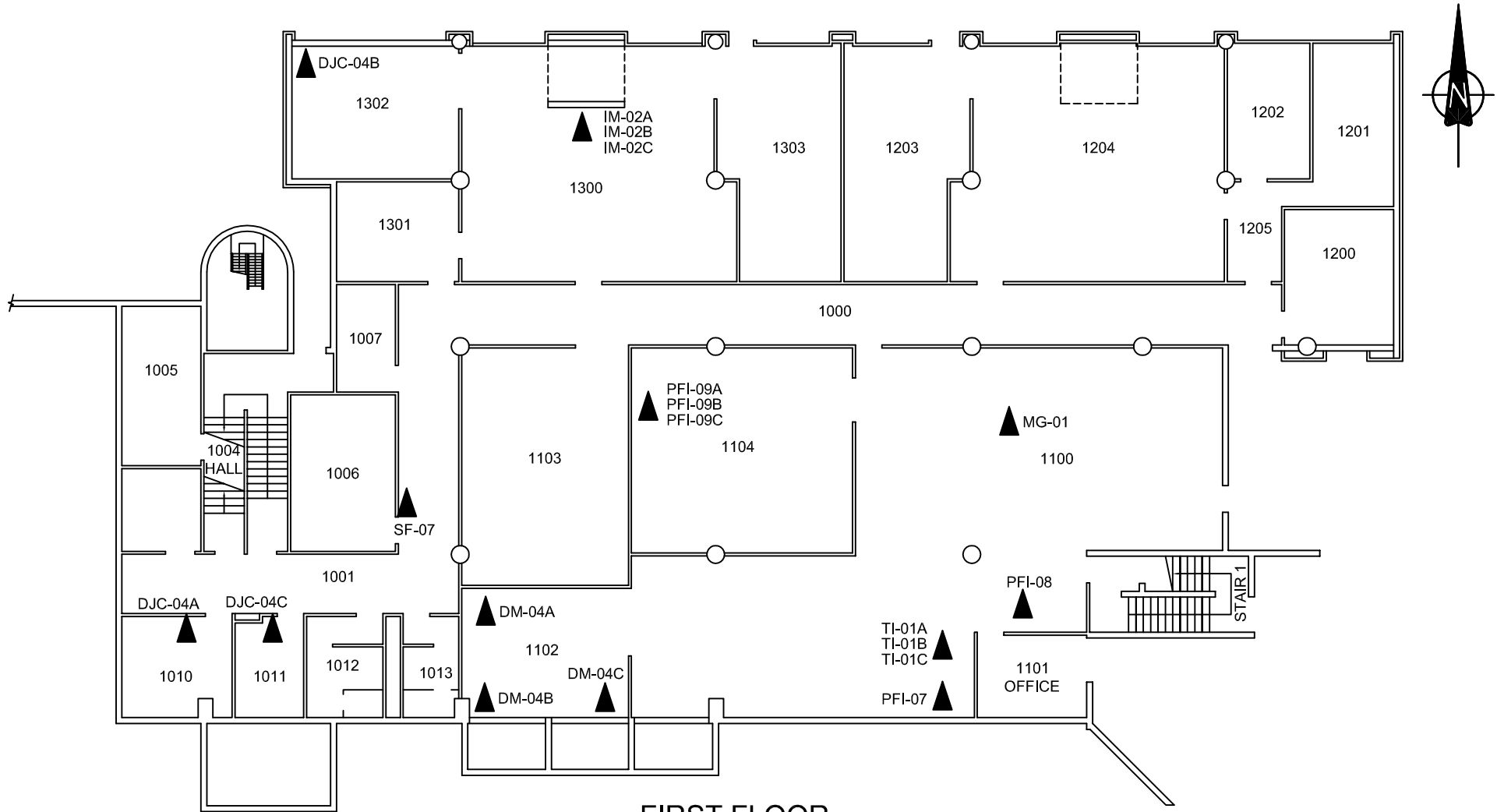
Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)

Project No.:	123220690
Scale:	N.T.S.
Date:	16/11/17
Dwn. By:	CD <small>SL2016110568 VM/DM</small>
App'd By:	TW

Dwg. No.:

B1





**FIRST FLOOR
BUILDING 1 - ADMINISTRATION / LABORATORY**

LEGEND

ASBESTOS BULK SAMPLE

- NOTES:** 1. BROWN WINDOW FRAME CAULKING APPLIED TO INTERIOR WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
 2. BLACK WINDOW PANE CAULKING APPLIED TO INTERIOR PARTITION WINDOWS AND FLOOR TO CEILING WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
 3. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

**FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS
AND BULK SAMPLE LOCATIONS**

SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE, 4200 97 HIGHWAY, SUMMERLAND BC

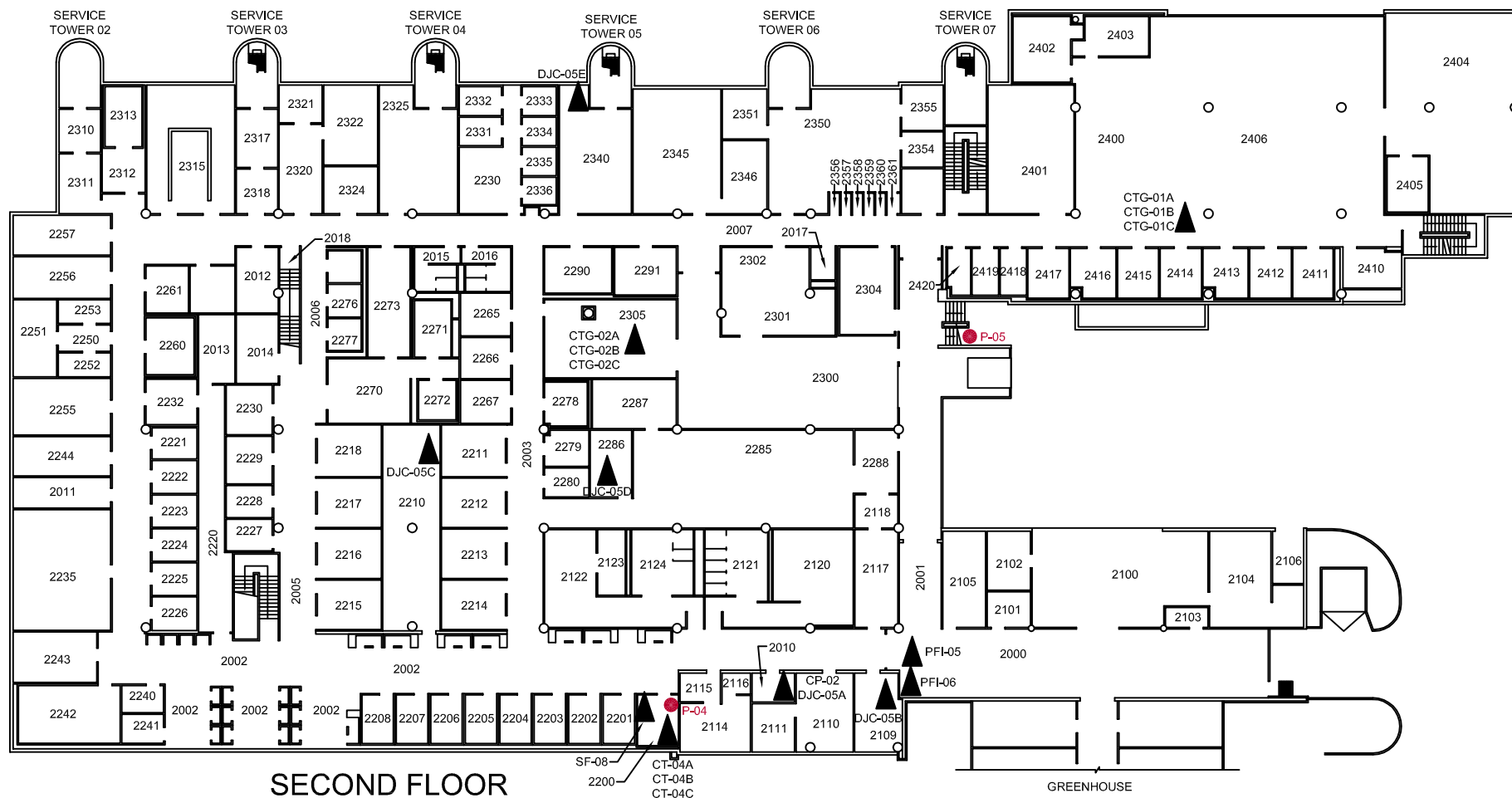
Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)

Project No.: 123220690
Scale: N.T.S.
Date: 16/12/06
Dwn. By: CD <small>SL2016120032 VM/DM</small>
App'd By: TW

Dwg. No.:



B2





SECOND FLOOR BUILDING 1 - ADMINISTRATION / LABORATORY

LEGEND

-  ASBESTOS BULK SAMPLE
-  PAINT CHIP SAMPLE LOCATION

- NOTES:**
1. BLACK FIBERGLASS INSULATION MASTIC THROUGHOUT SERVICE TOWER WALLS AND PENTHOUSE WALLS IS ASBESTOS-CONTAINING.
 2. RED MASTIC APPLIED TO THE SEAMS OF HVAC DUCTING THROUGHOUT PENTHOUSE AND SERVICE TOWERS IS ASBESTOS-CONTAINING.
 3. BROWN WINDOW FRAME CAULKING APPLIED TO INTERIOR WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
 4. BLACK WINDOW PANE CAULKING APPLIED TO INTERIOR PARTITION WINDOWS AND FLOOR TO CEILING WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
 5. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE, 4200 97 HIGHWAY, SUMMERLAND BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)

Project No.:	123220690
Scale:	N.T.S.
Date:	16/11/17
Dwn. By:	CD <small>SL2016110570</small> VM/DM
App'd By:	TW

Dwg. No.:

B3



LEGEND

▲ ASBESTOS BULK SAMPLE

- NOTES:** 1. BLACK FIBERGLASS INSULATION MASTIC THROUGHOUT SERVICE TOWER WALLS AND PENTHOUSE WALLS IS ASBESTOS-CONTAINING.
2. RED MASTIC APPLIED TO THE SEAMS OF HVAC DUCTING THROUGHOUT PENTHOUSE AND SERVICE TOWERS IS ASBESTOS-CONTAINING.
3. BROWN WINDOW FRAME CAULKING APPLIED TO INTERIOR WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
4. BLACK WINDOW PANE CAULKING APPLIED TO INTERIOR PARTITION WINDOWS AND FLOOR TO CEILING WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
5. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Project No.:	123220690
Scale:	N.T.S.
Date:	16/12/06
Dwn. By:	CD ^{SL2016120031} _{VM/DM}
App'd By:	TW

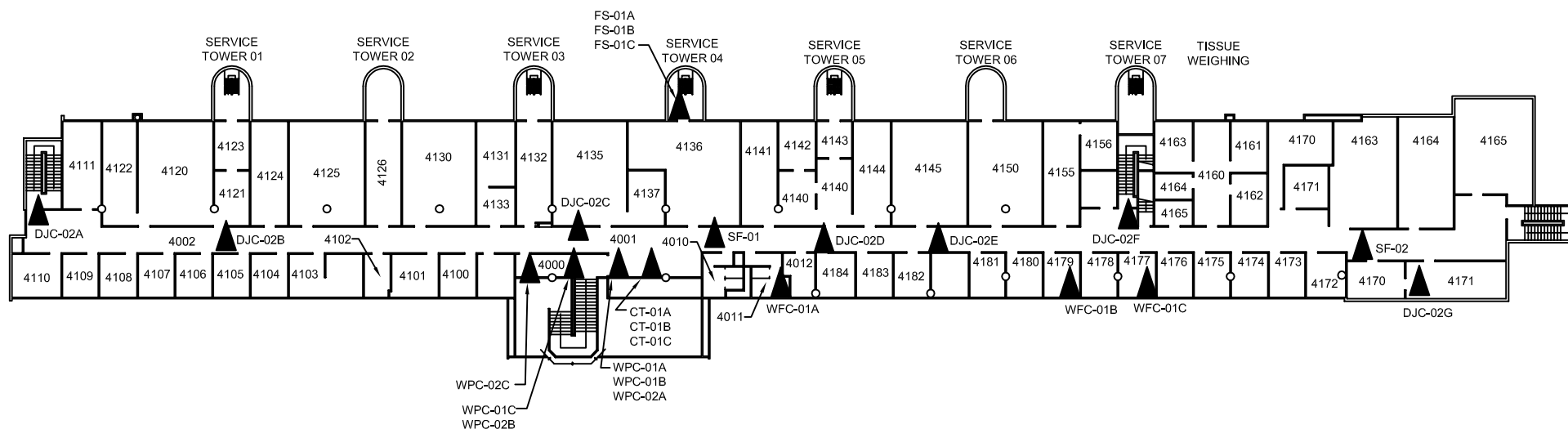
Dwg. No.:

B4



SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE, 4200 97 HIGHWAY, SUMMERLAND BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)



FOURTH FLOOR BUILDING 1 - ADMINISTRATION / LABORATORY

LEGEND

ASBESTOS BULK SAMPLE

- NOTES:**
1. BLACK FIBERGLASS INSULATION MASTIC THROUGHOUT SERVICE TOWER WALLS AND PENTHOUSE WALLS IS ASBESTOS-CONTAINING.
 2. RED MASTIC APPLIED TO THE SEAMS OF HVAC DUCTING THROUGHOUT PENTHOUSE AND SERVICE TOWERS IS ASBESTOS-CONTAINING.
 3. BROWN WINDOW FRAME CAULKING APPLIED TO INTERIOR WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
 4. BLACK WINDOW PANE CAULKING APPLIED TO INTERIOR PARTITION WINDOWS AND FLOOR TO CEILING WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
 5. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

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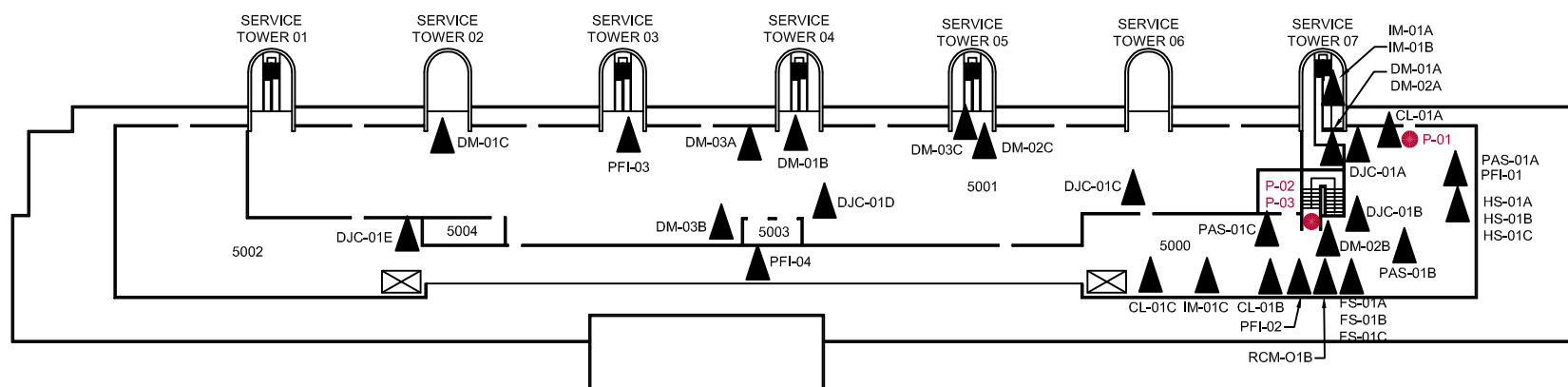
Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)

Project No.: 123220690
Scale: N.T.S.
Date: 16/11/17
Dwn. By: CD <small>SL2016110572 VM/DM</small>
App'd By: TW

Dwg. No.:

B5





PENTHOUSE BUILDING 1 - ADMINISTRATION / LABORATORY

LEGEND

- ASBESTOS BULK SAMPLE
- PAINT CHIP SAMPLE LOCATION

NOTES: 1. BLACK FIBERGLASS INSULATION MASTIC THROUGHOUT SERVICE TOWER WALLS AND PENTHOUSE WALLS IS ASBESTOS-CONTAINING.
2. RED MASTIC APPLIED TO THE SEAMS OF HVAC DUCTING THROUGHOUT PENTHOUSE AND SERVICE TOWERS IS ASBESTOS-CONTAINING.
3. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE, 4200 97 HIGHWAY, SUMMERLAND BC

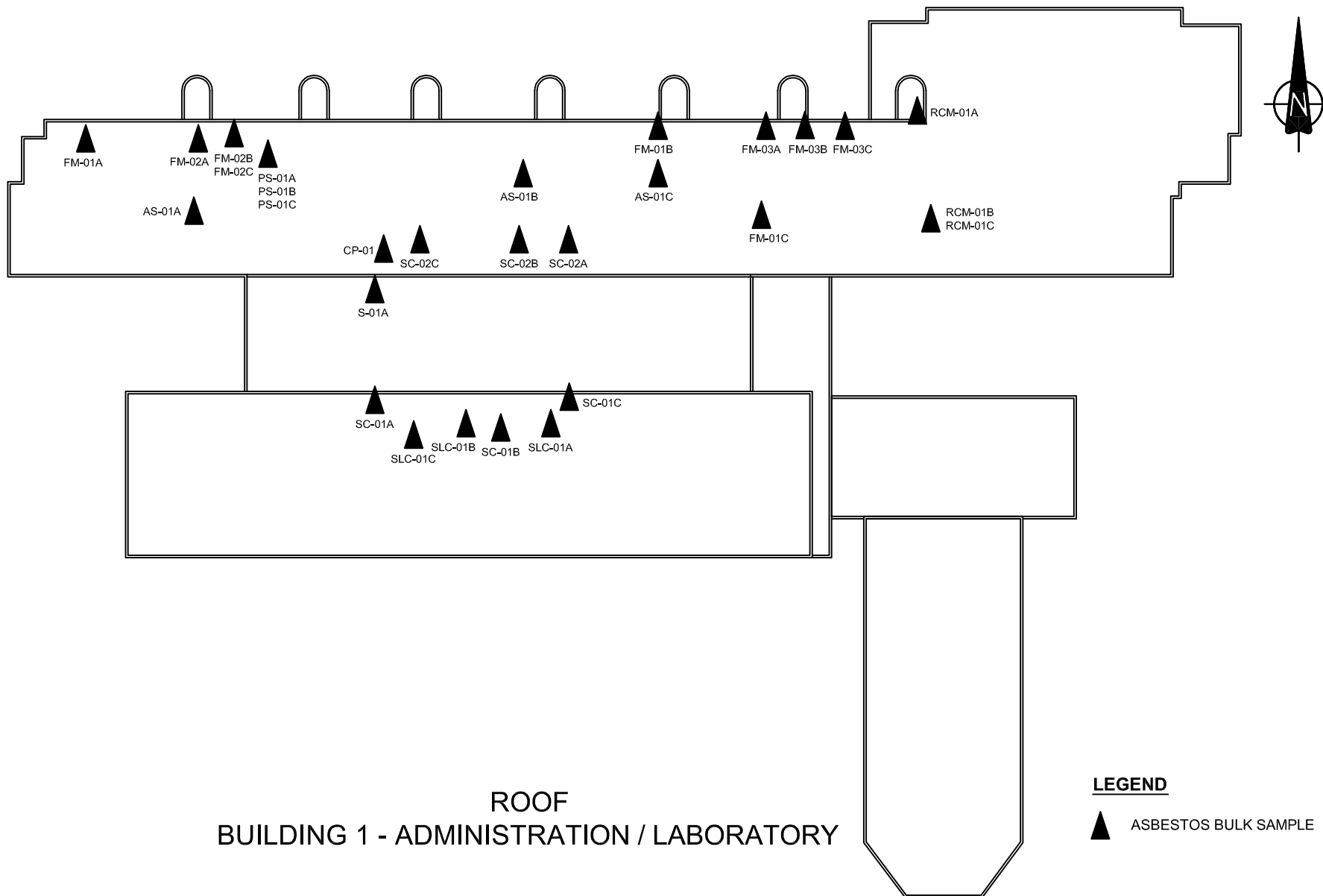
Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)

Project No.: 123220690
Scale: N.T.S.
Date: 16/11/17
Dwn. By: CD <small>SL2016110573</small>
App'd By: TW

Dwg. No.:

B6





FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE, 4200 97 HIGHWAY, SUMMERLAND BC		Project No.:	123220690	Dwg. No.: B7	
		Scale:	N.T.S.		
		Date:	16/11/17		
		Dwn. By:	CD <small>SL2016110574 VM/DM</small>		
Client:	PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PACIFIC REGION (PWGSC)	App'd By:	TW		

**ELEVATOR REPLACEMENT AT
SUMMERLAND RESEARCH AND DEVELOPMENT CENTRE
SUMMERLAND, BC**

APPENDIX 5

**PROJECT SPECIFIC PRE-RENOVATION HAZARDOUS BUILDING MATERIALS
ASSESSMENT REPORT**

PROJECT SPECIFIC PRE-RENOVATION HAZARDOUS BUILDING MATERIALS ASSESSMENT REPORT

Client:	PSPC	Client Project #:	700457412
Stantec Site Assessor:	Kim Wiese	Stantec Project #:	123221384
		Date of Site Visit:	July 2, 2019
Location:	4200 Highway 97, Summerland, BC	Date:	July 15, 2019

Reference: **Admin/Laboratory Building Elevator Replacement**

Stantec was retained by Public Services and Procurement Canada (PSPC) on behalf of Agriculture and Agri-Food Canada (AAFC) to provide a project specific pre-renovation hazardous building materials assessment at the Admin/Laboratory Building located at 4200 Highway 97 in Summerland, BC (subject building).

Stantec understands that a renovation project is planned within the subject building that will involve replacement of one passenger elevator and one freight elevator (the Project).

The purpose of the site review was to check for hazardous building materials that may require special handling and/or disposal practices as part of the Project, in accordance with the requirements of the Canada Labour Code Part II (Canada Labour Code) and the current version of British Columbia's Occupational Health & Safety Regulation (BC Reg. 296/97).

BACKGROUND

A previous assessment was completed within the subject building, with results detailed in the following report (Previous Report):

- Stantec report for Project No. 123220690 entitled "Hazardous Building Materials Assessment; 18 Buildings at the Summerland Research and Development Centre, Summerland, BC" dated December 14, 2016, and prepared for Public Works and Government Services Canada

According to the Previous Report, the following hazardous building materials were known to be present:

- Identified ACMs
 - Black fiberglass insulation mastic throughout service tower walls and penthouse walls
 - Red mastic applied to the seams of HVAC ducting throughout the penthouse and service towers
 - Brown window frame caulking applied to interior windows throughout
 - Black window pane caulking applied to interior partition windows and floor to ceiling windows throughout
 - Black sticky window pane caulking applied between glass and frame throughout the greenhouse
 - Black roof cap mastic applied between flashing and black roof paper on the upper roof (<1% Chrysotile detected, limited sample available without compromising integrity of seal. Should be presumed ACM until proven otherwise by further sample analysis)

Admin/Laboratory Building Elevator Replacement

- Identified Lead and LCPs
 - Tan coloured paint on interior metal trim
 - Lead is expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, in bell fittings for cast iron pipes, in electrical equipment, ceramic tile glaze, and vent and pipe flashings
- Mercury
 - Mercury vapour is present in the light tubes/bulbs in the approximately 2,500 fluorescent light fixtures observed throughout
 - Mercury may also be present in paints and adhesives
- Silica
 - Silica is presumed to be present in ceramic tiles, asphalt, drywall, mortar, vinyl floor tiles, ceiling tiles, concrete, cement and masonry block and interior wall finishes observed in various locations

As the previous report was non-destructive in nature, additional project-specific information pertaining to the identity, location and approximate extent of hazardous building materials (if any) that may be impacted by the Project was required.

STANDARDS, SCOPE AND METHODOLOGY

Site work was conducted in general compliance with the requirements of the COHSR, BC Reg. 296/97 and Stantec's Safe Work Practices (SWPs).

Mechanical systems, structures and finishes were visually examined to determine the suspected presence of the following suspected hazardous building materials that were expected to be impacted by the Project:

- Asbestos-containing materials (ACMs)
- Lead, including lead-containing paints (LCPs)
- Other hazardous building materials including electrical equipment containing polychlorinated biphenyls (PCBs); building materials impacted by mould; electrical items containing mercury; equipment that may contain ozone-depleting substances (ODSs); and materials presumed to contain silica.

Applicable standards for hazardous building materials considered during this assessment are summarized below, along with the scope and methodology completed pertaining to hazardous materials during this assessment.

- Asbestos
 - According to the COHSR, ACM means any article that is manufactured and contains 1% or more asbestos (by weight) at the time of manufacture, or any material that contains 1% or more asbestos when tested in accordance with accepted methods.
 - According to the current version of BC Reg. 296/97, ACM means any material containing at least 0.5% asbestos, or vermiculite insulation with any asbestos.
 - As provincially regulated workers (e.g., contractors) are expected to carry out work activities associated with the Project, and as the provincial regulations have a more stringent definition of ACM, and generally include the requirements noted in the COHSR, this assessment was conducted to meet the asbestos-related requirements of BC Reg. 296/97.

Admin/Laboratory Building Elevator Replacement

- Where observed, samples were collected from each “homogenous application” of additional suspected ACMs (materials suspected to contain asbestos that are uniform in material type, colour, texture application and estimated installation date) that was anticipated to be impacted by the Project, and submitted to EMSL Canada Inc. (EMSL) in Vancouver, BC for analysis of asbestos content using polarized light microscopy (PLM) with dispersion staining, in accordance with the United States Environmental Protection Agency (EPA) 600/R-93/116 analytical method “Asbestos (bulk) by PLM.” EMSL’s analytical laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).
 - o In some instances, supplemental samples were collected from materials that were sampled in the Previous Report. Such sampling was conducted to verify previous results, where appropriate, and/or to provide more definitive project-specific information.
- The number of samples collected for each homogenous application of a suspected ACM was based on the recommendations provided in the 2017 WorkSafeBC publication “Safe Work Practices for Handling Asbestos”, (BC Asbestos Guide) along with the assessor’s experience and understanding of the consistency of the observed building material applications.
- Lead
 - Work involving lead, LCPs and lead-containing coatings pertaining to provincially regulated contractors (expected to undertake work of the Project) in British Columbia is to be conducted in accordance with applicable regulations, guidelines and standards including, but not limited to the current versions of the following, at a minimum (which would meet or exceed the requirements of the COHSR):
 - o The WorkSafeBC 2017 publication entitled *Safe Work Practices for Handling Lead* (BC Lead Guide)
 - o BC Reg. 296/97
 - With respect to potential lead exposures associated with disturbance to surfaces coated with lead-containing products, the 2011 WorkSafeBC publication entitled *Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry*, indicates the following:
 - o The improper removal of lead paint containing 600 mg/kg (equivalent to “parts per million” or “ppm”) lead results in airborne lead concentrations that exceed half of the exposure limit.
 - The exposure limit indicated in both the COHSR and BC Reg. 296/97 is 0.05 mg/m³.
 - This potential for exposure exceeding half of the occupational exposure limit would be the trigger for implementation of an exposure control plan.
 - o Lead concentrations as low as 90 mg/kg may present a risk to pregnant women and children.
 - Any risk assessment should include for the presence of high risk individuals within the workplace.
 - In addition to the above, the BC Lead Guide indicates the following:
 - o Unlike for asbestos-containing material, WorkSafeBC does not numerically define what would be considered a lead-containing paint or coating. All suspected paints or coatings should be tested for lead because, depending on the nature of the work, even a small amount could pose a risk to workers. In order to determine which controls and personal protective equipment would be required for a particular job, a qualified person must consider this information as part of the risk assessment.
 - Additionally, using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. The following information is provided in the BC Lead Guide:
 - o Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m³ (16 times the exposure limit).

Admin/Laboratory Building Elevator Replacement

- o Given this information and that the analytical detection limit for lead paint analysis is 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.
- Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.
- Samples of potential lead-containing paints (LCPs) were collected from major paint applications on building materials. The sampling of paint applications involved the collection of paint chip samples of paint layers to the substrate, where possible. Samples collected were submitted to EMSL for analysis of total lead content using EPA Method SW 846 3050B*/7000B. EMSL's analytical laboratory is also accredited by the AIHA Environmental Lead Laboratory Approval Program (ELLAP).
- Other hazardous building materials
 - Various other hazardous building materials may be present that would have special handling and/or disposal considerations if they were to be impacted by the Project.
 - Assessment for the presence of other hazardous building materials was completed through visual means, as follows, specifically pertaining to building materials expected to be impacted during the Project:
 - o Visual review for the presence of PCBs in electrical equipment was completed. Equipment that is generally suspected of containing PCBs includes lamp ballasts, transformers, hydraulic systems, compressors, switchgear and capacitors. No sampling of dielectric fluids was undertaken as part of this assessment.
 - o Presence of suspect visible mould was assessed through visual observations. Material observed with dark-coloured staining and/or a textured and discoloured appearance is described as “suspected mould”. Mould identified visually is defined as “suspected mould” unless it is confirmed as mould by laboratory analysis.
 - o Assessment for equipment likely to contain ODSs was completed. Information on the type of equipment, manufacturer and type and quantity of refrigerants was recorded, where available
 - o Assessment for electrical equipment that is likely to contain mercury was completed visually. Information on the type of equipment (i.e., light tubes, gauges, switches, batteries, thermometers, etc.), and quantities was recorded, where such information was available.
 - o Assessment for the presence of silica was conducted. The presence of silica in building materials such as concrete, masonry, stone, terrazzo, refractory brick, ceramic tile, ceiling tile etc. was noted.

SITE REVIEW RESULTS

The passenger elevator that will be replaced during the Project travels on three floors. The passenger elevator unit includes vinyl sheet flooring inside of a steel construction, which is present in a concrete elevator shaft with metal doors and frames.

The freight elevator that will be replaced during the Project travels on five floors. The freight elevator unit includes vinyl sheet flooring inside and a steel construction in a concrete elevator shaft with metal doors and frames.

The Project will reportedly impact building materials including, but not limited to, the following:

- Roofing – new penetrations to be created for rooftop vents
- Wall materials – wiring installations, and call-button installation
- Flooring materials – new elevator cars to be installed

The table below summarizes the findings of Stantec's assessment and sampling activities undertaken at the subject building specifically in relation to building materials that are expected to be disturbed during the Project.

Table 1 Assessment Summary


Location	Hazardous Building Material Observations	Photo	Samples collected?	Analytical Results
Throughout	Asbestos-containing material (ACMs) identified in the Previous Report are not expected to be impacted by work of the Project	N/A	N/A	N/A
Roof (single consistent roof type)	Suspected ACM – 2 ply torch on roofing (1 st layer), roofing board (2 nd layer), roofing gyprock (3 rd layer) – will be impacted by the Project		Layer 1: R-01A R-01B R-01C Layer 2: R-02A R-02B R-02C Layer 3: R-03A R-03B R-03C	No Asbestos Detected

Table 1 Assessment Summary




Location	Hazardous Building Material Observations	Photo	Samples collected?	Analytical Results
Freight elevator and passenger elevator	Suspected ACM - Mosaic vinyl sheet flooring in elevators will be impacted by the Project		SF-01	No Asbestos Detected
Threads of sprinkler lines throughout	Suspected ACM - Grey pipe sealant applied to threads of sprinkler lines is anticipated to be impacted by the Project		PS-01A PS-01B PS-01C	No Asbestos Detected
Interior walls around elevator	Drywall joint compound applied to walls around the elevator will be impacted by the Project. Previously indicated as non-ACM, supplemental assessment/sampling completed to provide area-specific results		DJC-01A DJC-01B DJC-01C	No Asbestos Detected

Table 1 Assessment Summary



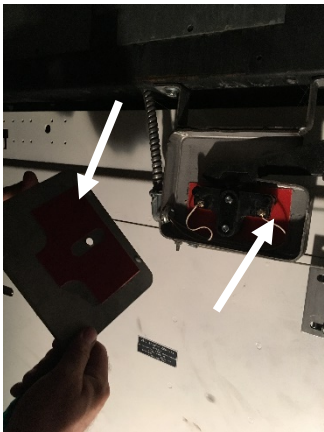


Location	Hazardous Building Material Observations	Photo	Samples collected?	Analytical Results
Interior walls around elevator	Suspected ACM - White vinyl wall covering on drywall walls around the elevators will be impacted by the Project		VC-01	No Asbestos Detected
Elevator shafts	Eight switches are located within the freight elevator shaft and six switches located in the passenger elevator. These switches were reported to potentially contain ACM paper layer. The switches were not able to be inspected and are presumed to be asbestos-containing and will be impacted by the Project.		N/A	Presumed ACM (PACM) if paper layer is present
Elevator shafts	Door locks located within the elevator shaft were reported to potentially contain ACM. One lock from each elevator shaft was dismantled and inspected and suspected ACMs were not observed.		N/A	N/A

Table 1 Assessment Summary

Location	Hazardous Building Material Observations	Photo	Samples collected?	Analytical Results
Passenger elevator machine room	Concrete block walls were identified in the passenger elevator machine room. To assess for the presence of vermiculite insulation (a potential ACM) the block wall cavity was drilled in two locations and no vermiculite was observed (block cavities were void of insulation).		N/A	N/A
Throughout	Lead-containing paints (LCPs) identified in the Previous Report are not expected to be impacted by work of the Project	N/A	N/A	N/A
Concrete walls	Suspected LCP - White coloured paint applied to concrete walls of the elevator machine rooms will be impacted by the Project		P-01	<140 ppm




Inspection date: July 2, 2019

Project Number: 123221384

Client Project Number: 700457412

Admin/Laboratory Building Elevator Replacement

Table 1 Assessment Summary

Location	Hazardous Building Material Observations	Photo	Samples collected?	Analytical Results
Concrete floors	Suspected LCP - Red coloured paint applied to concrete floors of the elevator machine rooms will be impacted by the Project		P-02	<170 ppm
Metal elevator machines	Suspected LCP - Blue coloured paint applied to the metal casing of the elevator machines will be impacted by the Project		P-03	<260 ppm
Metal doors and frames	Suspected LCP - Tan coloured paint applied to the metal doors and frames of the elevators and machine rooms will be impacted by the Project		P-04	450 ppm


Inspection date: July 2, 2019

Project Number: 123221384

Client Project Number: 700457412

Admin/Laboratory Building Elevator Replacement

Table 1 Assessment Summary

Location	Hazardous Building Material Observations	Photo	Samples collected?	Analytical Results
Elevators and machine rooms	PCBs may be present in the fluorescent light ballasts of the approximately 10 light fixtures observed, which may be impacted by the Project. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons.	N/A	N/A	N/A
Elevators and machine rooms	Mercury vapour is present in the light tubes within the approximately 10 fluorescent light fixtures observed, which may be impacted by the Project.	N/A	N/A	N/A
Throughout	Suspect mould was not observed during the assessment.	N/A	N/A	N/A
Throughout	Silica is expected to be present in the asphalt roofing materials, masonry blocks, concrete floor and walls of the elevator shafts and machine rooms, which will be impacted by the Project.		N/A	N/A
N/A	ODS-containing equipment was not observed.	N/A	N/A	N/A

The certificates of analysis for the sample submitted as part of this project, as provided by EMSL, is attached to this document, for reference.

CONCLUSIONS AND RECOMMENDATIONS

Based on the visual assessment and results of laboratory analyses for samples collected as part of this assessment as well as our review of the information provided in the Previous Report, the following hazardous building materials were identified which may require alteration (handling, alteration, disturbance, removal and/or disposal) as part of the Project:

- Fourteen switches within the elevator shaft may have asbestos-containing layers as internal components
 - These switches were unable to be inspected and should be evaluated during removal
- Approximately 10 light fixtures with potential PCB-containing ballasts
- Mercury vapour is present in the light tubes within the approximately 10 fluorescent light fixtures observed
- Silica-containing asphalt roofing materials, masonry blocks, concrete floor and walls of the elevator shafts and machine rooms

Stantec recommends the following with regards to meeting the requirements of the Canada Labour Code, the Asbestos Guide and BC Reg. 296/97, as they pertain to renovation:

- Asbestos
 - ACMs that may be during the Project should be altered, handled and/or removed by appropriately trained personnel (e.g., asbestos abatement contractor personnel), in accordance with the requirements of the COSHR, BC Reg. 296/97 and the Asbestos Guide.
 - Prior to activities that would disturb them, undertake testing of PACMs that may be impacted to determine their asbestos content. Confirmed ACMs should be handled accordingly.
 - o This would include dismantling of elevator switches to assess for potential ACM paper layers
 - Should a material suspected to contain asbestos fibres become uncovered during renovation and/or demolition activities, 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 asbestos fibres are present. Confirmed asbestos materials should be handled in accordance with applicable guidelines and regulations.
 - Suspected ACMs deemed visually similar to the ACMs identified in this report and the Previous Report should be considered asbestos-containing and handled as such, unless otherwise proven, through analytical testing.
 - Ensure asbestos containing waste is handled, stored, and disposed of in accordance with the requirements of the Federal Transportation of Dangerous Goods Regulation and the British Columbia Hazardous Waste Regulation (BC Reg. 63/88).
- Lead
 - If paints or are to be disturbed and/or removed, ensure compliance with the following:
 - o Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the BC Lead Guide
 - o Transportation and disposal requirements of BC Reg. 63/88
 - o Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
 - Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding). Airborne lead dust or fumes should not exceed the BC Reg. 296/97 8-hour Occupational Exposure Limit (OEL) of 0.05 milligram per cubic metre (mg/m³) during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust.

Admin/Laboratory Building Elevator Replacement

- Actual methods to maintain exposures within applicable limits are to be determined by the contractor through their own risk assessment, which will take into account the lead content of the paints as indicated herein, along with their planned disturbance methods (and associated dust control), tools, PPE and the overall duration of the work.
- Any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person. Development of such risk assessments and work practices will involve consideration of information including, but not limited to, the following:
 - o Composition of the material to be disturbed
 - o Lead content of the paint coating
 - o Methods and tools to be used, including exhaust ventilation
 - o Duration of the work/work shift
 - o Training of the personnel conducting the task
 - o Respiratory protection program in effect
- PCBs
 - When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada 1991 publication “Identification of Lamp Ballasts Containing PCBs”, (or equivalent reference)
 - PCB-containing items identified for removal and disposal should be handled, transported, stored and disposed of in accordance with the following:
 - o Transportation and disposal requirements of BC Reg. 63/88
 - o Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
 - o Federal PCB Regulations (SOR/2008-273)
- Mercury
 - Complete removal of mercury-containing equipment is required prior to renovation activities that may disturb the equipment. When mercury-containing items (e.g., fluorescent light bulbs/tubes) are removed, ensure all mercury waste is handled, stored and disposed of in accordance with the requirements of the disposal requirements of the following:
 - o Disposal requirements of BC Reg. 63/88
 - o Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
 - 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/m³ 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.
- Silica
 - When silica-containing materials are to be disturbed during the Project, ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by BC Reg. 296/97 (cristobalite and quartz—each 0.025 mg/m³). This would include, but not be limited to, the following:
 - o Providing workers with respiratory protection
 - o Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
 - o Providing workers with facilities to properly wash prior to exiting the work area
- Other hazardous building materials
 - As no other hazardous building materials were observed, no recommendations have been developed
 - If additional materials are uncovered during renovation that are thought to be hazardous, additional assessment should be conducted to determine the appropriate handling, removal and/or disposal requirements.

LIMITATIONS

In preparation of this report, Stantec used professional judgment based on experience. The work was conducted in accordance with generally accepted professional standards. Stantec relied on information from the Previous Report, information gathered during the site investigation and laboratory analytical reports.

This report reflects the observations made within accessible and accessed portions of the subject building, and the results of analyses performed on the specific material sampled during the assessment. Analytical results reflect the sampled material at the specific sample locations.

This assessment was conducted pertaining only to those building materials anticipated to be impacted by the Project and general exposed materials within the areas expected to be impacted by the Project. This assessment does not constitute a comprehensive hazardous building materials assessment for the subject building.

This report has been prepared for the exclusive use of Public Services and Procurement Canada (PSPC) on behalf of Agriculture and Agri-Food Canada (AAFC). Any use that a third party makes of this report, or reliance on, or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Inspection date: July 2, 2019

Project Number: 123221384

Client Project Number: 700457412

Admin/Laboratory Building Elevator Replacement

CLOSING

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this document, we request that we be notified immediately to reassess the information provided herein.

We trust that the document meets your current requirements. Should you have any questions or concerns regarding the above, please do not hesitate to contact the undersigned.

Stantec Consulting Ltd.

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Senior Associate
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Attachment: Suspected ACM Sample Analytical Record (EMSL)—3 pages
 Suspected LCP Sample Analytical Record (EMSL)—1 page



EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1
 Phone/Fax: (604) 757-3158 / (604) 757-4731
<http://www.EMSL.com> / vancouverlab@EMSL.com

EMSL Canada Order 691901699
 Customer ID: 55JACQ30L
 Customer PO: 123221384
 Project ID:

Attn: Kim Wiese
 Stantec Consulting Ltd.
 500 - 4730 Kingsway
 Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 7/05/2019
Analyzed: 7/08/2019

Proj: 123221384

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: R-01A **Lab Sample ID:** 691901699-0001

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/2 PLY SBF ROOFING (LAYER 1)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Brown	0.0%	100%	None Detected	

Client Sample ID: R-01B **Lab Sample ID:** 691901699-0002

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/2 PLY SBF ROOFING (LAYER 1)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Brown	0.0%	100%	None Detected	

Client Sample ID: R-01C **Lab Sample ID:** 691901699-0003

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/2 PLY SBF ROOFING (LAYER 1)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Brown	0.0%	100%	None Detected	

Client Sample ID: R-02A **Lab Sample ID:** 691901699-0004

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/BOARD (LAYER 2)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Brown	0.0%	100%	None Detected	

Client Sample ID: R-02B **Lab Sample ID:** 691901699-0005

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/BOARD (LAYER 2)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Brown	0.0%	100%	None Detected	

Client Sample ID: R-02C **Lab Sample ID:** 691901699-0006

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/BOARD (LAYER 2)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Brown	0.0%	100%	None Detected	

Client Sample ID: R-03A **Lab Sample ID:** 691901699-0007

Sample Description: ROOF ABOVE FREIGHT ELEVATOR/GYPROCK (LAYER 3)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	Gray	7.0%	93.0%	None Detected	No drywall joint compound



EMSL Canada Inc.

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EMSL Canada Order 691901699
 Customer ID: 55JACQ30L
 Customer PO: 123221384
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: R-03B **Lab Sample ID:** 691901699-0008
Sample Description: ROOF ABOVE FREIGHT ELEVATOR/GYPROCK (LAYER 3)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	Gray	7.0%	93.0%	None Detected	No drywall joint compound

Client Sample ID: R-03C **Lab Sample ID:** 691901699-0009
Sample Description: ROOF ABOVE FREIGHT ELEVATOR/GYPROCK (LAYER 3)

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	Gray	7.0%	93.0%	None Detected	No drywall joint compound

Client Sample ID: SF-01 **Lab Sample ID:** 691901699-0010
Sample Description: PASSENGER ELEVATOR/MOSAIC SHEET FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	7/08/2019	Beige	0.0%	100%	None Detected	

Client Sample ID: PS-01A **Lab Sample ID:** 691901699-0011
Sample Description: SECOND FLOOR, HALLWAY 2006, UNDER STAIRS/GREY PIPE SEALANT APPLIED TO THREADS OF SPRINKLER LINES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/08/2019	Brown/Beige	0.0%	100.0%	None Detected	

Client Sample ID: PS-01B **Lab Sample ID:** 691901699-0012
Sample Description: SECOND FLOOR, HALLWAY 2006, UNDER STAIRS/GREY PIPE SEALANT APPLIED TO THREADS OF SPRINKLER LINES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/08/2019	Brown/Beige	0.0%	100.0%	None Detected	

Client Sample ID: PS-01C **Lab Sample ID:** 691901699-0013
Sample Description: SECOND FLOOR, HALLWAY 2006, UNDER STAIRS/GREY PIPE SEALANT APPLIED TO THREADS OF SPRINKLER LINES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/08/2019	Brown/Beige	0.0%	100.0%	None Detected	

Client Sample ID: DJC-01A **Lab Sample ID:** 691901699-0014
Sample Description: SECOND FLOOR, FREIGHT ELEVATOR/DRYWALL JOINT COMPOUND APPLIED OUTSIDE ELEVATOR WALLS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: DJC-01B **Lab Sample ID:** 691901699-0015
Sample Description: PENTHOUSE, FREIGHT ELEVATOR/DRYWALL JOINT COMPOUND APPLIED OUTSIDE ELEVATOR WALLS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	White	0.0%	100.0%	None Detected	



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EMSL Canada Order 691901699
Customer ID: 55JACQ30L
Customer PO: 123221384
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: DJC-01C

Lab Sample ID: 691901699-0016

Sample Description: PENTHOUSE, FREIGHT ELEVATOR/DRYWALL JOINT COMPOUND APPLIED OUTSIDE ELEVATOR WALLS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: VC-01

Lab Sample ID: 691901699-0017

Sample Description: THIRD FLOOR, FREIGHT ELEVATOR/WHITE VINYL WALL COVERING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/05/2019	White	2.0%	98.0%	None Detected	

Analyst(s):

Chloe Huang PLM Grav. Reduction (3)
Dane Sorochnik PLM (10)
PLM Grav. Reduction (4)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 07/08/2019 15:28:42

**EMSL Canada Inc.**

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EMSL Canada Or 551908077
CustomerID: 55JACQ30L
CustomerPO: 123221384
ProjectID:

Attn: **Kim Wiese**
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 07/05/19 10:56 AM
Collected: 7/3/2019

Project: **123221384****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

<i>Client SampleDescription</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>RDL</i>	<i>Lead Concentration</i>
P-01 551908077-0001	7/3/2019	7/5/2019	0.1411 g	140 ppm	<140 ppm
Site: White on Concrete Desc: First Floor, Room 1005, Elevator Machine Room, Walls Insufficient sample to reach reporting limit.					
P-02 551908077-0002	7/3/2019	7/5/2019	0.1159 g	170 ppm	<170 ppm
Site: Red on Concrete Desc: First Floor, Room 1005, Elevator Machine Room, Floor Insufficient sample to reach reporting limit.					
P-03 551908077-0003	7/3/2019	7/5/2019	0.0767 g	260 ppm	<260 ppm
Site: Blue on Metal Desc: First Floor, Room 1005, Elevator Machine Room, Elevator Insufficient sample to reach reporting limit.					
P-04 551908077-0004	7/3/2019	7/5/2019	0.2403 g	83 ppm	450 ppm
Site: Tan on Metal Desc: Second Floor, Room 2013, Elevator Machine Room, Door + Door Frame					

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Cert #2845.08; AIHA-LAP, LLC - ELLAP #196142

Initial report from 07/08/2019 09:02:54