



# Public Works and Government Services Canada

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SPECIFICATIONS for:

## **SINCLAIR CENTRE REVITALIZATION Phase 2**

**ISSUED FOR TENDER  
March 15, 2013**

**APPROVED BY:**

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Regional Manager, AES

2013.04.01  
Date

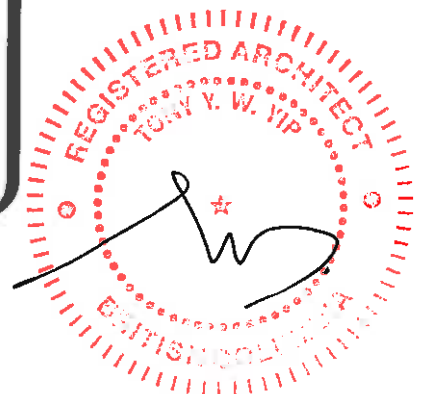
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13/04/02  
Date



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11	SIGN TYPE A20/21 INTERIOR DIRECTIONAL, SINGLE/DOUBLE FACED, FREESTANDING
12	SIGN TYPE A21.2 TEMPORARY INTERIOR DIRECTIONAL SINGLE FACED FREESTANDING
13	SIGN TYPE A21.3 INTERIOR DIRECTIONAL, SINGLE FACED, FREESTANDING
14	SIGN TYPE A22 INTERIOR DIRECTIONAL, WALL MOUNTED
15	SIGN TYPE A23/24 WASHROOM DIRECTIONAL, PROJECTING/WALL MOUNTED
16	SIGN TYPE A25 WASHROOM DIRECTIONAL, SUSPENDED
17	SIGN TYPE A40 INTERIOR BUILDING DIRECTORY WALL
18	SIGN TYPE A41 INTERIOR ELEVATOR DIRECTORY
19	SIGN TYPE A60 SERVICE CANADA/PASSPORT CANADA PRIMARY ID, FREESTANDING
20	SIGN TYPE A61 SERVICE CANADA/PASSPORT CANADA SECONDARY ID, FREESTANDING
21	SIGN TYPE A62 SERVICE CANADA/PASSPORT CANADA SECONDARY ID, WALL MOUNTED
22	SIGN TYPE A63 PASSPORT CANADA SECONDARY ID, PROJECTING
23	SIGN TYPE A70 TRASIT ID, ILLUMINATED SUSPENDED
24	SIGN TYPE A71 TRASIT ID, ILLUMINATED WALL MOUNTED
25	SIGN TYPE B1.1 ELEVATOR ID, ILLUMINATED
26	SIGN TYPE B1.2 ELEVATOR SMALL, ILLUMINATED
27	SIGN TYPE B3 WASHROOM ID
28	SIGN TYPE B6-B7 STAIRWELL/STAIR ID
29	SIGN TYPE B9 EMPLOYEES ONLY SIGN
30	SIGN TYPE X1 EXTERIOR BANNER
31	MAP STYLE GUIDE

**MESSAGE SCHEDULE**

2	GENERAL
3	MESSAGE SCHEDULE B1
4	MESSAGE SCHEDULE B1
5	MESSAGE SCHEDULE B1
6	MESSAGE SCHEDULE B1
7	MESSAGE SCHEDULE L1
8	MESSAGE SCHEDULE L1
9	MESSAGE SCHEDULE L1

**SIGN LOCATION PLANS**

SLP-00	LEVEL B1 (LOWER MALL) CUSTOMS QUADRANT SIGN LOCATION PLAN
SLP-01	LEVEL B1 (LOWER MALL) SIGN LOCATION KEY PLAN
SLP-02	LEVEL L1 (UPPER MALL) SIGN LOCATION KEY PLAN
SLP-03	LEVEL B1 (LOWER MALL) CUSTOMS QUADRANT SIGN LOCATION PLAN
SLP-04	LEVEL B1 (LOWER MALL) FEDERAL QUADRANT SIGN LOCATION PLAN
SLP-05	LEVEL B1 (LOWER MALL) WINCH QUADRANT SIGN LOCATION PLAN
SLP-06	LEVEL B1 (LOWER MALL) POST OFFICE QUADRANT SIGN LOCATION PLAN
SLP-07	LEVEL L1 (UPPER MALL) CUSTOMS QUADRANT SIGN LOCATION PLAN
SLP-08	LEVEL 1 (UPPER MALL) FEDERAL QUADRANT SIGN LOCATION PLAN
SLP-09	LEVEL 1 (UPPER MALL) WINCH QUADRANT SIGN LOCATION PLAN
SLP-10	LEVEL L1 (UPPER MALL) POST OFFICE QUADRANT SIGN LOCATION PLAN

**DIRECTIONAL CONTENT PLAN**

DCP-01	LEVEL B1 (LOWER MALL) DIRECTIONAL CONTENT PLAN
DCP-02	LEVEL L1 (UPPER MALL) DIRECTIONAL CONTENT PLAN

**BANNER DRAWINGS**

SCB-01	TYPICAL EXTERIOR BANNER CONSTRUCTION DETAILS WINCH BUILDING BANNERS 1 & 2 FEDERAL BUILDING BANNERS 3, 4 & 5 (LAMP HOLDERS NOT SHOWN)
SCB-02	TYPICAL EXTERIOR BANNER CONSTRUCTION DETAILS WINCH BUILDING BANNERS 1 & 2 FEDERAL BUILDING BANNERS 3, 4 & 5 (LAMP HOLDERS NOT SHOWN)
SCB-03	TYPICAL EXTERIOR BANNER CONSTRUCTION DETAILS CUSTOMS BUILDING BANNER 6, 7 & 8 (LAMP HOLDERS NOT SHOWN)
SCB-04	TYPICAL EXTERIOR BANNER CONSTRUCTION DETAILS CUSTOMS BUILDING BANNER 6, 7 & 8 (LAMP HOLDERS NOT SHOWN)
SCB-05	TYPICAL EXTERIOR BANNER CONSTRUCTION DETAILS TYPICAL FOR ALL 8 BANNERS (LAMP HOLDERS NOT SHOWN)
SCB-06	TYPICAL EXTERIOR BANNER CONSTRUCTION DETAILS TYPICAL FOR ALL 8 BANNERS (LAMP HOLDERS NOT SHOWN)
SCB-07	TYPICAL EXTERIOR BANNER TRUSS ASSEMBLY & ACCESSORIES CONSTRUCTION DETAILS TYPICAL FOR ALL 8 BANNERS

- SCB-08 TYPICAL EXTERIOR BANNER LAMP HOLDERS, LIGHT FIXTURES AND ACCESSORIES DETAILS TYPICAL FOR ALL 8 BANNERS
- SCB-09 TYPICAL EXTERIOR BANNER EXISTING BUILDING – NORTH ELEVATION BANNER INSTALLATION DETAILS
- SCB-10 TYPICAL EXTERIOR BANNER EXISTING BUILDING – SOUTH ELEVATION BANNER INSTALLATION DETAILS
- SCB-11 TYPICAL EXTERIOR BANNER EXISTING BUILDING – EAST ELEVATION BANNER INSTALLATION DETAILS
- SCB-12 TYPICAL EXTERIOR BANNER EXISTING BUILDING – WEST ELEVATION BANNER INSTALLATION DETAILS

END OF SECTION 00 00 10

1.0 GENERAL

1.1 CODES

- .1 Perform work in accordance with National Building Code for Canada 2010, Workers' Compensation Board of BC, Vancouver Building By-law 2007 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 Renovation, Seismic Upgrade and Passport Office Fit-Out at Sinclair Centre, Vancouver, BC, including demolition and construction work at level B2, Lower Mall and Upper Mall, and associated mechanical work at level B3 and mechanical penthouse of Post-Office Building as fully described in the Tender Documents.

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.
- .3 Cooperate with pre-purchased equipment suppliers in carrying out their respective works and carry out instructions from Departmental Representative.
- .4 Coordinate work with that of pre-purchased equipment suppliers. If any part of work under this Contract depends on its proper execution or result upon work of said suppliers, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of this Work.

1.4 TIME OF COMPLETION

- .1 Commence work immediately upon official notification of acceptance of offer and complete Passport Office Fit-out, including testing, adjusting and commissioning within thirty-two (32) weeks after contract award. Remainder of the work must be completed within fifty-nine (59) weeks after award of contract.

1.5 HOURS OF WORK

- .1 All work which generates excessive noise, including cutting and coring, hammer drills and power activated fastening shall be executed outside of the normal operating hours, except Saturday, for Sinclair Centre.
- .2 All other work, except for that noted in Clause 1.5.1 shall be executed during the normal operating hours for Sinclair Centre:  
Monday through Friday – 07:00 to 17:00 hours.  
Saturday – 10:00 to 17:30 hours.  
Sunday – Closed.
- .3 All work conducted during and 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.
  - .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 For funding allocation purposes only, within 30 days after contract award, submit a separate cost breakdown from Clause 1.7.1 above, dividing the contract price between "Base Building" and "Fit-up" costs generally as follows:

Base Building Works:

  - .1 Architectural- all works as described in architectural drawings except those drawings designated as Passport Office.
  - .2 Structure- all works as described in structural drawings.
  - .3 Mechanical- all works as described in mechanical drawings except
    - .1 HVAC- A/C in LAN Room.
    - .2 Plumbing-All plumbing distributions & fixtures except those within Passport Office.
  - .4 Electrical- all works as described in electrical drawings except:
    - .1 Power- all power distribution from junction box grid in ceiling of passport office.
    - .2 Lighting- Light fixtures in Meeting Room in Passport Office.
    - .3 Security- all work described in security drawings.
  - .5 Signage- all signage work in signage package except:
    - .1 Signage work as shown in Drawing A50.
- .3 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) 2010, 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 2010.
  - .13 Current construction standards of workmanship listed in technical Sections.
  - .14 Building Safety Plan.

#### 1.10 REGULATORY REQUIREMENTS

- .1 Building Permit
- .1 Obtain and pay for Building Permit, Occupancy Permit, Certificates, Licenses and other permits required by City of Vancouver, provincial or federal authorities to complete the work. Obtain 2 building permits, one for base building work and one for Passport Office Fit-Out. Obtain a sign permit from City of Vancouver for exterior banner installations. Commencement of work is independent of issuance of building permit from City of Vancouver.
- .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 authority having jurisdiction.

#### 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 Cooperate with and coordinate construction/demolition activities with Sinclair Centre property manager, SNC Lavalin.
  - .5 Obtain and pay for use of additional 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.
- .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 2010 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.
    - .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.
  - .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 the Consultant.
- .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 Owner, in hard copy and in PDF.
- .4 If required by Owner, arrange for the preparation of as-built drawings on AutoCAD computerized drafting system at an hourly rate. This will be charged to the Owner upon the Owner's approval of the estimated cost.
- .5 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.
- .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 PARTIAL OCCUPANCY & WARRANTY PERIOD**

- .1 To maintain uninterrupted operation of the complex during the construction period, construction phasing is expected to be implemented (refer to section 01 14 00 – Work Restrictions). Contractor will schedule progressive hand over of the completed work phase by phase to the Owner for occupancy. Warranty period of that phase or portion of work will deem to start from the date of Acceptance of Work and taken over by the owner for occupancy use.

**1.35 SUBSTANTIAL COMPLETION**

- .1 Notwithstanding clause 1.34.1, Substantial Completion of work will only apply to the whole project and release of lien holdback will be in accordance with BC Builders Lien Act.

END OF SECTION 01 11 00

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 Sinclair Centre's Operations, Safety and Security Procedures and Restrictions.
- .2 Cooperate with and coordinate construction/demolition activities with Sinclair Centre Property Management firm, SNC Lavalin.

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 conforming but not limited to the hoarding plans in the contract documents, and scaffolding plan for Departmental Representative to review 5 business days prior to installation.
- .3 Refer to Appendix D of this specification for designated Site Access, Site Office and Laydown Area.
- .4 All access through Level B2 loading area as shown in Appendix D will require commissionaires' attendance during normal hours or after hours. Charge out rate as in Section 1.7.3 will apply. Contractor to include cost of commissionaires' attendance in their contract price.

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.
- .7 Use designated elevator only for construction use in building for moving workers and materials.
  - .1 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to Sinclair Centre 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 3 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.
  - .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 generating Work outside the normal operating hours of Sinclair Centre, as per 1.9 Hours of Work.
  - .1 Means and procedures of controlling and isolating other 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.
- .5 Ingress and egress of Contractor vehicles at site is limited to loading dock at Level B2 off West Cordova Street.
- .6 Deliver materials outside of peak traffic hours unless otherwise approved by Departmental Representative. Peak traffic is defined as 07:00-9:00 and 15:00-17:00.

#### 1.7 SECURITY

- .1 All work scheduled outside normal Sinclair hours will require full-attendance security guard or guards. The Contractor shall make minimum 24 hours advance arrangements with the Sinclair Centre property management firm, SNC Lavalin, for access and security. All security costs will be paid for by PWGSC and reimbursed by the Contractor.
- .2 All access to secured areas such as all base building electrical and mechanical rooms, roof and roof penthouse, and other normally secured services rooms will need escort by Commissionaires

- during and after normal office hours.
- .3 Use of loading dock at Level B2 will need attendance of Commissionaires at all times.
  - .4 All access to existing occupied tenant spaces in the office towers for installation of banners and associated construction work during or after office hours will need escort by Commissionaires.
  - .5 Security Service charge will apply for all Commissionaire's escort and attendance.
    - .1 Charge-out hourly rate for regular federal work by Commissionaires BC are as follows:
      - .1 Regular rate \$ 29
      - .2 Regular overtime rate \$ 40.29
      - .3 Double overtime rate \$ 51.58
      - .4 Stat Holiday rate \$ 40.28
    - .2 Overtime is charged after 8 hours, double overtime after 12 hours.
  - .6 Contractor should have allowed cost of escort by Commissionaires in their contract price.
  - .7 The Owner will hire and pay for the Commissionaires directly but the contractor will allow for all Commissionaire costs in their contract price. When the final cost is known, the owner will then issue a credit change order for that cost.

#### 1.8 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted within Sinclair Centre.

#### 1.9 NOISE CONTROL

- .1 Refer to section 01 11 00 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 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

**WORK RESTRICTIONS**

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

- .5 All Hoarding enclosing noise generating activities must be acoustically sealed to structure. All temporary construction doors to be solid core wood door installed with door seal, door bottom and threshold.

**1.10 CONSTRUCTION PHASING**

- .1 To maintain Sinclair Centre operational during construction is of upmost priority. To achieve this goal, various construction works cannot be implemented at the same time.
- .2 Construction phasing plan and schedule must be submitted for approval by Departmental Representative prior to implementation. Phasing of Work and approximate extent of protective hoarding are generally described in hoarding plans. Phasing criteria are as follows:
- .1 A minimum of either the public washrooms in Federal Building or Post Office Building must be maintained operational during normal operating hours.
- .2 The new stair/performing stage in the atrium must be substantially completed and open for use prior to demolition of stair at Cordova Street entrance.
- .3 Galleria glazed entrances modification and upgrade must be carried out sequentially one at a time. No more than 2 entrances can be closed for construction at the same time.
- .4 Glazing adjustment along the galleria skylight must be carried out bay by bay and must not block the egress way.
- .5 Removal of existing signs must only be done right before installation of new signs.
- .6 Removal of existing galleria and atrium furniture must only be done right before installation of new furniture.
- .7 The following must be completed at the same time or before substantial completion of Passport Office:
- .1 Seismic and lighting upgrade at Post Office Building Lower Mall Level elevator lobby.
- .2 Seismic and Lighting upgrade at Lower Mall Level along the north frontage of Passport Office.
- .3 Glass block and concrete slab replacement at Upper Mall Level along the north frontage of Passport Office.

**1.11 WORK OR SITE VISIT WITHIN OCCUPIED TENANT SPACE**

- .1 Sinclair Centre : Protocol to enter space and lines of communication  
 All contractors requesting access to tenant spaces are required to submit a request a minimum of 48hrs in advance to the SNC Facility Representative. The request shall include: Purpose of the visit/duration/date and time. Request must be in writing. The SNC Facility contact will forward the request to the tenant occupying the space. Contractors should wait for confirmation before making the arrangements to visit the site, or carry out any construction work within the occupied tenant space.

SNC Lavalin O & M Contacts

Jim Kwan

Jen Vann

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PROJECT # R.041365.001  
SINCLAIR CENTRE REVITALIZATION  
VANCOUVER, BC  
GENERAL REQUIREMENTS

**WORK RESTRICTIONS**

SECTION 01 14 00  
24/04/2013  
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SNC Facility Manager (604) 488-1684    SNC Property Service Coordinator (604) 488-0672

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END OF SECTION 01 14 00



## 1.0 GENERAL

### 1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting seven days in advance of meeting date to Departmental Representative.
- .4 Meeting space can be held in the vacant retail space at Lower Mall level designated as Contractor's Office (Refer to Appendix D). Tables and chairs are already available in that space.
- .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 three days after meetings and transmit to meeting participants and affected parties not in attendance, Departmental Representative and Consultant.
- .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, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of Departmental Representative Consultant, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 7 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
  - .1 Appointment of official representative of participants in the Work.
  - .2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
  - .3 Schedule of 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 52 00 - Construction Facilities.
  - .5 Delivery schedule of specified equipment.
  - .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
  - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .8 Owner's Work.
  - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

**1.3 PROGRESS MEETINGS**

- .1 During course of Work and two weeks prior to Project Completion, schedule progress meetings bi-weekly.
- .2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.
- .3 Notify parties if there are any changes in meeting schedule.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for affect on construction schedule and on completion date.
  - .12 Other business.

END OF SECTION 01 31 19

## 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.

### 1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within Ten working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

#### 1.4 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
  - .1 Substantial Completion of Passport Office Fit-Out before within 32 weeks after contract award.
  - .2 Substantial Completion of the remaining work within 59 weeks after contract award.

#### 1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

#### 1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award.
  - .2 Shop Drawings, Samples.
  - .3 Permits.
  - .4 Mobilization.
  - .5 Demolition.
  - .6 Concrete Work.
  - .7 Metal Fabrication.
  - .8 Windows & Doors.
  - .9 Interior Finishing.
  - .10 Millwork.
  - .11 Heating, Ventilating, and Air Conditioning.
  - .12 Plumbing.
  - .13 Lighting.
  - .14 Power.
  - .15 Communication.
  - .16 Security.
  - .17 Fire Protection Systems.
  - .18 Testing and Commissioning.
  - .19 Owner's Work.
  - .20 Moving of Passport Office

#### 1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on a two week basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

**1.8 PROJECT MEETINGS**

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

END OF SECTION 01 32 16.07

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 **14** days for Departmental Representative's review of each submission, unless noted otherwise.

- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification sections and as Departmental Representative may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within 3 years of date of contract award for project.

- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .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, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of Construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.
- .22 Shop drawings format larger than 11" x 17" (275mm x 430mm) must be submitted with hardcopies together with electronic format. Submit sufficient copies such that Departmental Representative will keep 6 copies plus contractor's distribution and maintenance manual.
- .23 Electronic submissions will only be reviewed and returned electronically. No hardcopies will be returned to contractor.



**1.3 SAMPLES**

- .1 Submit for review samples in triplicate as requested 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 become standard of workmanship and material against which installed Work will be verified.

**1.4 MOCK-UPS**

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

**1.5 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Viewpoints and their locations as reasonably determined by Departmental Representative.
- .4 Provide photographic documentation of adjacent existing conditions prior to commencement of construction for determining and accidental damage as a result of contractor's work.
- .5 Frequency of photographic documentation: monthly as directed by Departmental Representative.
  - .1 Upon completion of: demolition, framing and services before concealment of Work, and as directed by Departmental Representative.

**1.6 CERTIFICATES AND TRANSCRIPTS**

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

END OF SECTION 01 33 00

## 1.0 GENERAL

- .1 This Section includes submittal requirements and procedures to comply with Canada Green Building Council (CaGBC) LEED for Commercial Interiors CI 1.0 (2007) prerequisites and credits for the Project to simulate LEED Silver score level, as indicated in Appendix E of this document.

## 1.1 REFERENCES

- .1 American Society of Heating Refrigeration and Air-Conditioning (ASHRAE)
  - .1 ASHRAE 52.2-99, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved).
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Carpet and Rug Institute (CRI)
  - .1 CRI Green Label Indoor Air Quality Test Program - Green Label Testing Program.
- .4 United States Forest Stewardship Council
  - .1 Principles and Criteria for Forest Stewardship-00.
- .5 Green Seal Environmental Standards
  - .1 Standard GC-03-93, Anti-Corrosive Paints.
  - .2 Standard GS-11-97, Architectural Paints.
- .6 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113-04, Architectural Coatings.
  - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
  - .1 IAQ Guideline for Occupied Buildings Under Construction.
- .8 United States Federal Trade Commission (US Federal Trade Commission)
  - .1 16 CFR 260.7 Trade Commission Guidelines for the Use of Environmental Marketing Claims.

## 1.2 DEFINITIONS

- .1 FSC - Forest Stewardship Council.
- .2 SFM - Sustainable Forest Management.
- .3 CFC - Chlorofluorocarbons.
- .4 Chain-of-Custody Certification - certificates signed by manufacturers certifying that wood used to make products was obtained from FSC certified forests. Certificates include evidence that mill is certified for chain-of-custody by FSC-accredited certification body.
- .5 HCFC - Hydro Chlorofluorocarbons.
- .6 LEED - Leadership in Energy and Environmental Design.
- .7 IAQ - Indoor Air Quality.
- .8 Rapidly Renewable Materials - materials made from agricultural products that are typically

harvested within a ten-year or shorter cycle. Rapidly renewable materials include but are not limited to products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, and wool.

- .9 Regionally Manufactured Materials - materials that are manufactured within a radius of 800 km from project location. Manufacturing refers to the final assembly of components into the building product that is installed at project site.
- .10 Recycled Content - percentage by weight of constituents that have been recovered or otherwise diverted from solid waste stream, either pre-consumer or post-consumer.
  - .1 Wastes and scraps from manufacturing process that are combined with other materials after minimal amount of reprocessing for use in further production of same product are not recycled materials.
  - .2 Discarded materials from one manufacturing process that are used as materials in another manufacturing process are pre-consumer recycled materials.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit required letters, calculations, spreadsheets and templates prepared by Departmental Representative for submittal to CaGBC.
- .4 Submit additional LEED submittal requirements included in other sections in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 When submitted items are duplicated to that submitted to comply with other requirements, submit duplicate copies as separate submittals for compliance with indicated LEED requirements.
- .5 Submit Project Materials and Cost Data: provide statement for total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.
- .6 Submit: LEED Action Plan: provide preliminary submittals within 30 days of date for start of Work indicating how the following requirements will be met:
  - .1 Materials and Resources Credit MRc2 Construction Waste Management: Divert Construction/Demolition Debris From Landfill. Prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Materials and Resources Credit MRc4 Recycled Content (Post-consumer + ½ Post-industrial, 10%- 20%). Submit list of proposed materials with recycled content.
    - .1 Identify cost, post-consumer content and pre-consumer content for products having recycled content.
  - .3 Materials and Resources Credit MRc5.1 Regionally Materials: 20% Manufactured Regionally and MRc5.2 10% Extracted and Manufactured Regionally. Submit list of proposed regionally manufactured materials and regionally extracted, harvested, and recovered materials.
    - .1 Identify regionally manufactured materials.
      - .1 Identify source and cost.
    - .2 Identify regionally extracted, harvested or recovered material.

- .1 Identify source and cost.
- .4 Materials and Resources Credit MRc-7- Certified Wood 50%. Submit list of proposed certified wood products.
  - .1 Indicate products containing certified wood.
    - .1 Indicate source, and cost.
  - .2 Include statement indicating total cost for wood-based materials used for project, including non-rented temporary construction.
- .5 Environment Quality Credit IEQc3.1 Construction IAQ Management Plan. Submit Construction indoor air quality management plan.
- .6 Submit LEED Progress Reports: with Applications for Progress Payments, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
  - .1 Materials and Resources Credit MRc2 Construction Waste Management- Divert Construction Waste From Landfill – 50%, 75%. Submit Waste reduction progress reports in accordance with 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Materials and Resources Credit MRc4 Recycled Content (Post-Consumer + ½ Post-Industrial), 10%,20%. Submit list of recycled content of materials.
  - .3 Materials and Resources Credit MRc5.1 Regionally Materials: 20% Manufactured Regionally, and MRc5.2 Regionally Materials: 10% Extracted and Manufactured Regionally. Submit list of regionally manufactured materials and regionally extracted, harvested, or recovered materials.
- .7 LEED Documentation Submittals:
  - .1 Submit product data for lighting fixtures for Sustainable Sites Credit SSc1, Option F-Light Pollution Reduction. Submit data for interior and exterior lighting fixtures that stop direct-beam illumination from leaving the building site.
  - .2 Submit product data for plumbing fixture for Water Efficiency Credits WEc1.1 Water Use Reduction: 20% Reduction and WEc1.2 Water Use Reduction: 30% Reduction. Submit Data for plumbing fixtures indicating water consumption.
  - .3 Submit product data for Energy and Atmosphere Prerequisite EAc3 CFC Reduction in HVAC&R Equipment and Elimination of Halons.
    - .1 Include product data for new HVAC equipment indicating absence of CFC refrigerants and Phase-out plan to replace CFC refrigerants in HVAC&R systems with CFC-free refrigerants within the Construction Period.
  - .4 Submit product data for Energy and Atmosphere Credit EAc3 Measurement and Payment Accountability. Submit product data and wiring diagrams for sensors and data collection systems for metering of building energy and water consumption performance.
  - .5 Submit Construction Waste Management Plan for Materials and Resources Credit MRc2.1 Construction Waste Management :Divert 50% From Landfill and MRc2.2 Construction and Waste Management: Divert 75% From Landfill. Comply with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Include the following submittals:
    - .1 Submit product data and certification letters for Materials and Resources Credit MRc4.1 Recycled Content: 10% and MRc.2 Recycled Content: 20%. Submit product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for products having recycled content.

- .2 Submit product data for Materials and Resources Credit MRc5.2 Regional Materials: 10% Extracted and Manufactured Regionally and MRc5.1 Regional Materials: 20% Manufactured Regionally. Submit product data indicating location of material manufacturer for regionally manufactured materials. Include the following:
  - .1 Statement indicating cost and distance from manufacturer to project for each regionally manufactured material.
  - .2 Statement indicating cost and distance from point of extraction, harvest, or recovery to project for each raw material used in regionally manufactured materials.
- .3 Submit product data and certificates for Materials and Resources Credit MRc7 Certified Wood. Submit product data and certificates of chain-of-custody for products containing certified wood.
  - .1 Include statement indicating costs for products containing certified wood.
  - .2 Include statement indicating total cost for wood-based materials used for project, including non-rented temporary construction.
- .6 Provide submittals for Indoor Environmental Quality Credit EQc3.1 Construction IAQ Management Plan . Include the following:
  - .1 Construction indoor air quality management plan.
  - .2 Product data for temporary filtration media.
  - .3 Product data for filtration media used during occupancy.
  - .4 Construction documentation submit 6 photographs at 4 different times during construction along with description of utilized IAQ measures in accordance with SMACNA, documenting protection of ducts and on-site stored or installed absorptive materials from moisture.
- .7 Provide submittals for Indoor Environmental Quality Credit EQc3.2 Construction IAQ Management plan: Testing Before Occupancy. Include the following:
  - .1 Signed statement describing building air flush-out procedures including start and completion dates of flush out and statement that filtration media was replaced after flush-out.
  - .2 Product data for filtration media used during flush-out and during occupancy.
  - .3 Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.
- .8 Submit product data for Indoor Environmental Quality Credit EQc4.1 Low-Emitting Materials: Adhesives and Sealants. Submit product data for interior adhesives and sealants indicating VOC content of product used. Indicate VOC content in g/L calculated in accordance with SCAQMD Rule 1168.
- .9 Submit product data for Indoor Environmental Quality Credit EQc4.2 Low-Emitting Materials: Paints and Coatings. Submit product data for interior paints and coatings indicating chemical composition and VOC content for products used. Indicate VOC content in g/L calculated in accordance with [Green Seal's Standard GS-11 and Green Seal's Standard GC-03 and SCAQMD Rule 1113.
- .10 Submit product data for indoor Environmental Quality Credit EQc4.3 Low-Emitting Materials: Carpet. Submit product data for carpet products indicating VOC content in accordance with CRI Green Label Indoor Air Quality Test Program.

- .11 Submit product data for Indoor Environmental Quality Credit EQc4.4 Low-Emitting  
  
Materials: Composite Wood and Laminates Adhesives. Submit product data for composite wood and agrifiber products indicating products contain no urea-formaldehyde resins.
  - .1 Include statement for adhesives use in fabrication of laminated assemblies.
- .12 Submit product data and shop drawing for Indoor Environmental Quality Credit EQc6.2 Controllability of Systems: Non-Perimeter Spaces. Submit product data and shop drawings for sensors and control systems used for individual airflow, temperature and lighting for minimum 50% of non-perimeter, regularly occupied space.
- .13 Submit product data and shop drawings for Indoor Environmental Quality Credit EQc7.2 Thermal Comfort: Monitoring. Submit product data and shop drawings for permanent monitoring sensors and controls system for temperature and humidity.

## 2.0 PRODUCTS

### 2.1 RECYCLED CONTENT OF MATERIALS

- .1 Materials and Resources Credits MRc4.1 Recycled Content: 10% (post-consumer + ½ post industrial) and MRc4.2 Recycled Content: 20% (post-consumer + ½ post industrial). Supply building materials with a minimum post-consumer recycled content of 10% of cost of project materials or with a minimum post-consumer recycled content plus 1/2 pre-consumer recycled content of 20% of cost of project materials.
  - .1 Cost of post-consumer recycled content of material will be determined by dividing weight of post-consumer recycled content in material by total weight of materials and multiplying by cost of material.
  - .2 Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of materials will be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in material by total weight of material and multiplying by cost of material.
  - .3 Do not include mechanical and electrical components in calculations.
  - .4 Recycled content of materials in accordance with Federal Trade Commission's Guide for the Use of Environmental Marketing Claims, 16 CFR 260.7.

### 2.2 REGIONAL MATERIALS

- .1 Materials and Resources Credit MRc5.1 Regional Materials: 20% and Manufactured Regionally. Supply 20% of building materials (by cost) that are regionally manufactured.
- .2 Materials and Resources Credit MRc5.2 Regional Materials: 10% Extracted and Manufactured Regionally. Regionally manufactured materials required by paragraph 2.3.1, supply 50% (by cost) of building materials that are regionally extracted, harvested, or recovered.

### 2.3 CERTIFIED WOOD

- .1 Materials and Resources Credit MRc7 Certified Wood . Supply a minimum of 50% (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC Principles and Criteria.
  - .1 Wood-based materials include but not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:
    - .1 Rough carpentry.
    - .2 Miscellaneous carpentry.

- .3 Heavy timber construction.
- .4 Wood decking.
- .5 Metal-plate-connected wood trusses.
- .6 Structural glued-laminated timber.
- .7 Finish carpentry.
- .8 Architectural woodwork.
- .9 Wood panelling.
- .10 Wood veneer wall covering.
- .11 Wood flooring.
- .12 Wood lockers.
- .13 Wood cabinets.
- .14 Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection.

## 2.4 LOW-EMITTING MATERIALS

- .1 Indoor Environmental Quality Credit EQc4.1 Low-Emitting Materials: Adhesives and Sealants. Interior applications requiring adhesives, sealants and sealant primers must comply with the following content limits for VOC of the State of California's South Coast Air Quality Management District (SCAQMD) Rule 1168.
  - .1 Wood Glues: 30 g/L.
  - .2 Metal to Metal Adhesives: 30 g/L.
  - .3 Adhesives for Porous Materials (Except Wood): 50 g/L.
  - .4 Subfloor Adhesives: 50 g/L.
  - .5 Plastic Foam Adhesives: 50 g/L.
  - .6 Carpet Adhesives: 50 g/L.
  - .7 Carpet Pad Adhesives: 50 g/L.
  - .8 VCT and Asphalt Tile Adhesives: 50 g/L.
  - .9 Cove Base Adhesives: 50 g/L.
  - .10 Gypsum Board and Panel Adhesives: 50 g/L.
  - .11 Rubber Floor Adhesives: 60 g/L.
  - .12 Ceramic Tile Adhesives: 65 g/L.
  - .13 Multipurpose Construction Adhesives: 70 g/L.
  - .14 Fiberglass Adhesives: 80 g/L.
  - .15 Structural Glazing Adhesives: 100 g/L.
  - .16 Wood Flooring Adhesive: 100 g/L.
  - .17 Contact Adhesive: 250 g/L.
  - .18 Plastic Cement Welding Compounds: 350 g/L.
  - .19 ABS Welding Compounds: 400 g/L.
  - .20 CPVC Welding Compounds: 490 g/L.
  - .21 PVC Welding Compounds: 510 g/L.
  - .22 Adhesive Primer for Plastic: 650 g/L.
  - .23 Sealants: 250 g/L.
  - .24 Sealant Primers for Nonporous Substrates: 250 g/L.
  - .25 Sealant Primers for Porous Substrates: 775 g/L.
- .2 Indoor Environmental Quality Credit EQc4.2 Low-Emitting Materials: Paints and Coatings. Interior applications use paints and coatings must comply with the following limits for VOC content when calculated according to Green Seal Standard GS-11 and Green Seal Standard GS-03 and SCAQMD Rule 1113.
  - .1 Flat Paints and Coatings: VOC not more than 50 g/L.
  - .2 Non-Flat Paints and Coatings: VOC not more than 150 g/L.
  - .3 Anti-Corrosive Coatings: VOC not more than 250 g/L.
  - .4 Varnishes and Sanding Sealers: VOC not more than 350 g/L.

- .5 Stains: VOC not more than 250 g/L.
- .6 Aromatic Compounds: paints and coatings not to contain more than 1.0% by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- .7 Restricted Components: paints and coatings not to contain the following:
  - .1 Acrolein.
  - .2 Acrylonitrile.
  - .3 Antimony.
  - .4 Benzene.
  - .5 Butyl benzyl phthalate.
  - .6 Cadmium.
  - .7 Di (2-ethylhexyl) phthalate.
  - .8 Di-n-butyl phthalate.
  - .9 Di-n-octyl phthalate
  - .10 1,2-dichlorobenzene.
  - .11 Diethyl phthalate.
  - .12 Dimethyl phthalate.
  - .13 Ethylbenzene.
  - .14 Formaldehyde.
  - .15 Hexavalent chromium.
  - .16 Isophorone.
  - .17 Lead.
  - .18 Mercury.
  - .19 Methyl ethyl ketone.
  - .20 Methyl isobutyl ketone.
  - .21 Methylene chloride.
  - .22 Naphthalene.
  - .23 Toluene (methylbenzene).
  - .24 1,1,1-trichloroethane.
  - .25 Vinyl chloride.
- .3 Indoor Environmental Quality Credit EQc4.3 Low-Emitting Materials: Carpet.
- .4 Indoor Environmental Quality Credit EQc4.4 Low Emitting Materials: Composite Wood and Laminate Adhesives. Do not use composite wood and agrifiber products that contain urea-formaldehyde resin.

### 3.0 EXECUTION

#### 3.1 REFRIGERANTS & CLEAN-AGENT FIRE-EXTINGUISHING-AGENTS REMOVAL

- .1 Prerequisite EAp-3 CFC Reduction in HVAC&R Equipment and Elimination of Halons.
  - .1 Remove CFC-based refrigerants from existing HVAC and refrigeration equipment indicated to remain and replace with non CFC based refrigerants.
  - .2 Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23.

#### 3.2 CONSTRUCTION WASTE MANAGEMENT

- .1 Credit MRc2.1 Construction Waste Management: Divert 50% From Landfill and MRc2.2 Divert 75% From Landfill. Comply with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 3.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- .1 Credit EQc3.1 Construction IAQ Management Plan: During Construction. Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.



- .2 Obtain written approval from Departmental Representative to operate permanent HVAC systems during construction. Operate permanent HVAC systems in accordance with Section 23 05 01 - Use of HVAC Systems During Construction. Install MERV-8 filter media in accordance with ASHRAE 52.2 at return-air inlets
  - .1 Replace air filters immediately prior to building air flush-out. Replacement air filters to be MERV-13 in accordance with ASHRAE 52.2.
- .3 Credit EQc3.2 Construction IAQ Management Plan: Testing Before Occupancy.
  - .1 Conduct 2-week building air flush-out upon construction completion with new air filters and 100 % outdoor air. Replace air filters after air flush-out. Replacement air filters to have a MERV 13 according to ASHRAE 52.2.
  - .2 Owner will conduct baseline indoor air quality testing program according to EPA Protocol for Environment Requirements, Testing for Indoor Air Quality Baseline IAQ.
    - .1 Payment for testing in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services. Testing services will be paid by Departmental Representative.
    - .2 Employ independent testing and inspecting agency to conduct IAQ Testing.

END OF SECTION 01 35 21

## 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 2010):
  - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA as amended):
  - .1 CSA Z797-2009 Code of Practice for Access Scaffold
  - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
  - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Fire Protection Engineering Services, HRSDC:
  - .1 FCC No. 301, Standard for Construction Operations.
  - .2 FCC No. 302, Standard for Welding and Cutting.
- .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 Current B.C. Electrical Code

### 1.2 RELATED SECTIONS

- .1 Section 01 32 16.0 Construction progress schedules Bar (GANTT) Chart:
- .2 Section 01 33 00 Submittals procedures:
- .3 Section 01 51 00 Temporary utilities:
- .4 Section 01 52 00 Construction facilities:
- .5 Section 01 56 00 Temporary barriers and enclosures:
- .6 Section 02 82 00.02 Asbestos abatement Intermediate Precautions
- .7 Section 02 83 11 Lead Base Paint Abatement Intermediate Precautions:

### 1.3 WORKERS' COMPENSATION BOARD COVERAGE

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

#### 1.4 COMPLIANCE WITH REGULATIONS

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

#### 1.5 SUBMITTALS

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

#### 1.6 RESPONSIBILITY

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

**1.7 HEALTH AND SAFETY COORDINATOR**

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

**1.8 GENERAL CONDITIONS**

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

**1.9 PROJECT/SITE CONDITIONS**

- .1 Work at site will involve contact with Building Management, SNC Lavalin:
  - .1 Jim Scott 604 809-9764
  - .2 Jim Kwan 604 488-1684

**1.10 REGULATORY REQUIREMENTS**

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

**1.11 WORK PERMITS**

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

**1.12 FILING OF NOTICE**

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

**1.13 HEALTH AND SAFETY PLAN**

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
  - .1 Primary requirements:
    - .1 Contractor's safety policy.
    - .2 Identification of applicable compliance obligations.
    - .3 Definition of responsibilities for project safety/organization chart for project.
    - .4 General safety rules for project.

- .5 Job-specific safe work, procedures.
- .6 Inspection policy and procedures.
- .7 Incident reporting and investigation policy and procedures.
- .8 Occupational Health and Safety Committee/Representative procedures.
- .9 Occupational Health and Safety meetings.
- .10 Occupational Health and Safety communications and record keeping procedures.
- .2. Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
- .3 List hazardous materials to be brought on site as required by work.
- .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

#### 1.14 EMERGENCY PROCEDURES

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

- .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

#### 1.15 HAZARDOUS PRODUCTS

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

#### 1.16 ASBESTOS HAZARD

- .1 Carry out work or demolition activities involving asbestos in accordance with applicable Provincial regulations.
- .2 Removal and handling of asbestos will be performed as indicated in Section 02 82 00.02

#### 1.17 REMOVAL OF LEAD-CONTAINING PAINTS

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition activities involving lead-containing paints in accordance with applicable Provincial regulations.

#### 1.18 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.

#### 1.19 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.

**1.20 OVERLOADING**

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

**1.21 CONFINED SPACES**

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

**1.22 POWDER-ACTUATED DEVICES**

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

**1.23 FIRE SAFETY AND HOT WORK**

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

**1.24 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.

**1.25 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.

**1.26 UNFORESEEN HAZARDS**

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

**1.27 POSTED DOCUMENTS**

- .1 Post legible versions of the following documents on site:
  - .1 Health and Safety Plan.
  - .2 Sequence of work.
  - .3 Emergency procedures.

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

**1.28 MEETINGS**

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

**1.29 CORRECTION OF NON-COMPLIANCE**

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

END OF SECTION 01 35 33



## 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

- Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

#### 1.6 REPORTS

- .1 Submit electronic copy of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being, inspected or tested or manufacturer or fabricator of material being inspected or tested.

#### 1.7 TESTS AND MIX DESIGNS

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

#### 1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative as specified in specific Section.
- .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.
- .6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

#### 1.9 MILL TESTS

- .1 Submit mill test certificates as requested.

#### 1.10 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to Divisions 21, 22, 23, 26, 27 and 28 for definitive requirements.

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PROJECT # R.041365.001  
SINCLAIR CENTER REVITALIZATION  
VANCOUVER, BC  
GENERAL REQUIREMENTS

**QUALITY CONTROL**

SECTION 01 45 00  
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1.0 GENERAL

1.1 ACCESS AND DELIVERY

- .1 Only the designated entrance may be used for access to building.
  - .1 Maintain for duration of Contract.
  - .2 Make good damage resulting from Contractor's use.
- .2 The Sinclair Centre loading dock will be available for the delivery of materials provided that the Centre's property management firm, SNC Lavalin, has been given adequate notice.
- .3 Space for waste bins, Contractor's trailers, laydown area are allowed in the designated area outside the loading dock at Level B2 on Cordova Street (Refer to Appendix D).
- .4 Space for waste bins during weekends may be allowed at street curb subject to approval from City of Vancouver.

1.2 CONSTRUCTION PARKING

- .1 Construction staff shall be responsible for own parking in nearby private facilities.

1.3 STORAGE FACILITIES

- .1 Confine work and operations of employees to areas indicated on Contract Documents. Do not unreasonably encumber premises with products.
- .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.
- .4 Provide one waste bin for general debris and one for gypsum wallboard and associated products.

1.4 TEMPORARY CONSTRUCTION POWER

- .1 Designated electrical power circuits and lighting in existing building may be used for construction purposes at no extra cost, provided that warranties are not affected thereby and electrical components used for temporary power are replaced when damaged. Do not use emergency power or UPS panels for this purpose. Refer to Division 26.

1.5 WATER SUPPLY

- .1 Water supply is available in existing building and may be used for construction purposes at no cost.

1.6 SANITARY FACILITIES

- .1 Contractor may use existing washrooms within the construction area. Maintain in a safe and sanitary condition. Thoroughly clean and make good at end of project. Construction Staff will not be allowed to use other Sinclair Centre washrooms.

1.7 HEATING AND VENTILATION

- .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.

#### 1.8 SCAFFOLDING

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

#### 1.9 HOISTING

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

#### 1.10 ELEVATORS

- .1 The freight elevator in RV Winch /Post Office Building may be used for moving materials. Protect elevator cab and entrances from damage and dirt at all times. At completion of Project, remove any new temporary protection panels, make good to all damage and leave in "as before" condition.

#### 1.11 HOARDING

- .1 Prior to all demolition and construction, install special painted plywood hoarding, as detailed. 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 Installation of hoarding must not create permanent damage to existing wall cladding or flooring finish which is of heritage value.

#### 1.12 SITE OFFICE

- .1 A site office has been set up for site meeting in a vacant retail space at the Lower Mall Level. General power and lighting is available. Contractor is responsible to set up phone line, fax line or data line required.
- .2 Contractor should clear and demolish site office at end of project according to contract requirement.

#### 1.13 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.

1.14 CLEAN-UP

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

END OF SECTION 01 51 00

## 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.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

### 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 GUARD RAILS AND BARRICADES

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

### 1.6 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

### 1.7 ACCESS TO SITE

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

### 1.8 PUBLIC TRAFFIC FLOW

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

### 1.9 FIRE ROUTES

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

1.10 PROTECTION OFF-SITE AND PUBLIC PROPERTY

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

1.11 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.12 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



**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

- 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

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

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 11 00 General Instructions

1.2 COORDINATION

- .1 Contractor shall coordinate Owner supplied products and services with the Construction Schedule for delivery dates.
- .2 Contractor shall coordinate with the Owner for installation of Owner installed items, blocking and servicing requirements and confirm dimensional requirements for items being built-in or attached to Contractor work.
- .3 Contractor shall coordinate Owner supplied products, installed by Contractor for installation requirements, blocking and servicing requirements and confirm dimensional requirements for items being built-in or attached to Contractor's work.

2.0 PRODUCTS

2.1 OWNER'S WORK

- .1 The Owner has established the items of work as indicated in Appendix F to be Owner's supplied and installed, or Owner's supplied and Contractor to install. All Owner's work to be coordinated by Contractor.

3.0 EXECUTION

3.1 PREPARATION

- .1 Contractor shall provide all necessary framing, support and blocking to receive Owner's Work, all services roughing-in, in accordance with shop drawings, which will be, supplied by the Owner if available or products delivered on site, at no additional cost to the Contract.

END OF SECTION 01 64 00

## 1.0 GENERAL

### 1.1 REFERENCES

- .1 A set of construction drawings of existing buildings 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.
- .2 A GPR survey of existing services at Lower Mall Level and Part of Level B2 is available for reference.

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

END OF SECTION 01 71 00

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.

- .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.

1.6 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 73 00



1.0 GENERAL

1.1 REFERENCES

- .1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions "C", In Effect as Of: May 14, 2004.

1.2 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 21 - Construction/Demolition 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.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris including that caused by Owner or other Contractors.

- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, millwork floors and ceilings.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep gutters.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .18 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .19 Remove snow and ice from access to buildings.

**1.4 LEVEL OF CLEANINESS WITHIN TENANT OFFICE**

- .1 Work area within the tenant spaces at 2/F and 4/F for installation of banners must be cleaned up to be same as existing operating office condition. All walls, ceiling fixtures, furniture and floor must be free of duct and stain.
- .2 Work in these areas must be carried out by cleaning company whose usual business is maintenance and cleaning of Commercial or office premises with 5 years or more expertise.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

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

1.0 GENERAL1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.
- .2 PWGSC's Waste Management Goal 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.

1.2 REFERENCES

- .1 LEED Canadian Green Building Council (CAGBC), Green Building Rating System, For Commercial Interiors Version 1.0.

1.3 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-modelling 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.
- .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).

#### 1.4 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.

#### 1.5 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.

#### 1.6 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.

#### 1.7 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.
  - .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.

#### 1.8 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.

#### 1.9 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.

**1.10 WASTE PROCESSING SITES**

- .1 Obtain lists of current waste processing sites from the following:
  - .1 Name: Ministry of Environment Lands and Parks
  - .2 Telephone: 604-387-1161.
  - .3 Fax: 604-356-6464.
  - .4 Name: Waste Reduction Commission Soils and Hazardous Waste
  - .5 Telephone: 604-660-9550
  - .6 Fax: 604-660-9556

**1.11 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.
- .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.

**1.12 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.

**1.13 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.

**1.14 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.

### 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	
Carpet	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 %
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**GENERAL REQUIREMENTS**

Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

**3.4 WASTE AUDIT (WA)**

**SPEC NOTE:** 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						

**3.6 WASTE REDUCTION WORKPLAN (WRW)**

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

.1 Schedule B:



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

**3.7 DEMOLITION WASTE AUDIT (DWA)**

**SPEC NOTE:** 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						

**GENERAL REQUIREMENTS**

Slab Regular						
Wood						
Laminate						
Byfold-Closet						
Glazing						

**3.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT****.1 Schedule E - Government Chief Responsibility for the Environment:**

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

END OF SECTION 01 74 21

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 Inspection: Departmental Representative and Contractor will perform inspection 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 Owner's personnel.
    - .7 Work is complete and ready for Final Inspection.

END OF SECTION 01 77 00

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 01 71 00 – Examination & Preparation.
- .3 Section 01 77 00 - Closeout Procedures.
- .4 Section 01 91 13 – General Commissioning Requirement
- .5 Section 01 91 41 - Demonstration and Training.

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 Interim 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.
- .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.

1.3 INTERACTIVE OPERATING AND MAINTENANCE MANUAL SYSTEM

- .1 In addition to the printed copies, submit provide an Interactive Operating and Maintenance Manual System as specified herein.
- .2 System Description and Requirements
  - .1 All as constructed drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.
  - .2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.

- .3 Program shall be capable of storing separately and independently data of multiple buildings and shall be expandable for addition of new buildings and systems.
- .4 Data of each building shall be accessible by the input of either the building name or building number as defined by the Departmental Representative.
- .5 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:
  - .1 Architectural
  - .2 Mechanical
  - .3 Electrical
  - .4 Data & Communication
  - .5 BSCS
  - .6 Under each discipline, data shall be grouped into the following four major categories:
    - .1 Basic Documents
      - .1 'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the Departmental Representative:
        - .1 Introduction
        - .2 Consultant/Contractor/Suppliers List
        - .3 System Description
        - .4 Maintenance and Lubrication Schedules
        - .5 Testing and Commissioning (T&C) Reports
        - .6 Misc. Reports
        - .7 Specifications
        - .8 Equipment and/or point schedules as identified in the hard copy documents
        - .9 Others as stipulated by the Departmental Representative
      - .2 All Basic Documents PDF files shall be enhanced with appropriate bookmarks to facilitate searching of information within the document or linking to other relevant documents for references.
    - .2 'As-Constructed' Drawings
      - .1 'As-Constructed' drawings shall be converted from the original electronic files, such as CAD, into PDF format. If only the hard copies of the 'as constructed' drawings are available, they shall be scanned and saved in PDF format. PDF files of the 'As-Constructed' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:
        - .1 Drawing Number and Title
        - .2 Drawing Notes
        - .3 Major Equipment Locations
        - .4 Cross-links to other related drawings
        - .5 Revisions
    - .3 System Data
      - .1 Building systems shall be identified by their services, disciplines, function, nature and specific scope. System data shall be classified into the following categories:
        - .1 System Description
        - .2 Schematic (where applicable)
        - .3 Equipment List

- .2 Provide hot key buttons, where applicable, for direct access to drawings/data referenced on the schematics. The same shall be applied to listed equipment for direct links to the corresponding equipment data.
- .4 Equipment Data
  - .1 Equipment data shall be classified into the following categories:
    - .1 Equipment submittals
    - .2 T&C Report
    - .3 Maintenance Data
    - .4 Maintenance Records
    - .5 Photo
  - .2 Provide a summary screen to list all equipment classified under a specific system. On the summary screen, provide direct links to the corresponding equipment data under each category with addition links to the relevant 'As Constructed' drawings.
- .6 The system shall be executed by Professional Engineers with a minimum of 10 years post qualification experience in the field of Building Services Engineering.
- .7 The Contractor shall provide a minimum of 3 past job references as proven record of similar undertakings.
- .8 The Contractor shall provide a demonstration of the system to the Departmental Representative to provide verification that the requirements if the specification are fulfilled.
  - .1 Acceptable Service Provider: D-Elements Designing Service Inc.  
Contact: Ken Mak. Phone No: 604 786 8892. Email: [delements@telus.net](mailto:delements@telus.net).

#### 1.4 FORMAT HARD COPY MANUALS

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in .dwg format on CD.

#### 1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;

- .1 date of submission;
  - .2 names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
  - .3 schedule of products and systems, indexed to content of volume.
  - .4 copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.
  - .5 all extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification.
  - .6 complete set of all final reviewed shop drawings.
  - .7 certificates of inspection by authorities having jurisdiction.
  - .8 test reports and certificates as applicable.
  - .9 complete set of as constructed drawings.
- .2 For each product or system:
- .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: Refer to Section 01 91 41 - 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 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.
- .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.
- .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.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

**1.14 WARRANTIES AND BONDS**

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

1.0 GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
  - .1 Verify conditions for demonstration and instructions comply with requirements.
  - .2 Verify designated personnel are present.
  - .3 Ensure equipment has been inspected and put into operation in accordance with Division.
  - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .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 as follows:
  - .1 Heating, Cooling, Exhaust, and Ventilation Systems
  - .2 Plumbing System
  - .3 Electrical System
  - .4 Mechanical Control System
  - .5 Lighting Control System
  - .6 Communication System
  - .7 Security System

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide electronic & hard copies (Refer to Section 01 78 00 Closeout Submittals) of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

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

END OF SECTION 01 79 00

## 1.0 GENERAL

### 1.1 SUMMARY

- .1 Section Includes:  
General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Sections:  

Commissioning Forms	Section 01 91 33
Commissioning Training	Section 01 91 41
Commissioning of HVAC	Section 23 08 00
Electrical	Section 26 08 00
- .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 PI - Product Information.
  - .7 PV - Performance Verification.
  - .8 TAB - Testing, Adjusting and Balancing.

### 1.2 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 This section is included for reference. The Owner has retained the services of Airmec Systems as Commissioning Authority, to oversee the commissioning process, and to perform the commissioning tasks of the mechanical systems. Commissioning of the electrical systems are to be undertaken by the electrical contractor, their suppliers and appropriate sub-trades. The Contractors are required to participate and provide all required manpower and specialized services to ensure the equipment supplied by the contractor meets the contract requirements. Duties of the Commissioning Authority do not relieve the contractor from providing equipment and systems that meet the design intent and specifications. It is not intended that this work shall, in any way, replace normal factory start-up service for equipment or relieve the contractor or his sub-trades of their responsibility for providing systems and equipment in satisfactory working order.
- .3 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 to be interactively with each other as intended in accordance with Contract Documents and design criteria.
- .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .4 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

### 1.3 COMMISSIONING OVERVIEW

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages 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.
- .6 Departmental Representative will issue Interim Acceptance Certificate 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.

### 1.4 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 Commissioning Authority, 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 Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

### 1.5 PRE-CX REVIEW

- .1 Before Construction:
  - .1 Review contract documents, confirm by writing to Commissioning Authority.
    - .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 Commissioning Authority.
- .7 Have Cx schedules up-to-date.
- .8 Ensure systems have been cleaned thoroughly.
- .9 Complete TAB procedures on systems, submit TAB reports to and Commissioning Authority for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Commissioning Authority in writing of discrepancies and deficiencies on finished works.

#### 1.6 CONFLICTS

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

#### 1.7 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 Commissioning Authority for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
- .3 Submit proposed Cx procedures to Commissioning Authority 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 and Commissioning Authority. Specifically;
  - .1 Cx Plan and Schedule
  - .2 Accepted Shop drawings
  - .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 Training and Attendance forms
  - .9 Accepted "As-built" Plans and Specifications

#### 1.8 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 Departmental Representative and Commissioning Authority to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Commissioning Authority.

#### 1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 11 55 General Instructions.
- .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.

#### 1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 11 55 General Instructions.
- .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 11 55 General Instructions. Commissioning Authority 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 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.
- .6 Meeting will be chaired by Commissioning Authority, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

#### 1.11 STARTING AND TESTING

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

#### 1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days' notice prior to commencement.
- .2 Commissioning Authority to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.



**1.13 MANUFACTURER'S INVOLVEMENT**

- .1 Factory testing: manufacturer to:
  - .1 Coordinate time and location of testing.
  - .2 Provide testing documentation for approval by Commissioning Authority.
  - .3 Arrange for Commissioning Authority to witness tests.
  - .4 Obtain written approval of test results and documentation from Commissioning Authority before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Commissioning Authority
  - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
  - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
  - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
  - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
  - .1 Experienced 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 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 Start-up: follow accepted start-up procedures.
  - .3 Operational testing: document equipment performance.
  - .4 System PV: include repetition of tests after correcting deficiencies.
  - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative and Commissioning Authority after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Commissioning Authority. 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 Commissioning Authority.
  - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Commissioning Authority.

- .3 If evaluation report concludes that major damage has occurred, Departmental Representative and Commissioning Authority shall reject equipment.
  - .1 Rejected equipment to be remove 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 Commissioning Authority 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 or Commissioning Authority 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.
- .2 With assistance of manufacturer develop written maintenance program and submit to Commissioning Authority for approval by Departmental Representative 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 interim acceptance.

#### 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 Commissioning Authority at least 21 days 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 Commissioning Authority 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 Commissioning Authority to witness activities and verify results. Departmental Representative may also witness activities at their discretion.

**1.22 AUTHORITIES HAVING JURISDICTION**

- .1 Where specified 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 Commissioning Authority within 5 days of test and with Cx report.

**1.23 COMMISSIONING CONSTRAINTS**

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

**1.24 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 Departmental Representative or Commissioning Authority in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

**1.25 EXTENT OF VERIFICATION**

**Building:**

- .1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative and Commissioning Authority.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

- .5 Perform additional commissioning until results are acceptable to Departmental Representative and Commissioning Authority.

#### 1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative and Commissioning Authority for third and subsequent verifications where:
  - .1 Verification of reported results fail to receive Departmental Representative's or Commissioning Authority's approval.
  - .2 Repetition of second verification again fails to receive approval.
  - .3 Departmental Representative or Commissioning Authority deems Contractor's request for second verification was premature.

#### 1.27 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.

#### 1.28 DEFICIENCIES, FAULTS, DEFECTS

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

#### 1.29 COMPLETION OF COMMISSIONING

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

#### 1.30 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.

#### 1.31 TRAINING

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

#### 1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

#### 1.33 OCCUPANCY

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

#### 1.34 INSTALLED INSTRUMENTATION

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

#### 1.35 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 +/- 2% of recorded values.

#### 1.36 OWNER'S PERFORMANCE TESTING

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

END OF SECTION 01 91 13

## 1.0 GENERAL

### 1.1 SUMMARY

- .1 Section Includes:
  - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

### 1.2 REFERENCES

- .1 American Water Works Association (AWWA)
- .2 Public Works and Government Services Canada (PWGSC)
  - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.
- .3 Underwriters' Laboratories of Canada (ULC)

### 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 Optimized life cycle costs.
  - .4 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 Occupancy.
  - .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 Acronyms:
  - .1 Cx - Commissioning.
  - .2 BMM - Building Management Manual.
  - .3 EMCS - Energy Monitoring and Control Systems.
  - .4 MSDS - Material Safety Data Sheets.
  - .5 PI - Product Information.
  - .6 PV - Performance Verification.
  - .7 TAB - Testing, Adjusting and Balancing.
  - .8 WHMIS - Workplace Hazardous Materials Information System.
- .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 8 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 Revise, refine and update every 6 months during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

#### 1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
  - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
  - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
    - .1 Review of Cx documentation from operational perspective.
    - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
    - .3 Protection of health, safety and comfort of occupants and O&M personnel.
    - .4 Monitoring of Cx activities, training, development of Cx documentation.
    - .5 Work closely with members of Cx Team.
- .3 Departmental Representative is responsible for:
  - .1 Organizing Cx.
  - .2 Monitoring operations Cx activities.
  - .3 Witnessing, certifying accuracy of reported results.
  - .4 Witnessing and certifying TAB and other tests.
  - .5 Developing BMM.
  - .6 Ensuring implementation of final Cx Plan.

- .7 Performing verification of performance of installed systems and equipment.
- .8 Implementation of Training Plan.
- .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
  - .1 Testing.
  - .2 TAB.
  - .3 Performance of Cx activities.
  - .4 Delivery of training and Cx documentation.
  - .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
- .5 Contractor's Cx agent implements specified Cx activities including:
  - .1 Demonstrations.
  - .2 Training.
  - .3 Testing.
  - .4 Preparation, submission of test reports.
- .6 Property 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.

#### 1.7 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
  - .1 Installation contractor/subcontractor:
    - .1 Equipment and systems except as noted.

#### 1.8 EXTENT OF CX

- .1 Cx Structural and Architectural Systems:
  - .1 Doors, windows, related hardware:
    - .1 Overhead doors
    - .2 Door and window hardware.
- .2 Commission mechanical systems and associated equipment:
  - .1 Plumbing systems:
    - .1 Domestic CWS and HWS.
    - .2 Domestic water heating systems.
    - .3 Regular sanitary waste systems.
    - .4 Sewage pumps.
    - .5 Storm water systems.
    - .6 Sump pumps.
  - .2 HVAC and exhaust systems:
    - .1 HVAC systems.
    - .2 General exhaust systems.
    - .3 Heat recovery systems.
  - .3 Fire and life safety systems:
    - .1 Fire extinguishers.
  - .4 Seismic restraint and control measures.



- .5 Noise and vibration control systems for mechanical systems.
- .3 Commission electrical systems and equipment:
  - .1 Low voltage below 750 V:
    - .1 Low voltage equipment.
    - .2 Low voltage distribution systems.
    - .3 Central clock systems.
    - .4 Electronic data and communications information systems.
  - .2 Emergency power generation systems:
    - .1 Generators.
    - .2 Fuel systems.
    - .3 Transfer switchgear and controllers.
  - .3 Lighting systems:
    - .1 Lighting equipment.
    - .2 Distribution systems.
  - .4 Fire alarm systems, equipment:
    - .1 Annunciators.
    - .2 Control panels.
    - .3 Fire alarm battery banks.
  - .5 Other systems and equipment:
    - .1 Intrusion and access security and safety systems

#### 1.9 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.
  - .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.

#### 1.10 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
  - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
  - .1 Cx as used in this section includes:
    - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
    - .2 Factory inspections and performance verification tests.

- .3 Deliverables: provide:
  - .1 Cx Specifications.
  - .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.
  - .8 Description of Cx of integrated systems and documentation.
  - .9 Tests of following witnessed by PWGSC Design Quality Review Team:
  - .10 Tests performed by Owner/User.
  - .11 Training Plans.
  - .12 Cx Reports.
  - .13 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

**1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION**

- .1 Items listed in this Cx Plan include the following:
  - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
  - .2 Departmental Representative to use approved check lists.
  - .3 Departmental Representative will monitor some of these pre-start-up inspections.
  - .4 Include completed documentation with Cx report.
  - .5 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 does not form part of Cx specifications.
  - .6 Departmental Representative will monitor some of these inspections and tests.
  - .7 Include completed documentation in Cx report.
- .2 Pre-Cx Activities - ARCHITECTURAL AND STRUCTURAL:
  - .1 Doors, windows, related hardware:
    - .1 Overhead doors:
    - .2 Door and window hardware
- .3 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.
  - .2 HVAC equipment and systems:
    - .1 "Bump" each item of equipment in its "stand-alone" mode.
    - .2 At this time, 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.
    - .4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.

- .5 Pre-Cx Activities - ELECTRICAL:
  - .1 Low voltage distribution systems under 750 V:
    - .1 Requires independent testing agency to perform pre- energization and post-energization tests.
  - .2 Emergency power generation systems
    - .1 Transfer switches: test by simulating loss of power. Verify availability of power at equipment requiring same.
    - .2 Uninterruptible power systems: test under full and partial load conditions.
  - .3 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representative has witnessed and certified report, demonstrate devices and zones to Departmental Representative.
  - .4 Low voltage systems: these include:
    - .1 Clock, communications, low voltage lighting control systems and data communications systems.
    - .2 Special systems such as Simultaneous Translation systems, MPs Call systems, Messenger Call systems, Division Bell systems.
  - .5 Security, surveillance and intrusion alarm systems: to include verification by Departmental Representative.

**1.12 START-UP**

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:
- .3 Departmental Representative to monitor some of these start-up activities.
  - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
  - .1 Approved Cx Agent to perform.
    - .1 Repeat when necessary until results are acceptable to Departmental Representative.
  - .2 Use procedures modified generic procedures to suit project requirements.
  - .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
  - .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
  - .5 Departmental Representative 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.

**1.13 CX ACTIVITIES AND RELATED DOCUMENTATION**

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

**1.14 CX IF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION**

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Tests to be witnessed by Departmental Representative and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.
- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
  - .1 Integrated HVAC systems.
  - .2 Fire alarm systems.
  - .3 Emergency power generator.
  - .4 Transfer switch and controllers.
- .6 Identification:
  - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Project Manager, Property Manager and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

**1.15 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.

**1.16 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.

**1.17 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.

1.18 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.

1.19 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative 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.
    - .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 Consultant, Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.20 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative 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.

1.21 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.

1.22 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project.

1.23 TRAINING PLANS

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

1.24 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.

END OF SECTION 01 91 31

## 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 Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance 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.

### 1.5 SAMPLES OF COMMISSIONING FORMS

- .1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.

- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

**1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS**

- .1 When additional forms are required, but are not available from Departmental Representative, DCC Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
  - .1 Additional commissioning forms to be in same format as provided by Departmental Representative

**1.7 COMMISSIONING FORMS**

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
  - .1 Departmental Representative provides Contractor 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 and reviewed and signed off by Departmental Representative.
  - .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).

**1.8 LANGUAGE**

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



## 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
  - .3 Wet Pipe Sprinkler Systems Section 21 13 13
  - .4 Electrical Section 26 05 00

### 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 Engineer 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.
- .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 Authority will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Commissioning Authority.

#### 1.8 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
  - .1 Review of facility and occupancy profile.
  - .2 Functional requirements.
  - .3 System philosophy, limitations of systems and emergency procedures.
  - .4 Review of system layout, equipment, components and controls.
  - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
  - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
  - .7 Maintenance and servicing.
  - .8 Trouble-shooting diagnosis.
  - .9 Inter-Action among systems during integrated operation.
  - .10 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.
- .4 Use training forms in Appendix H of the specification document.

## 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 format accepted and approved by Departmental Representative.

### 1.3 APPROVALS

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

### 1.4 GENERAL INFORMATION

- .1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
  - .1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
  - .2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
    - .1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
  - .3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
  - .4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.
  - .5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.
  - .6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.
  - .7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.
  - .8 Operating and maintenance manual - Section 3.2 of BMM.
  - .9 Final commissioning plan as actually implemented.

- .10 Completed commissioning checklists.
- .11 Commissioning test procedures employed.
- .12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.
- .13 Commissioning reports.

#### 1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

- .1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.
- .2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.
- .3 Include original manufactures brochures and written information on products and equipment installed on this project.
- .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, lose 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.
- .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

**1.1 RELATED REQUIREMENTS**

- .1 Section 02 41 99 - Demolition for Minor Works
- .2 Section 02 82 00.02 - Asbestos Abatement Intermediate Precautions
- .3 Section 02 83 11 - Lead Base Paint Intermediate Precautions

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
  - .2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
  - .3 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.
  - .4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
  - .1 Canada Green Building Council (CaGBC)
    - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
  - .2 CSA International
    - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
  - .3 Underwriters' Laboratories of Canada (ULC)
    - .1 CAN/ULC-S660-08, Standard for Nonmetallic Underground Piping for Flammable and Combustible Liquids.
    - .2 ULC/ORD-C58.15-1992, Overfill Protection Devices for Flammable Liquid Storage Tanks.
    - .3 ULC/ORD-C58.19-1992, Spill Containment Devices for Underground Flammable Liquid Storage Tanks.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
    - .1 Verify project requirements.
    - .2 Verify existing site conditions adjacent to demolition work.
    - .3 Co-ordination with other construction subtrades.
  - .2 Hold project meetings every 2 weeks.
  - .3 Ensure key personnel site supervisor, project manager and subcontractor representatives WMC attend.
  - .4 WMC must provide written report on status of waste diversion activity at each meeting.
  - .5 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

- .2 Scheduling:
  - .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
    - .1 In event of unforeseen delay notify Consultant in writing.

#### 1.4 ACTION & INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 21 - Construction/Demolition Waste Management Disposal.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Prior to beginning of Work on site submit detailed Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:
  - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
  - .2 Schedule of selective demolition.
  - .3 Number and location of dumpsters.
  - .4 Anticipated frequency of tipping.
  - .5 Name and address of waste receiving organizations.
- .4 Submit PDF copies of receipts from authorized disposal sites and reuse and recycling facilities for material removed from site on a bi-weekly basis upon request of Consultant.
  - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.
- .5 Shop Drawings:
  - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
  - .2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

SPEC NOTE: Co-ordinate the following paragraph with Section 01 35 21 - LEED Requirements.

- .6 Sustainable Design Submittals:
  - .1 LEED Canada CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 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.

#### 1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Ensure Work is performed in compliance with applicable Provincial and Municipal regulations.

#### 1.6 SITE CONDITIONS

- .1 Environmental protection:
  - .1 Ensure Work is done in accordance with Section 01 35 43 - Environmental Procedures.

- .2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Fires and burning of waste or materials is not permitted on site.
- .4 Do not bury rubbish waste materials.
- .5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into storm or sanitary sewers.
  - .1 Ensure proper disposal procedures are maintained throughout project.
- .6 Do not pump water containing suspended materials into storm or sanitary sewers, or onto adjacent properties.
- .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
- .8 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .9 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all interior and exterior public areas.

#### 1.7 EXISTING CONDITIONS

- .1 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative immediately. Proceed only after receipt of written instructions has been received from Consultant.
- .2 Structures to be demolished are based on their condition at time of examination prior to tendering.

#### 2.0 PRODUCTS

##### 2.1 EQUIPMENT

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

#### 3.0 EXECUTION

##### 3.1 PREPARATION

- .1 Protection of in-place conditions:
  - .1 Work in accordance with Section 01 35 43 - Environmental Procedures.
  - .2 Prevent movement, settlement or damage of adjacent structures, services and parts of existing building to remain.
    - .1 Provide bracing, shoring and underpinning as required.
    - .2 Repair damage caused by demolition as directed by Departmental Representative
- .3 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative



- .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
  - .1 Disconnect and cap mechanical services.
  - .2 Natural gas supply lines: remove in accordance with gas company requirements.
  - .3 Sewer and water lines: remove or provide temporary support if they are to remain as indicated on drawings.
  - .4 Other underground services: remove and dispose of as indicated on drawings.

### 3.2 DEMOLITION

- .1 Do demolition work in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .2 Blasting operations not permitted during demolition.
- .3 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
- .4 Prior to start of Work, remove contaminated or hazardous materials as indicated in Hazardous Material Report from site and dispose of at designated disposal facilities in safe manner and in accordance with recommendation in report.
- .5 Demolish structural work as indicated on drawings.
- .6 Crush concrete generated due to demolition of concrete structure to size suitable for recycling
  - .1 Where possible identify markets which will accept crushed material as aggregate.
- .7 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .8 At end of each day's work, leave Work in safe and stable condition.
- .9 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- .10 Use natural lighting to do Work where possible.
  - .1 Shut off lighting except those required for security purposes at end of each day.

### 3.3 CLEANING

- .1 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill to site approved, and Departmental Representative.
- .4 Designate appropriate security resources / measures to prevent vandalism, damage and theft.

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Section 02 41 16 - Structure Demolition
- .2 Section 01 35 21 - LEED Requirements
- .3 Section 02 82 00.02 - Asbestos Abatement Intermediate Precautions
- .4 Section 02 83 11 - Lead Base Paint Intermediate Precautions

### 1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 CSA International
  - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

### 1.3 ACTION & INFORMATIONS SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and 01 74 21 - Construction/Demolition Waste Management Disposal.
- .2 Submit hoarding layout plan for approval by Departmental Representative at each stage of work.
- .3 Sustainable Design Submittals:
  - .1 LEED Canada CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 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 Review "Pre-Renovation Hazmat Survey" and take precautions to protect environment.
- .2 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 Consultant.
- .3 Notify Departmental Representative before disrupting building access or services.
- .4 Extent of Demolition - refer to drawing including removal and disposal of all existing furniture and tables in the galleria and atrium only after arrival and installation of new furniture.

## 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 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 and the Owner concerned 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.

### 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 21 - Construction/Demolition Waste Management and Disposal and 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

## 1.0 GENERAL

### 1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal of asbestos containing material from building material within the project area at lower mall and upper mall level as indicated in the Pre-Renovations Hazmat Survey in Appendix A.

### 1.2 RELATED REQUIREMENTS

- .1 Section 02 41 99 Demolition for Minor Works
- .2 Section 02 83 11 Lead Basepaint Intermediate Precautions

### 1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.205- 94 , Sealer for Application of Asbestos Fibre Releasing Materials.
- .2 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 Underwriters' Laboratories of Canada (ULC)

### 1.4 DEFINITIONS

- .1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .2 Asbestos Containing Materials (ACMs): materials that contain 0.5 0.1 provincial regulated amount per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.
- .3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.
- .4 Authorized Visitors: Engineers, or designated representatives, and representatives of regulatory agencies.
- .5 Competent worker person : in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .6 Friable Materials: material that when dry can be crumbled pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .7 Glove Bag: prefabricated glove bag as follows:

- .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
- .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
- .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
- .4 Straps for sealing ends around pipe.
  
- .8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
  
- .9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
  
- .10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.
  
- .11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
  
- .12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

#### 1.5 ACTION & INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
  
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.
  
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
  
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
  
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
  
- .6 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
  
- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
  
- .8 Submit Worker's Compensation Board status and transcription of insurance.
  
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
  - .1 Encapsulants;

- .2 Amended water;
  - .3 Slow drying sealer.
- .10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

#### 1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
      - .1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
      - .2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.
    - .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
    - .4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

- .5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are located as indicated on drawings.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .7 Visitor Protection:
  - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
  - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
  - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

#### 1.7 WASTE MANAGEMENT & DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition 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 bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers steel metal plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Fold up metal banding, flatten and place in designated area for recycling.
- .8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

#### 1.8 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project is appended in appendix A of this specifications.
- .2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

#### 1.9 SCHEDULING

- .1 Hours of Work: perform work in accordance with Section 01 14 00 Work Restrictions.

#### 1.10 PERSONNEL TRAINING

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker

has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Drop and Enclosure Sheets:
  - .1 Polyethylene: 0.15 mm thick.
  - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.
- .3 Waste Containers: contain waste in two separate containers.
  - .1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.
  - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
  - .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.
- .4 Glove bag:
  - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
  - .2 The glove bag to be equipped with:
    - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
    - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
    - .3 A tool pouch with a drain.
    - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
    - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- .5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.



- .1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.
- .7 Encapsulant: surface film forming / penetrating type conforming to CAN/CGSB-1.205.

### 3.0 EXECUTION

#### 3.1 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

#### 3.2 PROCEDURES

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.
  - .3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.
    - .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
    - .2 Do not use compressed air to clean up or remove dust from any surface.
  - .4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
    - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
    - .2 When removing suspended ceilings and walls themselves do not enclose work area and when removing asbestos containing material from piping or equipment and "glove bag" method is not used erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.
  - .5 Before removing suspended ceilings, remove friable material on upper surfaces using HEPA vacuum equipment.
    - .1 Remove and clean surfaces of ceiling panels using HEPA vacuum, wrap clean panels in 0.10 mm thick polyethylene, and store in building as directed by Departmental Representative.
    - .2 Clean "T" grid suspension system, disconnect, wrap in 0.10 mm thick polyethylene, and store in building as directed by Engineer.
  - .6 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.

- .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
- .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .7 Pipe Insulation Removal Using Glove Bag:
  - .1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:
    - .1 It may not be possible to maintain a proper seal for any reason including, without limitation:
      - .1 The condition of the insulation.
      - .2 The temperature of the pipe, duct or similar structure.
    - .2 The bag could become damaged for any reason including, without limitation.
      - .1 The type of jacketing.
      - .2 The temperature of the pipe, duct or similar structure.
  - .2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.
  - .3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.
  - .4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.
  - .5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.
  - .6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.
  - .7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.
  - .8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.
- .8 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .9 Cleanup:
  - .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
  - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
  - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
  - .4 Seal and remove double bagged waste from site. Dispose of in accordance with

requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

- .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

### 3.3 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with Provincial/Territorial Occupational Health and Safety Regulations PWGSC requirements.
  - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.
- .3 Ensure that respiratory safety factors are not exceeded.
- .4 During the course of Work, Departmental Representative to measure fibre content of air outside Work areas by means of air samples analyzed by Phase Contrast Microscopy (PCM).
  - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.

END OF SECTION 02 82 00.02

**1.0 GENERAL****1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal of lead based paint from walls and ceilings within the project area only at lower mall and upper mall level as indicated in Pre-Renovation Hazmat Survey by scraping or sanding using non-powered hand tools.
  - .2 Manual demolition of lead-painted plaster walls or building components by striking wall with sledgehammer or similar tool.

**1.2 RELATED REQUIREMENTS**

- .1 Section 02 41 99 Demolition for Minor Works
- .2 Section 02 82 00. 02 Asbestos Abatement Intermediate Precautions

**1.3 REFERENCES**

- .1 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .3 Human Resources and Social Development Canada (HRSDC)
  - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 U.S. Environmental Protection Agency (EPA)
  - .1 EPA 747-R-95-007- 1995, Sampling House Dust for Lead.
- .6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
  - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- .7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
  - .1 Lead in Construction Regulation - 29 CFR 1926.62- 1993.
- .8 Underwriters' Laboratories of Canada (ULC)

**1.4 DEFINITIONS**

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Owner Departmental Representative or designated representatives and representatives of regulatory agencies.
- .3 Occupied Area: areas of building or work site that is outside Work Area.
- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine

- spray. Must be appropriate capacity for scope of work.
- .5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.
  - .6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows:
    - .1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.
    - .2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.
    - .3 Overlap each polyethylene sheet at openings 1.5 m on each side.
  - .7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic meter of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic meter of air within Work Area.
  - .8 Competent person: Professionals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.
  - .9 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

#### 1.5 ACTION & INFORMAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.
- .3 Provide: Provincial Territorial and local requirements for Notice of Project Form.
- .4 Provide proof of Contractor's General and Environmental Liability Insurance.
- .5 Quality Control:
  - .1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that it has been received and properly disposed.
  - .2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.
  - .3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
- .6 Product data:
  - .1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
    - .1 Encapsulants.
    - .2 Amended water.
    - .3 Slow drying sealer.

**1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:
      - .1 Respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.
      - .2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
  - .2 Requirements for workers:
    - .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
    - .2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.
    - .3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.
- .3 Eating, drinking, chewing, and smoking are not permitted in Work Area.
- .4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.
- .5 Ensure workers wash hands and face when leaving Work Area. Facilities for washing are located as indicated on drawings.
- .6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

- .7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.
- .8 Visitor Protection:
  - .1 Provide protective clothing and approved respirators to Authorized Visitors to Work Areas.
  - .2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.
  - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

#### 1.7 WASTE MANAGEMENT & DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

#### 1.8 EXISTING CONDITIONS

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project is appended in Appendix A of this specifications.
- .2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

#### 1.9 SCHEDULING

- .1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:
  - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
  - .2 Provincial Ministry of Labour.
  - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Departmental Representative copy of notifications prior to start of Work.
- .4 Hours of Work: perform work in accordance with Section 01 14 00 Work Restrictions. Include in Contract Sum additional costs due to this requirement.

#### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

- .2 FR polyethylene: 0.15 mm reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.
- .5 Lead waste containers: metal fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.
  - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

### 3.0 EXECUTION

#### 3.1 SUPERVISION

- .1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead based paints.

#### 3.2 PREPARATION

- .1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.
- .2 Work Area:
  - .1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
  - .2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
  - .3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.
  - .4 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
  - .5 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.
  - .6 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.
  - .7 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:
    - .1 CAUTION LEAD HAZARD AREA (25 mm).
    - .2 NO UNAUTHORIZED ENTRY (19 mm).
    - .3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
    - .4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
- .8 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.
- .9 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.



- .10 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.
- .3 Worker Decontamination Enclosure System:
  - .1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:
    - .1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.
    - .2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .4 Construction of Decontamination Enclosures:
  - .1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.
  - .2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .5 Separation of Work Areas from Occupied Areas
  - .1 Barriers between Work Area and occupied area to be constructed as follows:
    - .1 Construct floor to ceiling lumber metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply 9 plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.
    - .2 Cover plywood with polyethylene sheeting and sealed with duct tape.
- .6 Maintenance of Enclosures:
  - .1 Maintain enclosures in clean condition.
  - .2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.
  - .3 Visually inspect enclosures at beginning of each work day.
  - .4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

**3.3 LEAD-BASE PAINT ABATEMENT**

- .1 Removal of lead based paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted plaster walls or building components by striking a wall with sledgehammer or similar tool.
- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet

sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

- .4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean work area including equipment and access room, and equipment used in process. After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces. Do not disturb work for 8 hours with no entry, activity, ventilation or disturbance during this period.
- .6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

### 3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.
- .2 Departmental Representative will inspect work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When lead dust leakage from Work Area occurs Departmental Representative may order Work shutdown.
  - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

### 3.5 LEAD SURFACE SAMPLING-WORK AREAS

- .1 Final lead surface sampling to be conducted as follows:
  - .1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed. Departmental Representative will perform lead wipe sampling in Work Area.
    - .1 Final lead wipe sampling results from horizontal and vertical surfaces where lead based paints have been removed must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples must be collected and analyzed in accordance with EPA 747-R-95-007.
    - .2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
    - .3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

### 3.6 FINAL CLEAN-UP

- .1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.
- .5 Clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

### 3.7 RE-ESTABLISHMENT OF OBJECTS & SYSTEMS

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION 02 83 11

**1.0 GENERAL****1.1 RELATED WORK**

- |    |                        |                  |
|----|------------------------|------------------|
| .1 | Concrete Reinforcing   | Section 03 20 00 |
| .2 | Cast-in-Place Concrete | Section 03 30 00 |

**1.2 REFERENCES**

- .1 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA-O86-09, Engineering Design in Wood (Limit States Design).
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O151-04, Canadian Softwood Plywood.
- .5 CSA S269.1-1975, Falsework for Construction Purposes.
- .6 CAN/CSA-S269.3-M92, Concrete Formwork.

**1.3 SHOP DRAWINGS**

- .1 Prepare shop drawings for formwork and falsework in accordance with Section 01 33 00 – Shop drawings, product data and samples.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings and comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
- .5 The contractor is responsible for the design of all formwork and shoring and for complying with all Workers' Compensation Board regulations pertaining to formwork construction, design and inspection. Formwork and shoring shall be designed by a qualified professional engineer registered or licensed in British Columbia.

**2.0 PRODUCTS****2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use plywood and wood formwork materials to CSA-O121 and CAN/CSA-O86,
  - .2 For concrete with special architectural features, use formwork materials to CAN/CSA-A23.1.
- .2 Pan forms: removable as indicated.
- .3 Form ties:

- .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Form liner:
  - .1 Plywood: Douglas Fir to CSA O121 or Canadian Softwood Plywood to CSA O151 square edge.
- .5 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.
- .6 Falsework materials: to CSA S269.1.
- .7 Sealant: to Section 07 90 00 –Sealant.

### 3.0 EXECUTION

#### 3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork / falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .8 Align form joints and make watertight. Keep form joints to minimum.
- .9 Use 25mm chamfer strips on external corners and/or 25mm fillets at interior corners of concrete members, joints, unless specified otherwise.
- .10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated. Refer to architectural drawings for reveals, recesses, chamfers, finishes and other architectural requirements not indicated on the structural drawings.
- .11 Refer to architectural, mechanical and electrical drawings for locations and sizes of curbs and equipment pads.

- .12 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 Build in anchors, sleeves, and other inserts required to accommodate Work specific in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .14 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

### 3.2 REMOVAL AND RESHORING

- .1 Formwork removal and reshoring: Do not remove forms and shoring before the concrete has attained sufficient strength to ensure the safety of the structure and not before the following minimum and long term performance periods of time after placing concrete:

Walls, footing and beam sides	24 hours
Beam soffits	7 days
- .2 Provide all necessary reshoring of members where early removal of forms for beams may be required or where members may be subjected to additional loads during construction as required.
- .3 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

END OF SECTION 03 10 00

**1.0 GENERAL****1.1 RELATED WORK**

- |    |                                  |                  |
|----|----------------------------------|------------------|
| 1. | Concrete Forming and Accessories | Section 03 10 00 |
| .2 | Cast-in-Place Concrete           | Section 03 30 00 |

**1.2 REFERENCES**

- .1 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.
- .2 ACI 315R-94, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .3 ASTM A775/A775M-04, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
- .5 CAN3-A23.3-04, Design of Concrete Structures for Buildings.
- .6 CSA G30.3-M1983 (R1991), Cold Drawn Steel wire for Concrete Reinforcement.
- .7 CSA G30.5-M1983 (R1991), Welded Steel Wire Fabric for Concrete Reinforcement.
- .8 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement.
- .9 CSA G30.14-M1983 (R1991), Deformed Steel Wire for Concrete Reinforcement.
- .10 CSA G30.15-M1983 (R1991), Welded Deformed Steel wire Fabric for Concrete Reinforcement.
- .11 CAN/CSA-G40.21-04, Structural Quality Steels.
- .12 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .13 CSA W186-M1990, Welding of Reinforcing Bars in Reinforced Concrete Construction.

**1.3 SOURCE QUALITY CONTROL**

- .1 Provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 1 week prior to commencing reinforcing work.
- .2 Inform Departmental Representative of proposed source of material to be supplied.

**1.4 SHOP DRAWINGS**

- .1 Produce shop drawings including placing of reinforcement.
- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacing, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacing and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.

- .3 Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated.

## 1.5 SUBSTITUTES

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .2 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA G30.18.
- .3 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .4 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
- .5 Epoxy coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .6 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .7 Mechanical splices: subject to approval of Departmental Representative.
- .8 Plain round bars: to CAN/CSA-G40.21.

### 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise. For epoxy coated bars, fabricate in accordance with ASTM D3963.
- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. For epoxy coated bars, method of bundling and transportation should be in accordance with ASTM A775/A775M and ASTM D3963.

## 3.0 EXECUTION

### 3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.



**3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION 03 20 00

1.0 GENERAL

1.1 RELATED SECTIONS

- |    |                                  |                  |
|----|----------------------------------|------------------|
| .1 | Concrete Forming and Accessories | Section 03 10 00 |
| .2 | Concrete Reinforcing             | Section 03 20 00 |

1.2 REFERENCES

- .1 ASTM C109-05, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
- .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C332-99, Specification for Lightweight Aggregates for Insulating Concrete.
- .4 ASTM C827-01a, Test Method for Early Volume Change of Cementitious Mixtures.
- .5 ASTM C939-02, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
- .6 ASTM D412-98a (2002), Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
- .7 ASTM D624-00e1, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .8 ASTM D1751-99, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- .9 ASTM D1752-04, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .10 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .11 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .12 CAN/CSA-A5-98, Portland Cement.
- .13 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
- .14 CAN/CSA-A23.2-09, Methods of Test for Concrete.
- .15 CAN/CSA-A23.5-98, Supplementary Cementing Materials.
- .16 ASTM C 260 – 01, Specifications for Air-Entraining Admixtures for Concrete.
- .17 ASTM C 494M – 05a, Specifications for Chemical Admixtures for Concrete.

1.3 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

1.4 QUALITY ASSURANCE

- .1 Minimum 2 weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval for following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.
  - .6 Formwork removal.
  - .7 Joints.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5.
- .2 Supplementary cementing materials: to CAN/CSA-A23.5.
- .3 Water: to CAN/CSA-A23.1.
- .4 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
- .5 Low density aggregate for insulating concrete: to CAN/CSA-A23.1 and ASTM C332 group II.
- .6 Air entraining admixture: to ASTM C260.
- .7 Chemical admixtures: to ASTM C494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
  - .1 Compressive strength: 50 MPa at 28 days.
  - .2 Consistency:
    - .1 Fluid: to ASTM C827. Time of efflux through flow cone ASTM C939), under 30 s.
    - .2 Flowable: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portion) 125 to 145%.
    - .3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125%.
    - .4 Dry pack to manufacturer's requirements.

- .9 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .10 Curing compound: to CAN/CSA-A23.1 and to ASTM C309, Type 1-chlorinated rubber.
- .11 Ribbed waterstops: extruded PVC Arctic Grade of sizes indicated with welded corner and intersecting pieces:
  - .1 Tensile strength: to ASTM D412, method A, Die "C", minimum 11.4 MPa.
  - .2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.
  - .3 Tear resistance: to ASTM D624, method A, Die "B", minimum 48 kN/m.
- .12 Premoulded joint fillers:
  - .1 Bituminous impregnated fiber board: to ASTM D1751.
  - .2 Sponge rubber: to ASTM D1752, Type I, flexible grade.
- .13 Weep hole tubes: plastic.
- .14 Dampproofing: Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2.
- .15 Polyethylene film: 6 mil thickness to CAN/CGSB-51.34.

## 2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following properties:
  - .1 Cement: Portland Cement, types as follows:
    - Footing and walls in contact w/ soil: Type MS or MSb
    - Other members: Type GU or GUb
  - .2 Minimum compressive strength at 28 days, class of exposure and nominal size of coarse aggregate:

Member	minimum 28-days strength (Mpa) Category	maximum aggregate size (mm)	exposure class	air content
Walls in contact w/ soil	35	14	S-3	2
Exterior columns	30	20	F-2	2
Interior columns	30	20	N	-
Other walls, beams	35	14	N	-
Footings	30	20	S-3	2
Interior Slabs	25	20	N	-
Topping on metal deck	20	10	N	-
Slab on grade - interior	25	20	N	-
Slab on grade - Exterior	32	20	C-4	2

- .3 Slump at time and point of discharge: To CSA-A23.1 Clause 4.3.2.3. When superplasticizers are used, the slump may be increased by shall kept below the point where segregation will occur. The cost of superplasticizers shall be included in the cost of the concrete. Smaller aggregate size may be used where necessary to increase slump.
- .4 Air content: To CSA-A23.1 Table 2 & 4 to suit appropriate exposure class.

- .5 Chemical admixtures: following admixtures in accordance with to ASTM C494M. Admixtures shall contain no salts or acids.
- .6 Concrete mix designs shall be submitted to a material consultant for approval and to Departmental representative for review prior to any concrete work.

### 3.0 EXECUTION

#### 3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 48 h notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .7 Do not place load upon new concrete until authorized by Departmental Representative.

#### 3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1 and CAN/CSA-A23.2. Adhere strictly to CSA-A23.1 for proper preparation and protection for cold weather and hot weather concrete work.
- .2 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Departmental Representative.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
  - .4 Check locations and sizes of sleeves and openings shown on drawings.
  - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts.
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 With approval of Departmental Representative, grout anchor bolts in holes drilled after concrete has set. Drilled holes to be to manufacturer's recommendations.
  - .3 Protect anchor bolt holes from water accumulations, snow and ice build-up.

- .4 Set bolts and fill holes with epoxy grout.
- .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forms and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .6 Finishing:
  - .1 Finish concrete in accordance with CAN/CSA-A23.1.
  - .2 Use procedures acceptable to Departmental Representative or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: Provide written declaration that compounds used are compatible.
- .7 Waterstops:
  - .1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.
  - .2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
- .8 Joint fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
  - .2 Locate and form isolation, construction and expansion joints as indicated. Install joint filler.
  - .3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .9 Dampproof membrane:
  - .1 Install dampproof membrane under concrete slabs-on-grade inside building.
  - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
  - .3 Seal punctures in dampproof membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.
- .10 Locations of construction joints shall be submitted to the departmental representative for review in advance and prior to commencement of construction.
- .11 Supply and set anchor bolts, sleeves, pipe hangers, expansion joints and other inserts and openings as indicated in the structural drawings and specifications or in documents by other consultants.

- .12 All dowels, anchor bolts, embedded plates and other inserts shall be placed before the concrete is poured.
- .13 Slab on grade joints shall be 35mm deep sawcuts spaced maximum 4500mm apart, layout of joints shall be approved by the Departmental representative, seal with flexible joint sealer to prevent ingress of water.

### 3.3 SITE TOLERANCE

- .1 All horizontal surfaces shall meet the Class A Slab and Floor Finish classification (+/- 8mm) in accordance with Table 19 of CAN/CSA-A23.1 straight edge method.
- .2 Tolerance closer than those specified in CSA-A23.1 may be required at certain locations for structural, architectural and construction requirements.

### 3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a CSA certified Testing Laboratory designated by Departmental Representative in accordance with CAN/CSA-A23.1. Submit all concrete testing results to the departmental representative.
- .2 Costs of tests will be borne by the Contractor.
- .3 Departmental Representative may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .5 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION 03 30 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Concrete Formwork	Section 03 10 00
.2	Concrete Reinforcement	Section 03 20 00
.3	Cast-in-Place Concrete	Section 03 30 00
.4	Concrete Finishing	Section 03 35 00

1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A 775/A 775M-07b, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - .3 ASTM D 412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
  - .4 ASTM D 2240-05 (2010), Standard Test Method for Rubber Property - Durometer Hardness.
  - .5 ASTM C 494/C 494M-10a, Standard Specification for Chemical Admixtures for Concrete.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .4 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3-04 (R2010), Design of Concrete Structures.
  - .3 CSA A23.4-09, Precast Concrete-Materials and Construction.
  - .4 CSA A3000-08, Cementitious Materials Compendium.
    - .1 CSA A3001-08, Cementitious Materials for Use in Concrete.
  - .5 CSA G30.18-09, Carbon and Steel Bars for Concrete Reinforcement.
  - .6 CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .7 CSA G279-M1982 (R1998), Steel for Prestressed Concrete Tendons (Metric Version).
  - .8 CAN/CSA-S6-06, Canadian Highway Bridge Design Code.
  - .9 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .10 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).
  - .11 CSA W186-M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.



- .6 Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - 2007.
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .8 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### 1.3 ACTION AND 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 concrete mixes and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Material samples: submit the following samples of materials for approval to the Consultant. Approved samples shall be used as the acceptable standard for all materials used on the project. Samples of the following are required:
  - .1 Forming materials.
  - .2 Gaskets, sealing materials, and form jointing system (as applicable).
  - .3 Ties and cones.
  - .4 Rustication strip material.
  - .5 Form release agent.
  - .6 Chairs and spacers.
- .4 Sample panel: in a concealed location designated by the Consultant, provide a sample of architectural concrete utilizing proposed formwork materials and methods. If accepted, this panel shall serve as a control sample for the balance of the architectural concrete work.
- .5 Shop drawings and formwork design:
  - .1 The Contractor shall design and prepare detailed drawings showing the forming he proposes for the typical elements of the structure. Submit to the Consultant for review a3 min. of ten (10) days prior to relevant phase of work. Drawings shall be min. 1:100 scale for elevations and 1:50 for details, and shall show all typical details and non-typical areas. Indicate all locations where typical details will be used.
  - .2 Shop drawings shall show the following principal items:
    - .1 Type of forming materials, blockouts and bulkheads, and methods of fixing.
    - .2 Location of joints in forming material.
    - .3 Location of construction and expansion joints.
    - .4 Location of rustication strips and method of fixing.
    - .5 Detailed description of construction methods proposed to be used in the work, including method of sealing forms between construction joints, corners and intersections and texturing of architectural surfaces.
    - .6 Shoring and re-shoring locations and details.
  - .3 Formwork design (general): the design of formwork shall follow strictly the standards of appearance as indicated by detailed drawings of typical elements, showing systematically

placed tie locations, form joint locations, rustication strip locations, and special formwork materials.

- .4 Formwork design (architectural requirements): patterns of individual forming panels, rustication bands, and construction joints shall be reflected in the Contractor's shop drawings, and must be read in conjunction with structural requirements showing configurations, dimensions, and reinforcing as detailed on structural drawings and specified in structural sections of Division 3.
- .5 Prior to commencement of shop drawings the contractor shall consult with the Consultant regarding tie locations and joint placement.
- .6 Adjustment to reinforcing details shown on the drawings including use of couplers or dowels to suit formwork design and joint patterns shall be approved in writing by the Consultant. The Contractor shall bear the cost of such adjustments.
- .6 Sustainable Design Submittals:
  - .1 LEED Canada-CI Version 1.0-2007. Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Management Plan Waste Reduction Work plan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50 75 % of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
    - .2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.
  - .4 Regional Materials: submit evidence that project incorporates required percentage 10 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .5 Low-Emitting Materials:
    - .1 Submit listing of coatings and sealers used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### 1.4 TOLERANCES

- .1 Formwork shall be constructed and finished in accordance with CSA S269.1-1975. Failure to comply with these limits will result in the Contractor, at his expense, filling and/or grinding the substandard surfaces, or if this is deemed unsatisfactory by the Consultant, then the concrete section will be removed and reconstructed at no expense to the Owner. All slabs, stairs, landings, and areas, where detailed, shall have positive slopes to drains sufficient to provide complete water drainage with no ponding.

### 1.5 WARRANTY

- .1 Contractor hereby warrants the precast elements will not spall or show visible evidence of cracking, except for normal hairline shrinkage cracks, in accordance with the 12 months warranty period prescribed in General Conditions, is extended to 60 months.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Refer to Section 03 30 00- Caste-in-Place Concrete.
- .2 Repair Materials:
  - .1 Cement types and aggregates shall be determined by job site mix.
  - .2 Other materials proposed for use will be considered based on successful performance based on prototype construction.
- .3 Form release agent: chemical non-staining release agent, which will not affect the architectural concrete surface. Release agent shall be used in strict accordance with the manufacturer's recommendations.

#### 2.2 FORMWORK DESIGN AND FABRICATION

- .1 Forms shall be tight to prevent loss of mortar. Corner chamfer strips are not allowed on above grade exposed concrete, making mandatory especially tight, well designed corners of the forms. Girts and blocking shall be provided behind all plywood butt joints.
- .2 Plug and caulk all cracks, slits, holes, gaps, and apertures in forms, wherever located, with material sufficient to withstand pressures and remain completely watertight.
- .3 Seal forms at all joints with the use of gasket materials, such as foam rod and foam tape or other approved method to provide adequate means of maintaining a leak-free seal during concrete placement.
- .4 Form removal: design forms to permit removal without damaging architectural finish.

### 3.0 EXECUTION

#### 3.1 GENERAL

- .1 Do concrete work in accordance with CAN/CSA A23.1-01 unless otherwise indicated.
- .2 Concrete placing and consolidation:
  - .1 Forms shall be thoroughly reconditioned and recoated with a non-staining form release agent prior to each use. Any damage to formwork during placing, removal or storage shall be completely repaired, and approved by the Consultant. Formwork with repairs or patches, which would have adverse effects on concrete finish, shall not be used in the work. Store formwork and form materials, as required, to preclude any damage or distortion.
  - .2 Carry on concreting as a continuous operation until section of approved size and shape is completed. Cut-offs and construction joints shall be as per approved details and location. Cold joints shall be permitted only when specifically approved by the Consultant.
  - .3 The Contractor shall provide such equipment and shall employ only those methods and arrangements of equipment, which will reduce to a minimum separation of coarse aggregate from the concrete. Equipment shall be selected for its ability to handle concrete of the lowest slump that can be consolidated by means of vibration after placement.

- .4 Take special care to completely fill forms by depositing as near final position as possible, and to force concrete under and around reinforcement without displacement. After deposited concrete has taken initial set, exercise care to avoid jarring forms or placing strain on ends of projecting reinforcement.
  - .5 Plunge vibrators in the concrete rapidly to minimize entrapped air between concrete and forms. Thoroughly blend the layers of previously placed and new concrete. Remove vibrator from concrete with a pumping action to break up and release air entrapped between concrete and forms. Min. spacing of vibrator insertions shall be in accordance with manufacturer's recommended radius of influence.
  - .6 Install lay-in-waterstop at joints in all exposed exterior concrete walls concrete walls of the building. Install as per manufacturer's written instruction.
- .3 Stripping, protection, curing and cleaning:
- .1 Curing: use no curing method, which could impair the appearance of arch. Concrete surfaces.
  - .2 Protection:
    - .1 Protect architectural concrete from any damage by the elements and defacement of any nature during construction operation.
    - .2 Protect from staining from rebar corrosion.
    - .3 All corners and surfaces subject to possible damage shall be suitably protected with boards or hoardings.
    - .4 Make adequate provision to keep all exposed concrete free from laitance caused by spillage, leaking forms or other contaminants. In no event shall laitance be allowed to penetrate, stain or harden on surfaces, which have been sandblasted.
    - .5 Adequate protection shall be given to all exposed reinforcing steel in architectural concrete to prevent staining of surfaces of concrete due to rust and corrosion. If any rust or corrosion does occur, it shall be removed immediately to avoid permanent staining.

### 3.2 EXAMINATION

- .1 General:
  - .1 Areas to be repaired shall be determined by the Consultant and shall not exceed 0.2 sm. for each 93 sm. of surface area, and shall be widely dispersed. Repairs shall match the surrounding area. Architectural concrete requiring repair in excess of above standard is subject to rejection by the Consultant and subsequent removal and replacement with work at no additional cost to the Owner.
  - .2 Before commencing any repair work, the Contractor shall confirm repair procedures with the Consultant and establish by trial mix the formula required. The Contractor shall demonstrate his repair techniques on the prototype.
  - .3 The following are key steps to making a repair to architectural concrete:
    - .1 Prepare the area to be repaired. This should include achieving the desired finish in the surrounding area. Remove loose particles and chip out part of the sound concrete to avoid feather edge repairs.
    - .2 Proportion the repair mix by weight according to the same proportions as used in the concrete mix but substituting a portion of white cement for grey cement. This should be based on tests to determine what is required to match the finished surface.
    - .3 Apply a coat of bonding material to the root of the areas to be repaired, being careful to avoid dripping on any surface to be exposed.

- .4 Fill in the area to be repaired and brush it out to match the surrounding area.
- .5 Cure the repaired area.
- .6 Clean the repaired area to remove laitance and match the surrounding area.
- .4 Repairs:
  - .1 Repairs shall be carried out under the direction of the Consultant. Usual good practices, i.e. cutting out of loose honeycombs, squaring off edges, etc. shall be followed during preparation. Soak the area to be repaired with water. Place a stiff, colour-matching mortar in the void, striking flush with a wood float and texturing, as required, for the finish designated.
  - .2 Repair mortar mix shall be specially formulated, matching coloured mortar. It shall be non-shrink, and have a twenty-eight day (28) day strength of 35 MPa.
  - .3 The quantity of mixing water shall be no more than necessary for handling and placing. The repair mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing. A mixture of one part bonding agent to four parts water shall be used as mixing water.
  - .4 The repair mix shall be consolidated into place and struck off so as to leave the repaired area slightly higher than the surrounding surface to permit initial shrinkage. The repair shall be left undisturbed for at least one hour before being textured. The repaired area shall be kept damp for seven days.
  - .5 Sponge or wood floats shall be used in finishing repairs to be left exposed. Metal tools shall not be used in finishing repaired areas to be left exposed. The repairing of architectural concrete shall be done after the concrete is textured except honeycombed or other areas determined by the Consultant immediately after form removal.
  - .6 Heavy grinding will be permitted to correct irregularities of planeness in concealed areas only.

### 3.3 CLEANING

- .1 Obtain approval of cleaning methods from Departmental Representative before cleaning soiled architectural concrete surfaces.
- .2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.4 PROTECTION

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

- .2      Repair damage to adjacent materials caused by architectural concrete installation.

END OF SECTION 03 33 00

1.0 GENERAL

1.1 DOCUMENTS:

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

1.2 RELATED REQUIREMENTS

- .1 Section 03 30 00 Cast-In-Place Concrete
- .2 Section 03 33 00 Architectural Concrete
- .3 Section 09 06 00 Room Finish Schedule

1.3 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Commercial Interiors.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-A2005, Adhesive & Sealants Applications.

1.4 QUALITY ASSURANCE

- .1 Standards: Conform to CAN/CSA-A23.1-M90, for concrete finishes.
- .2 Sandblasting / Grind & Polish operations shall conform to applicable codes and regulations.
- .3 Installer Qualifications:
  - .1 Work shall be carried out by personnel who are thoroughly trained and experienced in the floor treatment. The installer to provide a list of a minimum of 3 projects performed within 3 years of equivalent complexity and scope as this contract.
  - .2 Polished concrete installer to be certified or licensed by concrete finish equipment and chemical manufacturer and able to provide adequate number of skilled workmen who are thoroughly trained and experienced.
- .4 Mock-ups:
  - .1 Sandblasting
    - .1 Prior to beginning full scale sandblasting operations, prepare a minimum 4' x4' 1200 x 1200 mm) test area as selected by Departmental Representative to review sandblasting techniques and desired results for light, medium, and coarse sandblast finishes.
  - .2 Polished Concrete
    - .1 Apply Mock-up of 4 square meters of concrete finish to demonstrate surface finish, colour variations and to determine a level of workmanship and finish.

- .2 Build mock-up in location directed by the Departmental representative.
- .3 Prior to proceeding, ensure that Mock-up meets all requirements of the Departmental representative.
- .4 Maintain Mock-up during construction in an undisturbed condition as a standard for judging the work. Accepted Mock-up may remain as part of the work.
- .5 Pre-installation Meeting:
  - .1 Prior to commencement of Work on site, convene a pre-installation conference to be attended by the Contractor, Coating Subcontractor, Manufacturer's Technical Representative, Consultant and Owner to review:
    - .1 Convey proper installation and placement of concrete slabs to ensure proper concrete finishing requirements in order to achieve adequate floor polishing application.
    - .2 Convey to Construction Manager Requirements for protection of concrete slabs to receive concrete floor polishing and to coordinate sequence of work and application during construction.

#### 1.5 SUBMITTALS

- .1 Submittals to be in accordance with 01 33 00 Submittal Procedures.
- .2 LEED Documentation
  - .1 Submit completed LEED forms in accordance with 01 35 21 LEED Requirements as they apply to the materials of this section.
- .3 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06-Health & Safety Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.
    - .2 Include application instructions for concrete floor treatments.
- .4 Submit maintenance instructions for insertion in operations and maintenance manuals. Instructions shall give specific warning of maintenance or cleaning practices or materials, which may damage installed work.

#### 1.6 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 and storage requirements:
  - .1 Deliver materials to site in manufacturer's original factory packaging, labelled with manufacturer's name and address.
  - .2 Store materials in a clean dry area in accordance with manufacturer's instructions.
  - .3 Keep product from freezing.
  - .4 Avoid direct contact with this product as it may cause mild to moderate irritation of the eyes and/or skin.
  - .5 Protect materials during handling and application to prevent damage or contamination.
- .3 Dispense special concrete finish material from sealed containers.
- .4 Packaging Waste Management: Comply with requirements of Section 01 74 21 Construction Waste Management and 01 35 21 LEED Requirements.



- .5 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.

#### 1.8 ENVIRONMENTAL REQUIREMENTS / PROJECT CONDITIONS

- 1. Do not apply product when air, surface, or material temperature is below 35°F (2°C) or above 135°F (57°C).
- 2. Do not apply to frozen concrete.
- 3. Do not use on highly dense or non-porous surfaces.
- 4. Allow concrete to cure a minimum of 45 days, or as otherwise acceptable by product manufacturer before commencement of work.
- 5. Do not commence with polishing until Work has been sufficiently advanced, whereby Work yet to be performed will not adversely affect polished concrete floors. Application of products shall take place a minimum of 21 days prior to fixture and trim installation and Substantial Performance of Work.
- 6. Limit and control dust generated by grinding and polishing procedures in order to prevent potential damage to adjacent surfaces and equipment.
- 7. Control the use of water. Remove standing water from completed floor surfaces.
- 8. Ensure that penetrating sealers are not applied to concrete floors that are to be polished.

#### 1.9 EXTENDED WARRANTY

- 1. Provide two (2) year manufacturer's warranty on products and installation against fading and delamination of finished surfaces.

#### 2.0 PRODUCTS

##### 2.1 MATERIALS

- .1 Concrete materials shall conform to requirements of Section 03300-Cast-In-Place Concrete and CAN/CSA-A23.1-M01.
- .2 Sandblasting materials shall conform to CPCA Manual, Chapter 9, Sandblasting.
- .3 Aggregate for Polished Concrete: 10mm pea gravel in salt and pepper colours.
- .4 Bonding Agent: Formulated for bonding new concrete to cured concrete. Acceptable Products:
  - .1 "Polymer Bonding Agent" by Target Products Ltd.
  - .2 "710 Flex-Con" by Else Construction Products.
  - .3 "K-710 Krystobond" by Kryton International Inc.
  - .4 "Fabribond-A" by Fabrikem Manufacturing Ltd.
  - .5 Or approved alternative.
- .5 Curing and Sealing Compound: Surface Sealer: to CAN/CGSB-25.20. Acrylic carnuba wax, Low VOC. Acceptable Products:
  - .1 "Masterkure N-Seal" by Master Builder Company Limited.
  - .2 "Cure and Seal" by Target Products Ltd.
  - .3 "760 Clear Acrylic Sealer" by Elstro Construction Products.
  - .4 "Buff Hard" by Symons Corporation.
  - .5 Or approved alternative.

- .6 Natural Hardener: Premixed, abrasion resistant non-metallic hardener (Type 1). Acceptable Products:
  - .1 "Mastercron" by Master Builders Company Limited.
  - .2 "Diamag 7" by Sternson Limited.
  - .3 "Non-Metallic Floor Hardener" by Target Products Ltd.
  - .4 "785 Genflor Non-Metallic Floor Hardener" by Elsro Construction Products.
  - .5 Or approved alternative.
- .7 Non-Shrink Grout (for patching): Acceptable Products:
  - .1 "Embeco Mortar" by Master Builders Company Limited.
  - .2 Pre-mixed "Fast-Set Patching Concrete" by Target Products Ltd
  - .3 "810 Gengrout" by Elsro Construction Products.
  - .4 "K-510 Krystol Patch/Grout" by Kryton International Inc.
  - .5 Or approved alternative.
- .8 Densifier: Non-flammable non-toxic, water-based formulation used on Portland Cement materials utilizing Quartz-Litium based products. Acceptable Products:
  - .1 "Crenz Protect" by Crenz Concrete.
  - .2 "Pentra Sil" by Convergent Concrete.
  - .3 "Euco Diamond Hard" by The Euclid Chemical Company.
  - .4 "Liquihard Ultra" Surface Hardener
  - .5 Or approved alternative.
- .9 Top Coat for Polished Concrete: "EnduraShine" by W R Meadows, concrete enhancement.

## 2.2 EQUIPMENT

- 1. Equipment to be used for grinding/polishing shall possess at least 600 lbs of head pressure.
- 2. Equipment to be used for grinding/polishing shall be as recommended by product manufacturer to achieve finish specified.
- 3. Equipment to be used for densifying and cleaning floor after grinding/polishing procedure has been performed:
  - .1 Auto-scrubber or equivalent with a head pressure of 150 lbs.
  - .2 Follow auto-scrubbers manual for cleaning instructions after densifying and conditioning the floor.
  - .3 Do not allow densifier to remain inside the auto-scrubber after densifying.

## 2.3 FINISHES

- .1 Polished Concrete Finish: Provide satin finish that will reflect images from side lighting only.
- .2 Sandblasting: Light to medium sandblasting to match existing architectural concrete finish.

## 3.0 EXECUTION

### 3.1 FINISHING-GENERAL

- .1 Do concrete finishing work in accordance with CAN/CSA-A23.1-M01, unless otherwise indicated.
- .2 Form materials for concrete surfaces which will be exposed to view, or which require smooth and uniform surfaces for applied finishes or other purposes, shall consist of square edged smooth panels of plywood. Panels shall be made in a true plane, clean, free of holes, surface markings and defects. Form release agents and curing agents shall be compatible with applied finishes where applicable. Do not use release agents containing wax or oil in connection with concrete to receive applied coatings.

- .3 Ties in exposed work shall generally be placed symmetrically about any section with plywood sheets and from each wall section or as shown on drawings. Provide drawings showing proposed form tie and form pattern for consultant approval.
- .4 Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or plains of weakness. If a section cannot be placed continuously, construction joints shall be located as permitted and approved by Departmental Representative. Placing shall be carried out at such a rate that concrete which is being integrated with fresh concrete is still plastic.
- .5 Tops of Walls and Columns to be level and true. Allowable tolerance 6 mm in 3,000 mm.

### 3.2 FORMED SURFACES

- .1 Inspect concrete surfaces for defects immediately after removal of formwork.
- .2 Remove or cut back to a depth of 3/4" (19 mm) from the surface of the concrete all bolts, ties, nails, or other metal that is not required and repair immediately. Patch all cone and sleeve holes flush with concrete surface in strict accordance with manufacture's printed instructions. Grout all steel inserts in strict conformance with grout manufacturer's printed instructions.
- .3 Remove imperfections such as bulges, fins, lips, and stains to permanently exposed surfaces as directed by Departmental Representative by chipping or grinding and patch to match adjacent surfaces. Do not proceed with grinding until the concrete has sufficiently hardened to prevent dislodgment of coarse aggregate particles. Allowable limits of grinding to be 1/16" so as to not expose aggregate.
- .4 Repair to exposed surfaces or surfaces to receive paint type finishes: Repairs to be carried out under the direction of the Departmental Representative. Blend cement and aggregate so that, when dry, patching mortar will match colour of surrounding. Provide test areas at inconspicuous location to verify mixture and colour match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface. Patch and fill all concrete imperfections such as "blow holes", "honeycomb" and voids as directed.
- .5 Strike off smooth and finish tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces with a texture matching the adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown.

### 3.3 HORIZONTAL SURFACES

- .1 Where floor drains occur, floors to be level around walls and have a minimum 1:50 uniform pitch to drains, unless indicated otherwise. Stairs and landings shall have positive slopes to provide complete water drainage with no ponding.
- .2 Finish horizontal concrete surfaces as follows:
  - .1 Exposed horizontal surfaces not intended to receive additional concrete: Smooth steel trowel finish or as indicated on the drawings.
  - .2 Horizontal concrete surfaces intended to receive waterproofing membrane or applied floor finishes: Smooth, steel trowel finish. Floors to be finished flat, free from defects which would telegraph through finish material.
  - .3 Horizontal concrete surfaces intended to receive additional concrete toppings, quarry tile or ceramic tile: Screeded off to true lines and levels shown, roughened to an amplitude of 3/16" (5 mm), cleaned of laitance and loose concrete and left ready to receive finish. Depress slabs to accommodate finish where indicated.

- .4 Broom Finish: After completion of floating and when excess moisture of surface sheen has disappeared, complete surface finishing by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Consultant.

### 3.4 PLAIN FLOOR FINISH (TROWELLED)

- .1 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed.
- .2 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.
- .3 Steel trowel to smooth and even surface.
- .4 Follow with second steel trowelling to produces smooth burnished surface to within tolerance described in CAN/CSA-A23.1-M90, Cause 22.1.2-Straight-Edge Method for Very Flat Classification Finish 1/8" (3 mm) in 10'-0" (3000 mm) to all floors receiving carpet, resilient flooring, liquid applied flooring, thin-set ceramic tile. All other floors shall be finished to Flat Classification Finish 3/16" (5 mm) in 10'-0" (3000 mm). Floors shall be true to plane as determined by a 10'-0" (3.0 meter) straight-edge placed anywhere on the surfaces in any direction. Check conformance to tolerance limits at any time after the curing period. Where this Section conflicts with other Sections in Division 3, this Section shall govern.
- .5 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.
- .6 Apply curing compound in accordance with manufacturer's instructions to all areas not scheduled to receive further floor finish.
- .7 Protect surfaces which will be exposed to direct sunlight during the curing period in accordance with manufacturer's instructions.

### 3.5 HARDENED FLOOR FINISH

- .1 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed and apply non-metallic hardener to manufacturer's instructions.
- .2 Apply first shake of aggregate (one half of amount) after floating.
- .3 Float first shake and apply second shake.
- .4 Float second shake.
- .5 Flat steel trowel to produce fine texture non-slip finish.
- .6 Apply two coats of curing and sealing compound in accordance with manufacturer's directions.

### 3.6 POLISHED CONCRETE FLOOR FINISH

- .1 Preparation.
  - .1 Prepare floor to manufacturer's written instruction similar to the following.
  - .2 Dry grind the floor within 100mm to 625mm of walls with 40 grit metal bond diamonds using a rotary planetary floor-grinding machine, equipment should be fitted with a dust collection system.
  - .3 Continue grinding in a half-moon pattern until there is a uniform scratch pattern.
  - .4 Vacuum floor thoroughly using a squeegee vacuum attachment or continue grinding floor within 100mm to 625mm of walls with a 100 grit followed by 200 grit metal bond diamonds.
  - .5 Vacuum floor thoroughly using a wet/dry VAC with squeegee after each grind.

- .6 Inspect surface for flatness, smoothness, scratch patterns, and test for absorbency as instructed prior to product applications.
- .7 Grind the edges with 50, 70, and 100 grit electroplated resin diamonds, removing all of scratches from previous grit using variable speed edge-grinding machine fitted with dust collector.
- .8 Vacuum thoroughly after each grind using squeegee type vacuum attachment.
- .9 Perform surface absorbency test by applying water (after 200 grit grind) to a representative portion of the prepared concrete floor. A properly prepared surface, when dry will immediately absorb clean water without any surface beading effect.
- .2 **Densifier Application**
  - .1 Apply a light thin even coat of densifier over surface in accordance with manufacturer's written instructions.
  - .2 Apply chemical hardener with pump sprayer without dilution. Additional light coats may
  - .3 Do not allow material to puddle. Spread out using a medium strength bristle broom to an even coat working in manageable sections. Work squeegee lines out on concrete surface. If all material has absorbed let the concrete dry.
  - .4 Dry Polish surfaces and edges with 400 grit, 800 grit and 1500 grit. Continue polishing in half moon pattern until there is a uniform scratch pattern.
- .3 **Polishing**
  - .1 For areas where sealer coat is to be applied and following application of densifier and associated grinding, apply a light thin even coat of penetrating sealer in accordance with manufacturer's written instructions.
  - .2 Allow surfaces to dry minimum of 48 hours before allowing foot traffic.

### 3.7 BONDING AGENT

- .1 Apply bonding agent to all concrete when new concrete will be applied against it under the following conditions:
  - .1 Patching.
  - .2 Feathering.
  - .3 Construction joints.
  - .4 Bonding of topping slabs.

### 3.8 SANDBLASTED CONCRETE

- .1 Sandblast concrete surfaces as indicated on drawings in accordance with referenced CPCA Manual, and MPI standards.
- .2 Sandblast finish -SF-2, Light: exposing some of the fine aggregate as well as removing surface dirt and stains - Depth of cut shall not exceed 1/16" (1.5 mm).
- .3 Sandblast Finish -SP-3, Medium: Exposed the top faces of the coarse aggregate faces near the surface. Depth of cut shall not exceed 3/16" (5 mm).
- .4 Sandblast Finish -SP-4, Coarse: Exposed the top faces of the coarse aggregate faces near the surface. Depth of cut shall not exceed 5/16" (7.5 mm).
- .5 Sandblast finish shall be uniform in appearance, similar in all respects to sample panel approved by Departmental Representative.

### 3.9 DEFECTIVE WORK

- .1 Repair honeycombing, rock packets, chips, spalls and other voids in exposed concrete surfaces, using patching materials as specified to provide a smooth surface. Remove fins and other protrusions in concrete surfaces. Maximum allowable depth of grinding to be 1/16".

- .2 Consult with Departmental Representative on the repair of defective concrete surfaces prior to execution of the work.
- .3 Patch form tie holes in all exposed concrete surfaces and surfaces designated to receive waterproofing unless otherwise directed.
- .4 Where in the opinion of the Departmental Representative, material or workmanship fails to meet the requirements of the specification, such work may be rejected. Work rejected shall be replaced or repaired to the approval of the consultant at no additional cost to the owner.

### 3.10 PROTECTION

- .1 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period shall be especially protected.
- .2 Protect work of other sections from damage resulting from work of this Section.
- .3 Provide suitable enclosures for collecting grit and dust from sandblasting operation.
- .4 Erect barricades to prevent traffic on newly finished surfaces.
- .5 Suggested protection in high traffic areas after the sealer has been applied is as follows:
  - .1 Place cheap colourfast carpet that is breathable (not rubber backed), fuzzy side down or Protect CP board.
  - .2 Masonite or plywood may then be applied over the carpet/cardboard for further protection.

### 3.11 ADJUSTING & CLEANING

- .1 Progress Cleaning: Clean during progress of the Work in accordance with Section 01 74 11- Cleaning.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.
- .4 Engage a concrete finish manufacturer's authorized representative to train Owner's maintenance personnel on proper maintenance procedures

END OF SECTION 03 35 00

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Section 04 05 12 Masonry Mortar Grout.
- .2 Section 04 22 00 Concrete Unit Masonry.

### 1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A165 Series-04, Standards on Concrete Masonry Units.
  - .2 CSA A179-04, Mortar and Grout for Unit Masonry.
  - .3 CSA-A371-04, Masonry Construction for Buildings.
- .3 International Masonry Industry All-Weather Council (IMIAC)
  - .1 Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meetings: comply with Section 01 31 19 - Project Meetings. Conduct pre-installation meeting one week prior to commencing work of this Section and on-site installations to:
  - .1 Verify project requirements, including mock-up requirements.
  - .2 Verify substrate conditions.
  - .3 Co-ordinate products, installation methods and techniques.
  - .4 Sequence work of related sections.
  - .5 Co-ordinate with other building subtrades.
  - .6 Review manufacturer's installation instructions.
  - .7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
  - .8 Review warranty requirements.
- .2 Sequencing: sequence with other work in accordance with 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart. Comply with manufacturer's written recommendations for sequencing construction operations.
- .3 Scheduling: schedule with other work in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

### 1.4 ACTION & SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, limitations and colours.
  - .2 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) – Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

- .3 Sustainable Design Submittals:
  - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.

#### 1.5 INFORMATION & SUBMITTALS

- .1 Certificates: provide manufacturer's product certificates certifying materials comply with specified requirements.
- .2 Test and Evaluation Reports:
  - .1 Provide certified test reports in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
  - .2 Test reports to certify compliance of masonry units and mortar ingredient with specified performance characteristics and physical properties.
  - .3 Provide data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.
- .3 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.
- .4 Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:
  - .1 Verification of compliance of work with Contract.
  - .2 Site visit reports providing detailed review of installation of work, and installed work.

#### 1.6 CLOSEOUT SUBMITTALS

- .1 Provide manufacturer's instructions for care, cleaning and maintenance of prefaced masonry units for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 1.7 EXTRA MATERIALS

- .1 Provide manufacturer's instructions in accordance with Section 01 78 00 - Closeout Submittals covering maintenance requirements and parts catalogue, with cuts and identifying numbers.

#### 1.8 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Manufacturer: capable of providing field service representation during construction and approving application method.
  - .2 Installer: experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
  - .3 Masons: company or person specializing in masonry installations with 5 years experience with masonry work similar to this project.
    - .1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.
- .2 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up of glass block strip (minimum 6 blocks long) showing masonry colours and textures, use of reinforcement, mortar, grout and workmanship.
  - .3 Mock-up used:
    - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
  - .4 Construct mock-up where directed by Departmental Representative.
  - .5 Allow 24 hours for inspection of mock-up by Departmental Representative before



- proceeding with work.
- .6 When accepted by Departmental Representative, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
- .7 Start work only upon receipt of written acceptance of mock-up by Departmental Representative.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver 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 Storage and Handling Protection:
  - .1 Keep materials dry until use.
  - .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
  - .3 Packaging Waste Management:
    - .1 Remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

#### 1.10 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.
- .2 Weather Requirements: to CSA-A371 to IMIAC - Recommended Practices and Guide Specifications for Hot and Cold Weather Masonry Construction.
- .3 Cold weather requirements:
  - .1 To CSA-A371 with following requirements.
    - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
    - .2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.
    - .3 Maintain temperature of masonry above 0 degrees C for minimum of 3 days, after mortar is installed.
    - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
  - .2 Hot weather requirements:
    - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
    - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .3 Spray mortar surface at intervals and keep moist for maximum of three days after installation.

#### 1.11 WARRANTY

- .1 For Work in this Section 04 05 00 - Common Work Results for Masonry, Provide 12 months warranty period for concrete masonry.

## 2.0 PRODUCTS

### 2.1 MANUFACTURERS

- .1 Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

### 2.2 MATERIALS

- .1 Masonry materials are specified elsewhere in related Sections:
  - .1 Section 04 22 00 Concrete Unit Masonry.

## 3.0 EXECUTION

### 3.1 INSTALLERS

- .1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

### 3.2 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.

### 3.3 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section.
  - .1 Co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.
- .3 Verification of Conditions:
  - .1 Verify that:
    - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete block and glass block.
    - .2 Field conditions are acceptable and are ready to receive work.
    - .3 Built-in items are in proper location, and ready for roughing into masonry work.
  - .2 Commencing installation means acceptance of existing substrates.

### 3.4 PREPARATION

- .1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent materials from damage and disfiguration.

### 3.5 INSTALLATION

- .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

### 3.6 CONSTRUCTION

- .1 Exposed masonry:
  - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, in exposed masonry and replace with undamaged units.
- .2 Jointing:
  - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
  - .2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
  - .3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cutting:
  - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
  - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In:
  - .1 Build in items required to be built into masonry.
  - .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
  - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .5 Wetting of bricks:
  - .1 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1000 mm<sup>2</sup>: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
  - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .6 Support of loads:
  - .1 Use 25 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.
  - .2 Use grout to CSA A179 where grout is used in lieu of solid units.
- .7 Provision for movement:
  - .1 Leave 6 mm space between top of non-load bearing walls and partitions and structural

elements. Do not use wedges.

- .8 Interface with other work:
  - .1 Cut openings in existing work as indicated.
  - .2 Openings in walls: reviewed by Departmental Representative.
  - .3 Make good existing work. Use materials to match existing.

### 3.7 SITE TOLERANCES

- .1 Tolerances in notes to CSA-A371 apply.

### 3.8 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection:
  - .1 Perform field inspection and testing in accordance with Section 01 45 00 - Quality Control.
  - .2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.
- .2 Manufacturer's Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, and protection of its products, and submit written reports in acceptable format to verify compliance of work with Contract.
  - .2 Manufacturer's field services: provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
  - .3 Schedule site visits to review work at stages listed:
    - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends 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.
  - .4 Obtain reports within three days of review and submit immediately to Departmental Representative.

### 3.9 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Progress Cleaning: in accordance with related masonry sections.
- .3 Final Cleaning:
  - .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
  - .2 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, 01 35 21 - LEED Requirements.
  - .1 Divert unused or damaged masonry units and glass block from landfill as specified in Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.10 PROTECTION**

- .1 Temporary Bracing:
  - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
  - .2 Bracing approved by Departmental Representative.
  - .3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
  
- .2 Moisture 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 flashing or other permanent construction.
  - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.  
Air Temperature Protection: protect completed masonry as recommended in 1.10  
SITE CONDITIONS.

END OF SECTION 04 05 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                                 |                  |
|----|---------------------------------|------------------|
| .1 | Common Work Results for Masonry | Section 04 05 00 |
| .2 | Masonry Accessories             | Section 04 05 23 |
| .3 | Concrete Unit Masonry           | Section 04 22 00 |

1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA A179-[04], Mortar and Grout for Unit Masonry.
  - .3 CAN/CSA A371-[04], Masonry Construction for Buildings.
  - .4 CAN/CSA-A3000-[03], Cementitious Materials Compendium; CAN/CSA-A3002-[03], Masonry and Mortar Cement.
- .3 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMAL SUBMITTALS

- .1 Product Data:
  - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Provide manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.
  - .3 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).
- .2 Samples:
  - .1 Samples: provide unit samples in accordance with Section 04 05 00 - Common Work Results for Masonry, supplemented as follows:
    - .1 Provide two size samples of mortar coloured mortar.
    - .2 Provide samples and confirmation of source or product data sheet, prior to mixing or preparation of mortars, to Departmental Representative.
      - .1 Aggregate: course aggregate and sand.
      - .2 Cement.
      - .3 Lime.
      - .4 Colour pigment samples.
- .3 Manufacturer's Instructions:
  - .1 Provide manufacturer's installation instructions.
- .4 Sustainable Design Submittals:
  - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.

#### 1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports including sand gradation tests in accordance with CAN/CSA A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
  - .1 Submit laboratory test reports in accordance with Section 01 29 83 - Payment Procedures: Testing Laboratory Services.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 31 19 Project Meetings.
- .4 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
    - .1 Sample panel: 6 Blocks long glass block strips using proposed procedures, colours, texture, finish and workmanship.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handles masonry mortar and grout materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:
  - .1 Deliver prepackaged, dry-blended mortar mix to project site in labelled plastic-lined bags each bearing name and address of manufacturer, production codes or batch numbers, and colour or formula numbers.
  - .2 Maintain mortar, grout and packaged materials clean, dry, and protected against dampness, freezing, traffic and contamination by foreign materials.
- .2 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.6 SITE CONDITIONS

- .1 Weather Requirements: CAN/CSA A371 International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Hot and Cold Weather Masonry Construction.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
  - .1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement Type 10 gray colour.
    - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
  - .2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA A179.
  - .3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA A179.
    - .1 Use low VOC products in compliance with SCAQMD Rule 1168.

- .4      Packaged Dry Combined Materials for mortar: to CAN/CSA A179, Type N, using gray colour cement.
- .3      Aggregate: supplied by one supplier.
  - .1      Aggregate: to CAN/CSA A179, Table 3 10mm maximum size.:
- .4      Water: clean and potable.
- .5      Lime:
  - .1      Quick Lime: to CAN/CSA A179, Type N.
  - .2      Hydrated Lime: to CAN/CSA A179, Type N.
- .6      Bonding Agent: latex type.
- .7      Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

## 2.2 COLOUR ADDITIVES

- .1      Use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample. Admixtures to be approved prior to use. Use in accordance with the specific manufacturer's recommendations.
- .2      White mortar: use white Portland cement, and lime to produce mortar type specified.

## 2.3 MORTAR MIXES

- .1      Mortar for interior masonry:
  - .1      Loadbearing: type S based on property specifications.
  - .2      Non-Loadbearing: N based on property specifications.
- .2      Pointing Mortar For Glass Block Masonry: CAN/CSA A179, Type N property specification.

## 2.4 MORTAR MIXING

- .1      Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to be within 1% accuracy.
- .2      Mix mortar ingredients in accordance with CAN/CSA A179 in quantities needed for immediate use.
- .3      Maintain sand uniformly damp immediately before mixing process.
- .4      Add mortar colour and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and colouration.
- .5      Do not use anti-freeze compounds including calcium chloride or chloride based compounds.
- .6      Do not add air entraining admixture to mortar mix.
- .7      Use a batch type mixer in accordance with CAN/CSA A179.
- .8      Pointing mortar: prehydrate pointing mortar by mixing 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 no more than 2 hours then remix with sufficient water to



produce mortar of proper consistency for pointing.

- .9 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .10 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

### 3.0 EXECUTION

#### 3.1 EXAMINATION

- .1 Request inspection of spaces to be grouted.

#### 3.2 PREPARATION

- .1 Apply bonding agent to existing concrete surfaces.
- .2 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

#### 3.3 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.

#### 3.4 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CAN/CSA A179 except where specified otherwise.

#### 3.5 MIXING

- .1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes, Mixing by hand must be pre-approved by the Departmental Representative.
- .2 Clean all mixing boards and mechanical mixing machine between batches.
- .3 Mortar must be weaker than the units it is binding.
- .4 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

#### 3.6 MORTAR PLACEMENT

- .1 Install mortar to manufacturer's instructions.
- .2 Remove excess mortar from grout spaces.

#### 3.7 GROUT PLACEMENT

- .1 Install grout in accordance with manufacturer's instructions.
- .2 Install grout in accordance with CAN/CSA A179.
- .3 Work grout into masonry cores and cavities to eliminate voids.
- .4 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.

- .5 Do not displace reinforcement while placing grout.

### 3.8 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
  - .1 Test and evaluate mortar prior to construction and during construction in accordance with CAN/CSA A179.
  - .2 Test and evaluate grout prior to construction and during construction to CAN/CSA A179; test in conjunction with masonry unit sections specified.
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00 - Common Work Results for Masonry.

### 3.9 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and 01 35 21 - LEED Requirements.

### 3.10 PROTECTION OF COMPLETED WORK

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION 04 05 12

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Common Work Results for Masonry Section 04 05 00
- .2 Masonry Accessories Section 04 05 23
- .3 Concrete Unit Masonry Section 04 22 00

1.2 REFERENCES

- .1 ASTM International Inc.
  - .1 ASTM A 36/A 36M- 05, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A 82/A 82M- 05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .3 ASTM A 167- 99(R2004), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .4 ASTM A 307- 04, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .5 ASTM A 580/A 580M- 06, Standard Specification for Stainless Steel Wire.
  - .6 ASTM A 641/A 641M- 03, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .7 ASTM-A666- 03, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED: Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A23.1/A23.2- 04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA A179- 04, Mortar and Grout for Unit Masonry.
  - .3 CAN/CSA A370- 04, Connectors for Masonry.
  - .4 CAN/CSA A371- 04, Masonry Construction for Buildings.
  - .5 CAN/CSA G30.18- M92 (R2007), Billet-Steel Bars for Concrete Reinforcement.
  - .6 CSA-S304.1- 04, Design of Masonry Structures.
  - .7 CSA W186- M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 ACTION AND INFORMAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheets illustrating products to be incorporated into project for specified products.
  - .2 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Manufacturer's Instructions:
  - .1 Provide manufacturer's installation instructions.

- .4 Sustainable Design Submittals:
  - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.

#### 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 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 04 05 00 - Common Work Results for Masonry.
- .4 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
    - .1 Construct mock-ups of glass strips 5 blocks long.
    - .2 Sample panel: using proposed procedures, anchorage material, connectors, reinforcement material, and workmanship.

#### 1.5 FIELD MEASUREMENTS

- .1 Make field measurements necessary to ensure proper fit of members.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle masonry anchorage and reinforcing materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:
  - .1 Deliver reinforcement and connectors, identified in shop and placement drawings.
- .2 Packaging Waste Management:
  - .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Bar reinforcement: Steel to CAN/CSA A371 and CAN/CSA G30.18, Grade 400.
- .2 Connectors: to CAN/CSA A370 and CSA-S304.1.
- .3 Corrosion protection: to CSA-S304.1, galvanized to CSA-S304.1 and CAN/CSA A370.
- .4 Fasteners: installed post-construction:
  - .1 Bolts and Screws: size and type to suit application, locate where indicated.
  - .2 Nails: case-hardened cut or spiral nails, size and type to suit fastening application.
  - .3 Powder-Driven Fasteners: pin styles and lengths to suit fastening application in accordance with manufacturers use, load and hold recommendations.
  - .4 Adhesives: epoxies, mastics and contact cements for fastening applications, use in accordance with manufacturers' recommendations.
- .5 Ties: hot dip galvanized to CAN/CSA A370 Table 5.2 steel finish.

- .1 Corrugated to CAN/CSA A370.
- .2 Unit ties, to CAN/CSA A370: wire stainless steel, size to suit application.
- .3 Adjustable Unit Ties: to CAN/CSA A370: proprietary type ties, type, style and size to suit application in accordance with manufacturer's recommendations.
- .4 Joint Reinforcement Ties: to CAN/CSA A370:
  - .1 Single Wythe Joint Reinforcement: ladder type:
    - .1 Steel wire, hot dip galvanized: to ASTM A 641, Class 3 after fabrication.
    - .2 Cold drawn steel wire conforming to ASTM A 82.
    - .3 Stainless steel conforming to ASTM A 580, Type 304, 4.8 mm side rods with 3 mm cross ties.
  - .2 Multiple Wythe Joint Reinforcement: ladder type: without moisture drip; adjustable:
    - .1 Steel wire, hot dip galvanized: to ASTM A 641 Class 3 after fabrication.
    - .2 Cold drawn steel wire conforming to ASTM A 82.
    - .3 Stainless steel conforming to ASTM A 580 Type 304, 4.8 mm side rods with 3 mm cross rods.

## 2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CAN/CSA A370.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .5 Ship reinforcement and connectors clearly identified in accordance with drawings.

## 2.3 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcement work.
- .2 Inform Departmental Representative of proposed source of material to be supplied.

## 3.0 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 PREPARATION

- .1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

### 3.3 INSTALLATION

- .1 Supply and install masonry connectors and reinforcement in accordance with CAN/CSA A370, CAN/CSA A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.
- .2 Prior to placing mortar, obtain Departmental Representative's approval of placement of

reinforcement and connectors.

- .3 Supply and install additional reinforcement to masonry as indicated.

### 3.4 BONDING AND TYING

- .1 Bond walls of two or more wythes using metal connectors in accordance with CSA-S304.1, CAN/CSA A371 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CAN/CSA A371 and as indicated.
- .3 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CAN/CSA A370 and CAN/CSA A371 manufacturer's instructions.
  - .1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA A371 and as indicated.
  - .2 Install horizontal joint reinforcement 400 mm on centre.
  - .3 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
  - .4 Place joint reinforcement continuous in first and second joint below top of walls.
  - .5 Lap joint reinforcement ends minimum 150 mm.
  - .6 Connect stack bonded unit joint corners and intersections with strap anchors 400 mm on centre.

### 3.5 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA-S304.1, CAN/CSA A371, and CAN/CSA A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA A371.

### 3.6 GROUTING

- .1 Grout masonry in accordance with CSA-S304.1, CAN/CSA A371 and CAN/CSA A179 and as indicated.

### 3.7 ANCHORS

- .1 Supply and install metal anchors in accordance with CAN/CSA A370 and CAN/CSA A371 as indicated.

### 3.8 LATERAL SUPPORT AND ANCHORAGE

- .1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

### 3.9 MOVEMENT JOINTS

- .1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

### 3.10 FIELD BENDING

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

- .3 Replace bars and connectors which develop cracks or splits.

**3.11 FIELD QUALITY CONTROL**

- .1 Site inspections in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Obtain Departmental Representative approval of placement of reinforcement and connectors, prior to placing mortar.

**3.12 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

**3.13 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.

END OF SECTION 04 05 19

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Common Work Results for Masonry Section 04 05 00.

1.2 REFERENCES

- .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A165 Series-2004, CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.
  - .2 CAN/CSA A371-04, Masonry Construction for Buildings.
  - .3 CSA S304.1-04, Design of Masonry Structures.
- .4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 ACTION & INFORMAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Product Data: provide product data, including manufacturer's printed data sheets and catalog pages illustrating products to be incorporated into project for specified products.
- .3 Manufacturer's Written Instructions: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.

1.4 QUALITY ASSURANCE SUBMITTALS

- .1 Certificates: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Test and Evaluation Reports: provide certified test reports in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .4 Sustainable Design Submittals:
  - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.
- .5 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
    - .1 Construct mock-up panel of interior concrete unit masonry construction 1200 x 1800 mm.



1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Packaging Waste Management:
  - .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Standard concrete block units Type : to CAN/CSA-A165 .1M-M94 ( CAN/CSA-A165.1) .
  - .1 Classification: H/15/A/M.
  - .2 Dimensions - Nominal: 200 mm wide x200 mm high x 400 mm long.
  - .3 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.
  - .4 Colour:
    - .1 Integrally coloured pre-finished architectural concrete block with one or more faces ground to expose variegated colours of natural aggregates; with factory-applied clear satin gloss acrylic finish.
    - .2 Unit faces filled with cementitious grout, polished with factory applied clear satin gloss acrylic finish.

2.2 REINFORCEMENT

- .1 Reinforcement in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.3 CONNECTORS

- .1 Connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.4 MORTAR MIXES

- .1 Mortar and mortar mixes in accordance with Section 04 05 12 - Masonry Mortar and Grout.

2.5 GROUT MIXES

- .1 Grout and grout mixes in accordance with Section 04 05 12 - Masonry Mortar and Grout.

2.6 CLEANING COMPOUNDS

- .1 Use low VOC products in compliance with SCAQMD Rule 1168.
- .2 Compatible with substrate and acceptable to masonry manufacturer for use on products.
- .3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.7 TOLERANCES

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:
  - .1 Maximum variation between units within specific job not to exceed 2 mm.
  - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
  - .3 Out of square tolerance not to exceed 2 mm.

**3.0 EXECUTION**

- .1 Verify surfaces and conditions are ready to accept work of this Section.
- .2 Commencing installation means acceptance of existing substrates.

**3.2 PREPARATION**

- .1 Protect adjacent finished materials from damage due to masonry work.

**3.3 INSTALLATION**

- .1 Concrete block units:
  - .1 Bond: stack.
  - .2 Coursing height: 200mm for one block and one joint.
  - .3 Jointing: concave where exposed or where paint or other finish coating is specified.
- .2 Special Shapes:
  - .1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
  - .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
  - .3 End bearing: not less than 200 mm.
  - .4 Install special site cut shaped units.

**3.4 REINFORCEMENT**

- .1 Install reinforcing in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing .

**3.5 CONNECTORS**

- .1 Install connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing .

**3.6 MORTAR PLACEMENT**

- .1 Place mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

**3.7 GROUT PLACEMENT**

- .1 Place grout in accordance with Section 04 05 12 - Masonry Mortar and Grout.

**3.8 CONSTRUCTION**

- .1 Cull out masonry units, in accordance with CAN/CSA A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.
- .2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .3 Construct masonry walls using [running] [stack] bond unless otherwise noted.
- .4 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .5 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .6 Install movement joints and keep free of mortar where indicated.
- .7 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar

on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.

- .8 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.
- .9 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .10 Tamp units firmly into place.
- .11 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .12 Tool exposed joints concave raked for interior work; strike concealed joints flush.
- .13 After mortar has achieved initial set up, tool joints.
- .14 Do not interrupt bond below or above openings.

### 3.10 REPAIR/RESTORATION

- .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

### 3.11 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
  - .1 Concrete masonry units will be sampled and tested by independent testing agency appointed and paid by Departmental Representative in accordance with CSA S304.1.
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00 - Common Work Results for Masonry.

### 3.12 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.
  - .1 Progress Cleaning:
    - .1 Standard Concrete Unit Masonry:
      - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
  - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and 01 35 21 - LEED Requirements.

### 3.13 PROTECTION

- .1 Brace and protect concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 Common Work Result Masonry
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 07 92 00 Joint Sealants

1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA A179- 04, Mortar and Grout for Unit Masonry.
  - .2 CAN/CSA A371- 04, Masonry Construction for Buildings.
  - .3 CAN/CSA-A3000- 03, Consolidation - Cementitious Materials Compendium.
  - .4 CAN/CSA-G164- M92 (R2003) , Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 80- 2007, Standard for Fire Doors and Other Opening Protectives.
- .4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1168- 05, Adhesives and Sealants Applications.
- .5 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN4-S106- M80EN, Standard Method For Fire Test of Window and Glass Block Assemblies.

1.3 SYSTEM DESCRIPTION

- .1 Furnish all floor system perimeter pieces, spanning members, spacer members, paver boots, paver units, sealant, all other materials and labor necessary for complete floor system installation as indicated on the Drawings and specified herein.
- .2 Glass block paver floor is to be designed to support structural live loads of 100 PSF.
- .3 Provide for expansion and movement joint along the edge of the building as required.
- .4 Design and install glass block paver floor by whole units. Cutting glass block paver is not acceptable.

1.4 ACTION AND INFORMAL SUBMITTALS

- .1 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's for joint fillers and sealants.
  - .1 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

- .2 Manufacturer's Instructions:
  - .1 Provide manufacturer's installation instructions in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .3 Samples: provide one module of glass block paver unit sample completed with paver boot and support member in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Sustainable Design Submittals:
  - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.
- .5 Shop Drawings:
  - .1 Provide shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
    - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada. Submit Schedule B and C-B as per 2007 AND NBC Schedule B1, B2, & C-B as attached in Appendix P of this specification.
    - .2 Shop drawings to indicate methods of construction, location and spacing of anchorage, joinery, finishes, sizes, shape, thickness and alloy materials, paver units, and relationship to the adjoining work.

#### 1.5 QUALITY ASSURANCE

- .1 Certificates: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Test and Evaluation Reports: provide certified test reports in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 - Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .4 Manufacturer Instructions: submit in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .5 Qualifications:
  - .1 Manufacturer: capable of providing field service representation during construction and approving application method.
  - .2 Installer: experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.
- .6 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
    - .1 Construct mock-up panel of interior glass block floor construction (full width by x 1800 mm.)
- .7 Delivery, Storage, and Handling:
  - .1 Deliver, store and handle glass unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .8 Packaging Waste Management:

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.6 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: provide in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Warranty Documentation: submit warranty documents specified.

#### 1.7 EXTRA MATERIALS

- .1 Provide manufacturer's instructions in accordance with Section 01 33 00 - Submittals Procedures covering maintenance requirements and parts catalogue, and including complete list of repair and replacement parts with cuts and identifying numbers.
- .2 Extra Stock Materials in accordance with Section 01 78 00 - Closeout Submittals: deliver to Owner 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.
  - .1 Provide Two percent of each type and size of glass units, under provisions of Section 01 78 00 - Closeout Submittals.
  - .2 Supply in original cartons using cushioning materials between units. Attach label identifying:
    - .1 Project Name.
    - .2 Description of Contents: name of manufacturer, trade name of product, generic description of contents.

#### 1.8 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperature is above 4 degrees C.
- .2 Field Measurements:
  - .1 Make field measurements necessary to ensure proper fit of all members.

#### 1.9 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for fire rated installations.

#### 1.10 GUARANTEE

- .1 Floor system manufacturer shall guarantee for a period of five years from the date of purchase that the floor system will be free of defects in materials and factory workmanship, and that defective materials will be repaired or replaced immediately, after proper notification.
- .2 The installing contractor shall guarantee for a period of five years against faulty installation workmanship due to on-site errors.

#### 2.0 PRODUCTS

##### 2.1 MANUFACTURERS

- .1 Ensure manufacturer has minimum 5 years' experience in manufacturing components similar to or exceeding requirements of project.

**2.2 MANUFACTURED PAVER SYSTEM**

- .1 Pre-engineered Glass Block Grid System for Floors: extruded aluminum Glass Block Grid System.
- .2 Rubber Paver Unit Boots: ASTM D2000 rubber compound furnished with glass paver grid system.
- .3 Sealant: glass block Sealant, furnished with glass grid system.
- .4 Aluminum Support grid member: Clear anodized matte finish, pre-engineered to span at least 1800 mm.
- .5 Glass block paver units: Nominal 6" x 6" x 1" thick and 8" x 8" x 1" thick, clear pattern solid glass paver units, extent of which as indicated on drawings.

**2.3 SOURCE QUALITY CONTROL**

- .1 Ensure glass paver, components and materials are from single manufacturer.

**3.0 EXECUTION**

**3.1 INSTALLERS**

- .1 Provide experienced and qualified technicians to carry out erection, assembly and installation of glass paver.

**3.2 MANUFACTURER'S**

- .1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

**3.3 EXAMINATION**

- .1 Examine conditions, substrates and work to receive the work of this Section. Co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Examine openings to receive glass unit masonry. Verify correct size, location, squared and plumb and readiness to receive work of this Section.
  - .1 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Consultant.
- .3 Verification of Conditions: verify that substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of glass block.
- .4 Beginning of installation means acceptance of conditions.

**3.4 PREPARATION**

- .1 Ensure structure or substrate is adequate to support glass block.
- .2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.
- .3 Clean glass units of foreign substances.
- .4 Establish and protect lines, levels, and coursing.

- .5 Protect elements surrounding work of this Section from damage and disfiguration.

### 3.5 INSTALLATION

- .1 Insert each paver unit into paver boot.
- .2 Assemble glass block grid floor system according to instructions furnished by manufacturer into prepared containment ring. Top surface of glass pavers shall finish flush with adjoining surface and exposed aluminum surface joints unless shown otherwise on the drawings.
- .3 Apply sealant to completely fill channel around each glass block paver unit and joints between aluminum grid members and wipe flush with top surface. Perform all sealant work in accord with the requirements of the Sealant Section of the specifications.
- .4 Application of Sealant:
  - .1 Install sealant in accordance with Section 07 92 00 - Joint Sealants.
  - .2 Apply sealant 24 hours after glass unit masonry installation.
  - .3 Form surfaces of sealant smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities. Tool surface to a slight concave profile. Edges of joints to expose shoulders of glass units.
  - .4 Remove excess sealant.

### 3.6 TOLERANCES

- .1 Tolerance for glass paver unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry, supplemented as follows.
  - .1 Variation from specified joint width: plus 2 mm and minimum 0 mm.
  - .2 Maximum variation from plane of unit to adjacent unit: 1 mm.
  - .3 Maximum variation from flat plane: 3 mm in 3 m, non-cumulative.

### 3.7 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry:
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00 - Common Work Results for Masonry.

### 3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning, supplemented as follows.
  - .1 Remove mortar particles using a clean, wet sponge or cloth. Rinse sponge or cloth frequently in clean water to remove abrasive particles that could scratch glass surfaces. Allow any remaining film on the block to dry to a powder.
  - .2 Remove excess sealant materials with commercial solvents such as mineral spirits and follow with normal wash and rinse. Do not damage caulking by overgenerous application of strong solvents. Comply with solvent manufacturers' printed data for toxicity and flammability warnings.
  - .3 When glass paver panels are completely installed and are not exposed to direct sunlight, final cleaning may be carried out. Start at the top of the panel and wash with generous amounts of clean water. Dry all water from the glass paver surface. Change cloth frequently to eliminate dried mortar particles that could scratch the glass surface. Use a clean, dry, soft cloth to remove the dry powder from the glass surfaces.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and 01 35 21 - LEED



Requirements.

**3.10 PROTECTION**

- .1 Brace and protect glass paver unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Make good damage to adjacent materials caused by glass block installation.

END OF SECTION 04 23 00

## 1.0 GENERAL

### 1.1 RELATED SECTIONS

- |    |                    |                  |
|----|--------------------|------------------|
| .1 | Metal Fabrications | Section 05 41 00 |
| .2 | Painting           | Section 09 91 23 |

### 1.2 REFERENCES

- |    |   |
|----|---|
| .1 | American Society for Testing and Materials International, (ASTM)  |
| .1 | ASTM A 36/A 36M-03a, Specification for Structural Steel.  |
| .2 | ASTM A 307-03, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.                             |
| .3 | ASTM A 325-04, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength. |
| .4 | ASTM A 325M-04, Specification for High-Strength Bolts for Structural Steel Joints.                            |
| .2 | Canadian General Standards Board (CGSB)   |
| .1 | CAN/CGSB-1.40-97, Anti-Corrosive Structural Steel Alkyd Primer.   |
| .2 | CGSB 85.10-99, Protective Coatings for Metals.  |
| .3 | CAN/CGSB-85.100-93, Painting.   |
| .3 | Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).             |
| .1 | CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.                                    |
| .2 | CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.   |
| .4 | Canadian Standards Association (CSA International)  |
| .1 | CAN/CSA-G40.20-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel.                |
| .2 | CAN/CSA-G40.21-04 (R2009), Structural Quality Steels.   |
| .3 | CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.                                 |
| .4 | CAN/CSA-S16-09, Limit States Design of Steel Structures.  |
| .5 | CSA W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel Structures.                      |
| .6 | CSA W48-06, Electrodes.   |
| .7 | CSA W55.3-08, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.  |
| .8 | CSA W59-03, Welded Steel Construction (Metal Arc Welding)   |

### 1.3 DESIGN REQUIREMENTS

- |    |   |
|----|---|
| .1 | Design details and connections in accordance with requirements of CAN/CSA-S16 to resist forces, moments, shears and allow for movements indicated.  |
| .2 | If connection for shear only (standard connection) is required:   |
| .1 | Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction".  |
| .3 | If shears are not indicated, select or design connections to support reaction from 120% maximum uniformly distributed load that can be safely supported by beam in bending (60% each end), provided no point loads act on beam. |

#### 1.4 SHOP DRAWINGS

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 01 50 – General Instructions.
- .2 On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings.
- .3 All fabricator designed assemblies, components and connections, and drawings to be stamped and signed by qualified professional engineer licensed in the province of British Columbia, Canada.
- .4 The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work submit to the Consultant a completed Schedule S-B: Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional, and Schedule S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.

#### 1.5 QUALITY ASSURANCE

- .1 Submit 2 copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work at least 2 weeks prior to fabrication of structural steel. Mill test reports shall be certified by metallurgists qualified to practice in British Columbia, Canada.
- .2 Fabricator of structural steel shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

#### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Structural steel: to CAN/CSA-G40.21 Grade as indicated on drawings.
- .2 Anchor bolts: ASTM A307 unless noted otherwise on drawings.
- .3 Bolts, nuts and washers: to ASTM A 325
- .4 Welding materials: to CSA W48 Series and CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint primer: to CISC/CPMA 1.
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m<sup>2</sup>.

#### 2.2 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Continuously seal members by continuous welds where indicated. Grind smooth.

### 2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16-01 except where members to be encased in concrete.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC SP7 brush off blast.
- .3 Apply one coat of CISC/CMPD2-75 primer in shop to steel surfaces to achieve minimum dry film thickness of 3 to 4 mils, except:
  - .1 Surfaces to be encased in concrete.
  - .2 Surfaces to receive field installed stud shear connections.
  - .3 Surfaces and edges to be field welded.
  - .4 Faying surfaces of friction-type connections.
  - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

### 3.0 EXECUTION

#### 3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

#### 3.2 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

#### 3.3 MARKING

- .1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark for fit and match.

#### 3.4 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Departmental Representative.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

### 3.5 FIELD QUALITY CONTROL

- .1 The Departmental Representative will not be responsible for inspection of the Contractor's work as described in Clause 7.12 of the CISC Code of Standard Practice for Structural Steel. The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the structural steel has been fabricated, erected and finished in accordance with the contract specifications.
- .2 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- .3 Testing requirements are as follows:  
Visual Field Inspection and Bolt Torque Testing (Random 10% of Bolts) of all bolted connections.
- Non Destructive Testing of Welds:
- 100% of all welds to be visually inspected
  - 10% of all moment connections to be ultrasonically tested (minimum 2 locations).
  - 20% of all full strength splice connections to be ultrasonically tested (minimum 2 locations).
  - 20% of all drag strut/tie welded connections to be ultrasonically tested.
- .4 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
- .5 Submit test reports to Departmental Representative within 1 week of completion of inspection.
- .6 Costs of tests shall be borne by the Contractor.

### 3.6 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 23 – Painting.
- .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

END OF SECTION 05 12 23

**1.0 GENERAL**

**1.1 RELATED WORK**

- .1 Structural Steel for Buildings Section 05 12 23
- .2 Painting and Coating Section 09 91 23

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA).
  - .1 CSA C22.2No.79-1978 (R1999), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
  - .2 CAN/CSA-S16-01, Limit States Design of Steel Structures.
  - .3 CSA-S136-07, Cold Formed Steel Structural Members.
  - .4 CSA 47.1- 03 (R2008), Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA 55.3-08, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .6 CSA W59- 03, Welded Steel Construction, (Metal Arc Welding).
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.181- 99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 American Society for Testing and Materials (ASTM).
  - .1 ASTM A 653/A 653M-09a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A792/A 792M-09a, Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .4 Canadian Sheet Steel Building Institute (CSSBI).
  - .1 CSSBI 10M- 08, Standard for Steel Roof Deck.
  - .2 CSSBI 12M- 08, Standard for Composite Steel Deck.

**1.3 DESIGN REQUIREMENTS**

- .1 Design steel deck using limit states design in accordance with CSA S136 and, CSSBI 10M and CSSBI 12M.
- .2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, and uplift as indicated.
- .3 Deflection under specified snow load not to exceed 1/360 of deck span.
- .4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.1, Annex 'E'.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings erection and shoring drawings in accordance with Section 01 01 50 – General Instructions.
- .2 Submit design calculations if requested by Departmental Representative.
- .3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacing, projections, openings, reinforcement details and accessories.

- .4 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTMA653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather, unpainted finish, 0.91mm minimum base steel thickness.
- .2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
- .3 Zinc (Z) coated steel sheet: to ASTMA653/A653M structural quality Grade 230, with Z275, coating, regular spangle surface, not chemically treated for paint finish, for exterior surfaces exposed to weather, 0.91mm minimum base steel thickness.
- .4 Aluminum-zinc alloy (AZ) coated steel sheet: to ASTMA 792/A 792M structural quality grade 230, with AZ 150 coating, surface not chemically treated for paint finish, for exterior surfaces exposed to weather, 0.91mm minimum base steel thickness.
- .5 Closures: as indicated.
- .6 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.
- .7 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

### 2.2 TYPES OF DECKING

- .1 Composite steel floor deck: 0.91 mm minimum base steel thickness, 38mm deep profile, non-cellular, upright embossed fluted profile, interlocking side laps.

## 3.0 EXECUTION

### 3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S136 and CSSBI 10M and CSSBI 12M.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

### 3.2 ERECTION

- .1 Erect steel deck as indicated and in accordance with CSA S136 CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.
- .2 Butt ends: to 1.5 to 3 mm gap. Install steel cover plates over gaps wider than 3 mm.
- .3 Lap ends: to 50 mm minimum.
- .4 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

- .5 Temporary shoring, if required, to be designed to support construction loads and other construction equipment.

### 3.3 CLOSURE

- .1 Install closures in accordance with approved details.

### 3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 For deck openings larger than 150 mm as indicated in the Structural Drawings.

### 3.5 CONNECTIONS

- .1 Install connections in accordance with CSSBI recommendations as indicated.

### 3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- .2 Provide safe access and working areas for inspection and testing on site, as required by testing agency and as authorized by Departmental Representative.
- .3 Submit test reports to Departmental Representative within 1 week of completion of inspection.
- .4 Costs of tests will be borne by Contractor.

END OF SECTION 05 31 00



1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Rough Carpentry           Section 06 08 99
- .2 Exterior Painting           Section 09 91 13
- .3 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.
- .2 Canada Green Building Council (CaGBC) C.1 Version 1.0 (2007)
  - .1 LEED Canada-LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 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.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
- .6 Cereen Seal Environmental Standard (GS)

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittals.
- .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 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
    - .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 VBBL 2007 Schedule B and CB and NBC Schedule B1, B2 and C-B as attached in Appendix P of this specification.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .4 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 50% of construction wastes were recycled or salvaged.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .3 Regional Materials: submit evidence that project incorporates required percentage 10 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .4 Low-Emitting Materials:
    - .1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

#### 1.4 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.

#### 1.5 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 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 21 Construction/Demolition 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 21 - Construction/Demolition Waste Management and Disposal.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade [300W] [350W].
- .2 Steel pipe: 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 Sheet: plain pattern, 20 ga min thickness, powder coated finish, colour as specified.
- .8 Grout: non-shrink, non-metallic flowable, 15MPC at 24 hours.
- .9 Stainless Steel Sheet: Conforming to ASTM A167, Type 304, #4 Satin Finish.
  - .1 16 Gauge (For use in S.S. corner guard).
  - .2 12 Gauge (For use in S.S. seismic joint cover plate).

### 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/m<sup>2</sup> to CAN/CSA-G164, for all exterior steel fabrication.
- .2 Shop coat primer: MPI- MPI- INT, EXT 5.1B in accordance with chemical component limits and restrictions requirements and VOC limits of GS-11. Prepare surface to an abrasive blast specification SSPC-SP10.
- .3 Zinc primer: zinc rich, ready mix to MPI-INT EXT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits of GS-11. Prepare surface to an abrasive blast SSPC-SP10.

### 2.4 ISOLATION COATING

- .1 Isolate aluminum 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 150 g/L maximum to GS-11.
- .2 Apply one shop coat of primer to metal items, with exception of 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.

## 2.6 RAILINGS AND GUARDRAILS

- .1 Steel fabrications: formed to shapes and sizes as indicated.
- .2 Galvanize exterior pipe railings after fabrication. Shop coat prime all interior steel work after fabrication.
- .3 Steel glass holder, formed to sizes and shapes as indicated.

## 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.

### 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 150 g/L to GS-11.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

- .1 Primer: maximum VOC limit 150 g/L to GS-11.

### 3.3 RAILINGS & GUARDRAILS

- .1 Install steel railings and guardrails and locations as indicated.
- .2 Install glass holders to locations as indicated.

### 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 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.5 PROTECTION

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

END OF SECTION 05 50 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Metal Fabrications Section 05 50 00
- .2 Glazing Section 08 80 50

1.2 REFERENCES

- .1 Do welding in accordance with CSA W59-1982 except where specified otherwise.
- .2 NAAMM Metal Finishes Manual; national Association of Architectural Metal Manufacturers.
- .3 Glass guard and windscreen to meet CAN/CGSB-12.20-M `Structural Design of Glass for Buildings.
- .4 Glass guard design to also meet NBC 2010 Division B Part and Arcile 4.1.5.14 Loads on Guards.

1.3 SUBMITTALS

- .1 Shop drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00.
  - .2 Indicate materials, core thicknesses, finishes, connections, joints, terminations, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
  - .3 Submit engineered shop drawings. All shop drawings to be signed and sealed by a Professional Engineer licensed in BC. Design and fabricate work in accordance with the NBC 2010, VBBL 2007. The said professional engineer to submit Schedule B and C-B according to VBBL 2007, and NBC Schedule B1, B2 and C-B as per attached Appendix P in this specification.
- .2 Product Data: Submit Manufacturer's technical product data for railing & windscreen components and accessories.
- .3 Samples of manufacturer's finishes for Consultant selection.

1.4 QUALITY ASSURANCE

- .1 Components and installation are to be in accordance with NBC 2010.
- .2 All components and fittings are furnished by the same manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials properly protected against damage to finished surfaces during transit.
- .2 Inspect materials upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
- .3 Store materials at building site under cover in dry location.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Aluminum Components: Conforming to ASTM B 221/ASTM B221M, Alloy 6063- T52.
- .2 Stainless Steel Components: Conforming to ASTM A 666, Type 304.

## 2.2 SYSTEM DESCRIPTION

- .1 Performance Requirements for Guard Railing Assembly:
  - .1 To meet or exceed Reference Standards.

## 2.3 COMPONENTS

- .1 Glazing: Refer to Section 08 80 00 Glazing and drawings.
- .2 Glass Guard Railing Assembly:
  - .1 Internal Handrail Cap Connection Sleeves: Metal tube, material compatible with handrail cap material.
  - .2 Dry Glazing System: Each set consists of two Tapers, and one L-Setting Block.
  - .3 Shoe Base:
    - .1 Profile: 2-1/2 inches (63.5 mm) wide by 4-1/8 inches (104.8 mm) high rectangular cross-section. Designed to work with Dry Glazed System with 1/2" to 5/8" (12 to 16 mm) monolithic tempered glass.
    - .2 Material: Aluminum 6063-T52.
    - .3 Finish: 304 Brushed Stainless.
    - .4 Base Cladding: 304 brush stainless steel cladding added to exposed shoe base sections. Adhere with double-sided tape and/or silicone adhesive. Provide end caps where ends of shoe base sections are exposed.
  - .4 Cap Railing:
    - .1 Profile: U-channel cap.
    - .2 Material & Finish: Standard 304 brushed stainless steel.
    - .3 Solid Oak profile to match existing heritage handrail (For Atrium Stair only).
  - .5 Fasteners: As per manufacturer's recommendation.
  - .6 Location: As indicated on drawings.
  - .7 Handrail (for Atrium staircase only):
    - .1 Handrail Brackets: Glass Mounted Handrail Bracket, 316 alloy brushed stainless steel.
    - .2 Metal Handrail Tubing: 1-1/2" (38.1mm) outside diameter thin wall hand rail tubing, wall thickness 0.050" (1.27mm), standard 304 stainless alloy, brushed finish. Complete with matching connectors & end caps.

## 2.5 FABRICATION

- .1 Fabricate all components to lengths and configurations complying with shop drawings.
- .2 Machine joint edges smooth and plane to produce hairline seams when site assembled; supply concealed sleeve connectors for joints.
- .3 Isolate dissimilar metals to prevent electrolytic action by applying primer to concealed surfaces of metal components.

## 3.0 EXECUTION

### 3.1 INSTALLATION

- .1 Install in accordance with manufacturer's recommended installation instructions and approved shop drawings.

### 3.2 CLEANING

- .1 Clean in accordance with Section 01 74 11-Cleaning, Supplemented as follows:
  - .1 Clean glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

- .2 Remove protective films from metal surfaces.
- .3 Clean railing & windscreen surfaces with clean water and mild detergent. Do not use abrasive chemicals, detergents, or other implements that may mar or gouge the material.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and 01 35 21 - LEED Requirements.

### 3.3 PROTECTION

- .1 Institute protective measures required throughout the remainder of the construction period to ensure that all the materials do not incur any damage or deterioration.
- .2 Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations; replace damaged components that cannot be repaired to Architect's acceptance.

END OF SECTION 05 73 10



1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Finish Carpentry Section 06 20 00

1.2 REFERENCES

- .1 LEED Canada-CI Version 1.0-2007, LEED Green Building Rating System and Reference Guide For Commercial Interiors.
- .2 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.
- .3 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.
- .4 Green Seal Environmental Standards (GS)
- .1 GS-11- 2008, 2nd Edition, Paints and Coatings.
- .5 National Lumber Grades Authority (NLGA)
- .1 Standard Grading Rules for Canadian Lumber 2000.
- .6 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 Sustainable Design Submittals:
- .1 LEED Canada-CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.
- .2 Construction Waste Management:
- .1 Submit project Waste Reduction Workplan 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.
- .3 Regional Materials: submit evidence that project incorporates required percentage 10 20 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
- .4 Wood Certification: submit vendor's Chain-of-Custody Certificate number for FSC certified

- wood.
- .5 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.
- .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 35 21 - LEED Requirements.
- .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 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

#### 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.
  - .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 Primer: VOC limit 100 g/L maximum to GS-11 and SCAQMD Rule 1113.
  - .2 Paint: VOC limit 50 g/L maximum to GS-11 SCAQMD Rule 1113.
  - .3 Coating: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.

## 2.2 ACCESSORIES

- .1 Fasteners: 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 material 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, 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.
- .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 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                                      |                     |
|----|--------------------------------------|---------------------|
| .1 | Rough Carpentry for Minor Works      | Section 06 08 99    |
| .2 | Door Hardware                        | Section 08 71 00    |
| .3 | Plastic Toilet Compartment           | Section 10 21 13.19 |
| .4 | Toilet & Bath Accessories            | Section 10 28 13    |
| .5 | Fire Extinguishers & Safety Blankets | Section 10 44 16.19 |

1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards, 1st edition, 2009.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada- CI Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-11.3-M87, Hardboard.
- .4 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-M1980 (R2008), Poplar Plywood.
- .5 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.
- .6 National Lumber Grades Authority (NLGA)
  - .1 NLGA Standard Grading Rules for Canadian Lumber 2008.
- .7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168 2005, Adhesives and Sealants Applications.
- .8 Underwriters Laboratories of Canada (ULC)
  - .1 CAN4-S104-80(R1985), 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 29.06 - Health and Safety Requirements.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
  - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .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.
  - .3 Submit duplicate 300 x 300 mm samples of handrails, soffits and cedar siding, wood trim.
- .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.
- .7 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .3 Regional Materials: submit evidence that project incorporates required percentage 10% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .4 Certified Wood:
    - .1 Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.
    - .2 Submit manufacturer's FSC Chain-of-Custody Certificate number.
  - .5 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions 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 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 - 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 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 21 - Construction/Demolition 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.
  - .5 Hardwood lumber: moisture content in accordance:
    - .1 AWMAC custom grade, moisture content as specified.
- .2 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 mm thick 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
- .3 Door Casings
    - .1 formaldehyde-free MDF, Primed for paint, 1/2" x 2 1/2" (12mm x 64mm)
  - .4 Coat Rods
    - .1 Heavy Duty Steel, 1 5/16" (59mm) diameter, chrome finish, support every 1220mm max.

## 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 Quality Standards of (AWMAC).
- .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.

### 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.
- .2 Standing and running trim:
  - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
  - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
  - .3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.
  - .4 Install door and window trim in single lengths without splicing.
- .3 Interior frames:
  - .1 Set frames with plumb sides and level heads and sills and secure.
- .4 Panelling:
  - .1 Secure panelling and perimeter trim using adhesive recommended for purpose by manufacturer. Fill nail holes caused by temporary fixing with filler matching wood in colour.
  - .2 Secure panelling and perimeter trim using concealed fasteners.
  - .3 Secure panelling and perimeter trim using counter sunk screws plugged with matching wood plugs.
- .5 Handrails, wall rails and bumper rails.
  - .1 Install handrails, wall rails and bumper rails in locations indicated.
  - .2 Make joints hair line, dowelled and glued.
  - .3 Install support brackets as indicated.
  - .4 Install brackets at ends and at 1200 mm on centre minimum at intermediate spacings.
  - .5 Install metal backing plates between studs at bracket locations to ensure proper support for brackets and bolts or self-tapping screws.
  - .6 Secure using counter sunk screws plugged with matching wood plugs.
- .6 Shelving:
  - .1 Install shelving on ledgers or shelf brackets as indicated.
- .7 Other:
  - .1 Install other specialties including
    - .1 Coat rods
    - .2 Coat hooks
    - .3 Corner Guards
    - .4 Door hardware

#### 3.4 INSTALLATION OF SHELIVING

- .1 MDF custom grade, 12 mm thick, plastic laminate or melamine finish/decorative overlay as indicated.

#### 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 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.6 PROTECTION

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

END OF SECTION 06 20 00

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Finish Carpentry Section 06 20 00
- .2 Interior Painting Section 09 91 23

### 1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards Illustrated, 8th edition, Version 1.0 2009.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .4 CSA International
  - .1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.
  - .2 CSA O112.4 SERIES-M1977 (R2006), Standards for Wood Adhesives.
  - .3 CSA O121-08, Douglas Fir Plywood.
  - .4 CSA O141-05, Softwood Lumber.
  - .5 CSA O151-09, Canadian Softwood Plywood.
  - .6 CSA O153-M1980 (R2008), Poplar Plywood.
- .5 American National Standards Institute (ANSI)
  - .1 ANSI/NPA A208.1-09, Particleboard.
  - .2 ANSI/NPA A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
  - .3 ANSI/HPVA HP-1 04, Standard for Hardwood and Decorative Plywood.
- .6 ASTM International
  - .1 ASTM E 1333-96 (2002), Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using A Large Chamber.
  - .2 ASTM D 2832-92 (R2005), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
- .7 ASTM D 5116-06, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
- .8 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.
- .9 Green Seal Environmental Standards (GS)
  - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
  - .2 GS-36-00, Commercial Adhesives.
- .10 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

- .11 National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).
- .12 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.
- .13 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2003(R2007).
- .14 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

### 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 architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Shop Drawings:
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
    - .1 Scales: profiles half-full sized, details quarter-full sized.
  - .2 Indicate materials, thicknesses, finishes and hardware.
  - .3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate samples of laminated plastic, acrylic sheets, engineered resin, quartz surface and vinyl faced plexigraphic.
  - .4 Submit duplicate samples of laminated plastic joints, edging, cutouts and post formed profiles.
  - .5 Submit 300 mm long sample of wood handrail.
- .5 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 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 amount of construction wastes that are recycled or salvaged.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required

percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

- .3 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
- .4 Certified Wood:
  - .1 Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.
  - .2 Submit manufacturer's FSC Chain-of-Custody Certificate number.
- .5 Low-Emitting Materials:
  - .1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions 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 by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.
- .3 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
    - .1 Shop prepare one base cabinet unit, wall cabinet, counter top and shelving unit complete with hardware and shop applied finishes, and install where directed by Departmental Representative.
    - .2 Allow 72 hours for inspection of mock-up by Departmental Representative before proceeding with Work.
    - .3 When accepted, mock-up will demonstrate minimum standard for Work.
    - .4 Do not proceed with work prior to receipt of written acceptance of mock-up by Departmental Representative.
    - .5 Mock-up may remain as part of finished work.

#### 1.5 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.
  - .1 Protect millwork against dampness and damage during and after delivery.
  - .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
- .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 Store and protect architectural woodwork from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work

.5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.6 COORDINATION & VERIFICATION

- .1 Verify all dimensions & existing conditions on job site prior to all shop fabrication and work on site. Where major discrepancies occur, alert Departmental Representative.
- .2 Coordinate work of this section with that of wall, electrical and mechanical sections where millwork interfaces with drywall partitions, plumbing, electrical outlets, etc.
- .3 It shall be the responsibility of this section to verify the dimensions and installation details for all Departmental Representative supplied equipment and furnishings requiring cut-outs, adaptations and interfacing with millwork items.

#### 1.7 INSPECTION

- .1 Architectural woodwork shall be manufactured and/or installed to AWMAC Quality Standards (Custom Grade) and shall be subject to an inspection at the plant and/or site, by an appointed inspector approved by the M.M.A.B.C. (the BC Chapter of AWMAC). Such inspection costs shall be included in the tender price for this project. Shop drawings shall be submitted for review or approval before any work is commenced. Where it is deemed necessary by the Departmental Representative, a sample cabinet (consisting of a minimum of 1 drawer, 1 door, showing precisely the materials, hardware and the type of construction the manufacturer intends to use), shall be submitted for inspection.
- .2 Any work which does not meet AWMAC Quality Standards as specified, shall be replaced by this Section at no additional cost to the Department Representative and to the satisfaction of the Departmental Representative and the inspector.

#### 1.8 GUARANTEE

- .1 This section shall furnish the Departmental Representative with a two (2) year M.M.A.B.C. (The BC Chapter of AWMAC) Guarantee Certificate or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork supplied will be in accordance with the Standards incorporated in the AWMAC Quality Standards manual, latest edition.
- .2 The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Section, which appear during a two (2) year period following the substantial completion of the Project.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 15% or less in accordance with following standards:
  - .1 CSA O141.

- .2 NLGA Standard Grading Rules for Canadian Lumber.
- .3 AWMAC custom grade, moisture content as specified.
- .4 Forestry Stewardship Council (FSC) certified.
  
- .2 Machine stress-rated lumber is acceptable for all purposes.
  
- .3 Hardwood lumber: moisture content 15% or less in accordance with following standards:
  - .1 National Hardwood Lumber Association (NHLA).
  - .2 AWMAC custom grade, moisture content as specified.
  
- .5 Douglas fir plywood (DFP): to CSA O121, standard construction, FSC certified.
  - .1 Plywood resin to contain no added urea-formaldehyde.
  
- .6 Canadian softwood plywood (CSP): to CSA O151, standard construction, FSC certified.
  - .1 Plywood resin to contain no added urea-formaldehyde.
  
- .7 Hardwood plywood: to ANSI/HPVA HP-1, FSC certified.
  - .1 Plywood resin to contain no added urea-formaldehyde.
  
- .8 Poplar plywood (PP): to CSA 0153, standard construction, FSC certified.
  - .1 Plywood resin to contain no added urea-formaldehyde.
  
- .9 Hardboard:
  - .1 To CAN/CGSB-11.3, FSC certified.
  - .2 Hardboard resin to contain no added urea-formaldehyde.
  
- .10 MDF (medium density fibreboard) core: to ANSI/NPA A208.2, Grade Custom, density 769 kg/m<sup>2</sup>, FSC certified.
  - .1 Medium density fibreboard performance requirements to: ANSI/NPA A208.2.
  - .2 MDF resin to contain no added urea-formaldehyde.
  
- .11 Laminated plastic for flatwork: to NEMA LD3, Type: General Purpose. Colours, pattern and finish, refer to schedule.
  - .1 For Cabinet tops, rigid plastic bases, countertops, backsplashes: Grade HGS, Size 1.27mm thick.
  - .2 For exposed vertical surfaces including front of doors, drawers and outside of gables: Grade VGS, Size 0.76m thick.
  
- .12 Laminated plastic for post forming work: to NEMA LD3, Type: Postforming, Grade HGP, size 1mm thick. Colours, pattern and finish, refer to schedule.
  
- .13 Laminated plastic backing sheet: Grade BK, Type S minimum of 0.5 mm thick or same thickness as face laminate, colour same as face laminate.
  
- .14 Laminated plastic liner sheet: Grade GP, Type S, size 0.5mm thick, white colour U.N.O.
  
- .15 Thermofused Melamine: to NEMA LD3 Grade VGL.
  - .1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
  
- .16 Nails and staples: to CSA B111.

- .17 Wood screws: stainless steel, type and size to suit application.
- .18 Splines: metal.
- .19 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .20 Laminated plastic adhesive:
  - .1 Adhesive: contact adhesive to CAN/CGSB-71.20.
  - .2 Adhesives: VOC limit 30 g/L maximum to SCAQMD Rule 1168 GS-36.
  - .3 Clear Wood Finishes: VOC limit 250 g/L maximum to GS-11
  - .4 Paints: VOC limit 50 g/L maximum to GS-11.

## 2.2 MANUFACTURED UNITS

- .1 Casework with Plastic Laminate Finish:
  - .1 AWMAC Quality Grade: Custom. Locations as noted on the drawings.
  - .2 Construction: Conform to Section 400 of the manual for Flush Overlay Casework. Close voids and cavities at inside corners and behind end fillers of upper cabinets.
  - .3 Exposed Parts: Plastic laminate on MDF, U.N.O.
  - .4 Semi-Exposed Parts: Plastic Laminate on MDF core. Color, pattern and finish to match exposed parts, U.N.O.
  - .5 Interior Shelving, U.N.O: 19mm melamine with finished edges. All interior gables and interior backing to be melamine on closed units. All doors, drawers would be plastic laminate on both sides; on open units interior to be plastic laminate.
  - .6 Edge Banding, U.N.O.: matching laminate face material finish in colour, pattern, and finish as per AWMAC Standard.
  - .7 Concealed Parts: backer to manufacturer's option.

## 2.3 CASEWORK HARDWARE

- .1 Hinges: fully concealed, all metal construction, 3-way adjustment, one (1) hinge in each pair to be spring activated, 170 degree opening.
- .2 Door and Drawer pulls: Stainless Steel Finish, 191mm c/c, 248mm length, 1 3/8" (35mm) projection. Acceptable Product: Richelieu BP 2102192 -170 or equivalent.
- .3 Recessed Pulls (Info desk): Hafele 126.22.909 or equivalent, anodized aluminum, silver color, cut length to suit.
- .4 Drawer Slides: Full extension with 25mm over travel, side mounting, telescopic action on ball bearings, 100 lb class, chrome finish, lift or lever disconnect for drawer removal, non-handed. Acceptable products: Accuride, Knape & Vogt, Roll-it or equivalent.
- .5 Shelf Supports: Metal Supports and socket, support 6mm dia hole, socket 8mm dia hole, Nickel Finish. Acceptable product: Richelieu CP 128 180 or equivalent.
- .6 Closet Coat Rod: chrome finish. 33mm dia minimum. Acceptable product: Richelieu # 122514 metal rod and support or equivalent.
- .7 Finish to all cabinet hardware-Satin chrome finish unless otherwise specified.
- .8 Provide colour-coordinated plastic screw caps on ctsk screws.



- .9 All millwork hardware as required to complete work.

#### 2.4 WORKSURFACES

- .1 Plastic Laminate on MDF core.
- .2 Post-form countertop, conform to AWI/AWMAC QSI Manual Section 400C.
- .3 Backer sheets to be applied to reverse side of all laminated work surfaces.
- .4 Edge Treatment: Same as laminate cladding on horizontal surfaces, U.N.O.
- .5 Core Materials: 19mm MDF generally, and non-telegraphing plywood at countertops with sink or other plumbing cut-outs. 25mm thick for longer span as per AWMAC requirement.

#### 2.5 COUNTERTOPS (SINK & VANITY) & BACK/SIDE SPLASHES:

- .1 Plastic laminate on plywood core.
- .2 Post-form countertop for counter, conform to AWI/AWMAC AS1 Manual Section 400C.
- .3 Backer sheets to be applied to the reverse side of all laminated countertops.
- .4 Edge treatment: Same as laminate on horizontal surfaces, U.N.O.
- .5 Core Materials: 19mm minimum non-telegraphing plywood at countertops with sink or other plumbing cut-outs. 25mm thick for longer span as per AWMAC requirement.
- .6 Caulking at all edges.

#### 2.6 QUARTZ SURFACE VANITY

- .1 Material:
  - .1 Specific Gravity: ASTM C97, 2.45 gr/cm<sup>3</sup>
  - .2 Mohs Hardness: BS 6431, 6-7 Mohs
  - .3 Impact Resistance: TS EN 14617-9, min 3 joule
  - .4 Flexural Strength: TS EN 14617-2, min. 38 mpa
  - .5 Abrasion Resistance: TS EN 14617-4, min.25 mm
  - .6 Water Absobtion: TS EN 14617-1, max .0.1%
  - .7 Apparent Density: TSEN14617-1, min. 2300 kg/m3
  - .8 Thickness: 20mm UNO.
  - .9 Colour: Gamma
  - .10 Sheet Size: As shown on drawings.

Acceptable Product: CIMSTONE: by Aeon or equivalent.
- .2 Accessories:
  - .1 Silicone Sealant: Mildew-resistant, FDA-compliant sealant recommended by manufacturer, in colour to match solid surface.
  - .2 All other accessories as recommended by quartz surface manufacturer.

#### 2.7 WOOD PANELING:

- .1 AWMAC Quality Grade-Custom.

- .2 13mm MDF for interior wall paneling.
- .3 19mm solid oak panel book match, for exterior wall panel at Howe Street Entrance.

## 2.8 INFO DESK

- .1 Engineered Resin (ER).
  - .1 Material: Optical grade engineered resin with renewable matte finish.
  - .2 Sizes: Panel to be either 1220 x 2438mm or 1220 x 3048mm; thickness to be 16mm.
  - .3 Flame Spread: ASTM E 84-03 Smoke developed less than 450.
  - .4 Smoke Density: ASTM D 2843 less than 75.
  - .5 Density: ASTM D1505,  $1.19 \times 10^{-3} \text{ kg/cm}^3$
  - .6 Water Absorption: ASTM D579, 24 hours @ 73°F, 0.2%
  - .7 Tensile Strength: ASTM D638, 69 MPa
  - .8 Elongation at Rupture: ASTM D638, 4.5%
  - .9 Tensile Modulus: ASTM D638, 2800 MPa
  - .10 Flexural Strength (rupture): ASTM D790, 117 MPa
  - .11 Flexural Modulus: ASTM D790, 3300 MPa
  - .12 Compressive Strength (yield): ASTM D695, 117 MPa
  - .13 Compressive Deformation ASTM D621 4000 psi, (122°F, 24 hours),  $\leq 0.85\%$
  - .14 Shear Ultimate Strength: ASTM D732,  $703 \text{ kg/cm}^2$
  - .15 Impact Strength (charpy method): ASTM D256 notched, 0.9 kgf\*cm/cm ASTM D256 un-notched, 3.17 kgf\*cm/cm
  - .16 Izod Impact Strength: ASTM D256 notched,  $\leq 13.3 \text{ J/m}$
  - .17 Rockwell Hardness: ASTM D785, M-93
  - .18 Barcol Hardness: ASTM D2583, 48
  - .19 Residual Shrinkage (internal strain): ASTM D702, 2%
  - .20 Refractive index: ASTM D542, 1.49
  - .21 Light Transmission (total): ASTM D1003, 92%
  - .22 Haze: ASTM D1003,  $<1\%$
  - .23 Max Continuous Use Temperature: 82°C
  - .24 Max Instantaneous Use Temperature: 100°C
  - .25 Deflection Temperature: ASTM D648@264 psi. 90°C
  - .26 Vicat Softening Point: ASTM D1525, 115°C
  - .27 Forming Temperature: 149-157°C
  - .28 Coefficient of Thermal Conductivity (k-factor): ASTM Cenco-fitch,  $0.19 \text{ w/m}^\circ\text{K}$
  - .29 Coefficient of Thermal Expansion: ASTM D696 @16°C,  $7.2 \times 10^{-5} \text{ (mm/mm/}^\circ\text{C)}$
  - .30 Acceptable Product: 3 Form Chroma, surf & reflect, renewable matte front, matte back; or equivalent.
- .2 Acrylic Sheet:
  - .1 Acceptable Product and Manufacturer: Acrylite by Evonik Cyro Industries; or equivalent.
  - .2 All sheets thicknesses are to be confirmed by manufacturer for structural integrity of specified usage.
  - .3 All thermoforming procedures and material use of bonding agent are to be as per manufacturer's recommendation.
  - .4 Acrylic Sheet Schedule:
    - .1 AS-1 Clear acrylic sheet, 6mm thick.
    - .2 AS-2 Abrasion Resistant AR acrylic sheet, clear, AR coating on outside, 3mm thick.
    - .3 AS-3 Clear acrylic sheet divider, 2mm thick.

## 2.9 FABRICATION

- .1 Set nails and countersink screws apply stained wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400mm. Keep joints 600 mm from sink cutouts.
- .9 Form shaped profiles and bends as indicated, using post forming grade laminate to laminate manufacturer's instructions.
- .10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .11 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .12 Apply laminated plastic liner sheet to interior of cabinetry.

## 2.10 FINISHING

- .1 Finish in accordance with Section 09 91 23 - Interior Painting.

## 3.0 EXECUTION

### 3.1 EXAMINATION

- .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 architectural woodwork to Quality Standards of AWMAC.
- .2 Install prefinished millwork at locations shown on drawings.
  - .1 Position accurately, level, plumb straight.

- .3 Fasten and anchor millwork securely.
  - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .4 Use draw bolts in countertop joints.
- .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.
- .7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
- .8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .9 Install cabinet hardware, at location as indicated, and as required.
- .10 For site application, offset joints in plastic laminate facing from joints in core.
- .11 Engineered resin (ER) to be installed according to manufacturer's recommendations. All joints to be seamless and edges rounded.

### 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.
  - .1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces.
  - .2 Remove excess glue from surfaces.
  - .3 Engineered resin to be cleaned as per manufacturer's instructions.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.4 PROTECTION

- .1 Protect millwork and cabinet work from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

### 3.5 SCHEDULES

- .1 Plastic Laminate: (Acceptable Product or equivalent):
  - .1 PL-1- Formica 3699-58 Rattan Cane.
  - .2 PL-2- Wilsonart 7949k-18 Asian Night.  
(Laminate grain to be installed horizontally)
  - .3 PL-3- Formica 7197-58 Dover White.

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PROJECT # R.041365.001  
SINCLAIR CENTER REVITALIZATION  
VANCOUVER, BC  
WOOD PLASTICS & COMPOSITES

**ARCHITECTURAL WOODWORK**

SECTION 06 40 00  
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- |    |                    |                           |
|----|--------------------|---------------------------|
| .4 | PL-4- Arborite     | P-623CA Brushed Aluminum. |
| .5 | PL-5-Octolam       | 919 Snakeskin White       |
| .6 | PL-6-Abet Laminati | 740 Morbida               |

END OF SECTION 06 40 00.

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |  |                  |
|----|--|------------------|
| .1 | Rough Carpentry                          | Section 06 08 99 |
| .2 | Air Barriers- Descriptive or Proprietary | Section 07 27 00 |

### 1.2 REFERENCES

- .1 ASTM International Inc.
  - .1 ASTM C 726- 05, Standard Specification for Mineral Fiber Roof Insulation Board.
  - .2 ASTM C 728- 05, Standard Specification for Perlite Thermal Insulation Board.
  - .3 ASTM D 41- 05, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  - .4 ASTM D 448- 03a, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
  - .5 ASTM D 449- 03, Standard Specification for Asphalt Used in Dampproofing and Waterproofing.
  - .6 ASTM D 2178- 04, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
  - .7 ASTM D 6162- 00a, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
  - .8 ASTM D 6163- 00e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
  - .9 ASTM D 6164- 05, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 37-GP-9Ma- 83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .2 CGSB 37-GP-56M- 80b (A1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- .3 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .4 Roofing Contractors Association of B.C. (RCABC)
  - .1 RGC Roofing Practices Manual- Millennium Edition
- .5 Canadian Standards Association (CSA International)
  - .1 CSA-A123.3- 05, Asphalt Saturated Organic Roofing Felt.
  - .2 CSA-A123.4- 04, Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
  - .3 CSA A231.1/A231.2- 06, Precast Concrete Paving Slabs/Precast Concrete Pavers.
- .6 Underwriters Laboratories' of Canada (ULC)
  - .1 CAN/ULC-S701- 05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S702.2- 03, Standard for Mineral Fibre Thermal Insulation for Buildings.
  - .3 CAN/ULC-S704- 03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

- .4 CAN/ULC-S706- 02, Standard for Wood Fibre Thermal Insulation for Buildings.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with waterproofing contractor's representative and Departmental Representative in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

### 1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide for review by Departmental Representative prior to commencing work, two copies of most recent technical waterproofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 21 - LEED Requirements, and indicate VOC content for:
    - .1 Primers.
    - .2 Asphalt.
    - .3 Sealers.
    - .4 Filter fabric.
- .3 Provide shop drawings and indicate:
  - .1 Flashing, control joints, insulation details.
- .4 Samples: submit two (2) samples of granular cap sheet and cap flashing.
- .5 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .6 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens and roofing felts and membrane with specification requirements.
- .7 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .8 Manufacturer's field report: in accordance with Section 01 45 00 - Quality Control.
- .9 Reports: indicate procedures followed ambient temperatures and wind velocity during application.
- .10 Sustainable Design Submittals:
  - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.

### 1.5 QUALITY ASSURANCE

- .1 For each type of work, obtain primary materials from single manufacturer, which has produced that type of product successfully for not less than 10-Years. Provide ancillary materials only as recommended by manufacturer of membrane materials for use with roofing system specified.
- .2 Roofing installer shall be approved by the manufacturer of the materials prior to tender; shall be

- experienced in the application of the materials and shall supply job references to show similar installations in satisfactory waterproof condition at least 5 years of age.
- .3 Installer Certification: Obtain written certification from manufacturer of membrane roofing systems certifying that installer is approved by manufacturer for installation of specified roofing system. Provide copy of certification prior to award of roofing work.
  - .4 Successful Contractors shall not sub contract any work unless special approval is received from the Consultant. Sub-contracting of work without approval shall be considered a violation of the contract.
  - .5 Installer's Field Supervision: Installer must maintain full-time supervisor/foreman on job-site during times that roofing work is in progress. Supervisor must have roofing trade certification and have minimum 5-years experience in roofing work similar to nature and scope of specified roofing. Tradesmen *installing* the roof membrane shall have roofing trade qualification certification or proof of equivalent.
  - .6 ULC Listing:
    - .1 Provide built-up roofing materials and components which have been tested for applications and slopes indicated and are listed by Underwriter's Laboratories of Canada (ULC) for Class C external fire exposure.
    - .2 Provide roof covering materials bearing Classification Marking (ULC) on bundle, package or container indicating that materials have been produced under ULC's Classification and Follow-up Service.
  - .7 Sustainability Standards Certification:
    - .1 Recycled Content: provide listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials or project.
    - .2 Regional Materials: provide evidence that project incorporates required percentage 20 % of regional materials/products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
    - .3 Construct mock-up of transition from EPDM membrane to SBS membrane.
    - .4 Mock-up may be part of finished work if acceptable to Departmental Representative.
  - .8 Mock-ups
    - .1 Construct mock-up in accordance with Section 01 45 00 Quality Control.
    - .2 Construct mock-up of liquid membrane and SBS transition at steel angle.

#### 1.6 DELIVERY, STORAGE & HANDLING

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store rolls of felt and membrane in upright position.
  - .1 Store membrane rolls with salvage edge up.
- .3 Remove only in quantities required for same day use.
- .4 Place plywood runways over completed Work to enable movement of material and other traffic.
- .5 Store sealants at +5 degrees C minimum.



- .6 Store insulation protected from daylight and weather and deleterious materials. Material contaminated with moisture shall be removed from site.
- .7 Handle waterproofing materials in accordance with manufacturer's written directives, to prevent damage or loss of performance.
- .8 Store and manage hazardous materials in accordance with Section 01 35 33 - Health and Safety Requirements 01 35 21 -LEED Requirements.
- .9 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition 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.

#### 1.7 SITE CONDITIONS

- .1 Ambient Conditions
  - .1 Do not install waterproofing when temperature remains below -18 degrees C for torch application, or -5 degrees C to manufacturers' recommendations for mop or adhered application.
  - .2 Minimum temperature for solvent-based adhesive is -5 degrees C.
- .2 Install waterproofing on dry deck, free of snow, ice and dew/moisture, use only dry materials and apply only during weather that will not introduce moisture into waterproofing system. Wood substrates must have moisture content of 19% or less prior to membrane installation. Protect substrate as required to achieve this.

#### 1.8 WARRANTY

- .1 Upon completion of work, this Contractor hereby warrants that the roofing membrane and membrane flashings will stay in place and remain leak proof for FIVE YEARS from date of substantial completion.
- .2 Provide for third-party inspection in accordance with specifications and with R.C.A.B.C. Standards. Inspection fees shall be included in this contract. RCABC Warranty is not required.
- .3 Upon Total Performance of the Contract submit a Ten (10) year Materials Warranty issued by the manufacturer of the roofing membrane.

#### 1.9 INSPECTION AUTHORITY

- .1 Selected from RCABC Approved list of Roofing Inspectors.
- .2 The presence of an Inspector shall in no way excuse the Contractor from performing the Work in accordance with the contract Documents and keeping with the best practices of the trades.
- .3 The Inspector will not be responsible for or have control or charge over safety precautions and programs required for the Work in accordance with the applicable construction safety legislation, other regulations or general construction practice, the acts or omissions of the contractor, his subcontractors or their agents, employees or other persons performing any of the Work.
- .4 The Contractor shall inform the Inspection Agency seven (7) days prior to commencement of work.

## 2.0 PRODUCTS

### 2.1 MEMBRANE

- .1 Two (2) ply system made from prefabricated modified bitumen membranes containing minimum 15% of elastomer Styrene Butadiene Styrene (SBS) and reinforced with non-flammable, fireproof and stress-resistant insert of composite reinforcing.
  - .1 Cap Sheet and Cap Sheet Flashing/Stripping Self-Adhesive: To be Type 1, Class A, Grade 2 material, reinforced with composite mat with a minimum membrane thickness of 3.5 mm to CGSB 37-GP-56M.
  - .2 Base Sheet and Base Sheet Flashing/Stripping Self-Adhesive: To be Type 2, Class C, Grade 2 material, reinforced with a glass fibre mat with minimum membrane thickness of 2.5 mm to CGSB 37-GP-56M.
  - .3 Liquid applied PMMA membrane for angle penetrations in gutter: Acceptable manufacturers: Soprema's Alsan RS230 or Siplast's Parapro 123.
- .2 Low Temperature Requirements:
  - .1 Grade 2 material to pass low temperature requirements at -30°C to CGSB 37-GP-56M.

### 2.2 ACCESSORIES

- .1 Metal Securing Strips: 25 mm wide, 0.67 mm galvanized steel, double hemmed.
- .2 Adhesives, primer, caulking and termination bar: as recommended by manufacturer of materials being adhered, and for use under climatic conditions to be encountered.
- .3 Material Fasteners
  - .1 Stainless steel for fasteners and hexagonal stainless steel plates for outboard waterproofing. Standard of Acceptance to meet Factory Mutual approval.
- .4 EPDM membrane and associated adhesive as transition membrane.
- .5 Mineral wool cushion- refer section 07 21 16.

## 3.0 EXECUTION

### 3.1 QUALITY OF WORK

- .1 Do examination, preparation and waterproofing Work in accordance with Roofing Manufacturer's Specification Manual and CRCA Roofing Specification Manual Provincial Roofing Association Manual, particularly for fire safety precautions.
- .2 Do priming for asphalt waterproofing in accordance with manufacturer's written recommendations.
- .3 The interface of the walls and roof assemblies will be fitted with durable rigid material of 19mm thick plywood providing connection point for continuity of air barrier.
- .4 Assembly, component and material connections will be made in consideration of appropriate design loads, with reversible mechanical attachments.

### 3.2 PROTECTION OF IN-PLACE CONDITION

- .1 Cover walls, walks and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.

- .3 Clean off drips and smears of bituminous material immediately.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .7 Metal connectors and decking will be treated with rust proofing or galvanization compound.

### 3.3 PROTECTED MEMBRANE APPLICATION

- .1 Primer
  - .1 Apply by brush or spray at a rate as designated by manufacturer.
- .2 Base Sheet
  - .1 Self-adhered base sheet:
    - .1 Apply primer to the top surface of insulation overlay board unless overlay board is mechanically fastened.
    - .2 Ensure base sheet membrane is installed parallel to the long side of the underlying insulation overlay board.
    - .3 Commencing at the lowest point of the roof, adhere the base sheet to a primed substrate. Apply base sheet with 75 mm (3") side laps and 150 mm (6") end laps. Extend the base sheet up vertical, to a point as indicated on the detail drawings, 50 mm (2") above the horizontal surface and fasten at 225 mm (9") O.C.
    - .4 Ensure base sheet is unrolled to enable membrane to relax prior to installation. Time required for relaxation will vary with weather conditions.
    - .5 Torch weld all lap joints by heat softening the membrane and pressing the edge of the membrane firmly with a roofing trowel.
- .3 Cap Sheet
  - .1 For self-adhered and cold-adhesive applied cap sheets:
    - .1 Colour to be confirmed by the Consultant.
    - .2 Plan membrane application so that laps are not superimposed over laps of the base sheet. Mark a chalk line where the first course is to start. Unroll 2.0 m to 3.0 m of the membrane and line it up to the chalk line or to selvage edge. Reroll and commence application. If the roll goes out of line by more than 12 mm (½"), cut and realign.
    - .3 Adhere one-ply of the membrane, granule side up. Constantly check adhesion to ensure proper bonding is achieved.
    - .4 Side laps must cover the selvage edge and be a minimum of 75 mm (3"), end laps must be 150 mm (6").
- .4 Membrane Sheet Stripping
  - .1 Plan two-ply membrane stripping application so that laps are not superimposed over the laps on the underlying membrane.
  - .2 Install membrane stripping with full roll widths perpendicular to the deck.
  - .3 Install reinforcing gussets at all inside and outside corners as per the manufacturer's recommendations.

- .4 Install base sheet stripping prior to horizontal cap sheet application. Extend membrane 100 mm (4") onto horizontal surface and 450 mm (16") up verticals, or as indicated on the detail drawings. Set membrane by adhering for material specified previously.
  - .5 Using a chalk line, lay out a straight line on the cap sheet surface. Set line parallel to the roof edge and 200 mm (8") from the base of the cant.
  - .6 Install cap sheet stripping after application of horizontal cap sheet. Extend membrane 200 mm (8") onto horizontal surface and 450 mm (16") up verticals or as indicated on the Detail Drawings.
  - .7 Granules shall be embedded for the preparation of the selvage where the membrane will overlap on the mineral surface.
  - .8 At all head laps, where "T" joints occur, cut corner of membrane to be overlapped, on a 45 degree angle. Apply manufacturer approved mastic seal to cover granule portion at overlap areas and to fill the step where the membrane "T" overlaps.
  - .9 Secure all membrane strippings to verticals with continuous securement strips installed along the top edge of membrane strippings and fastened at 200 mm (8") o.c. or as detailed. Lap all strips to the selvage a minimum of 75 mm and seal the laps securely.
- .5 General
- .1 Patching of the cap sheet membrane shall be carried out utilizing patches with a minimum size of 450 mm (16") by 1000 mm (3 ft.).
  - .2 Minimum length of cap sheet on flat run of roof shall not be less than 1000 mm (3ft.).
  - .3 Wrinkled or deformed ends of cap sheet rolls will not be tolerated and therefore must be discarded prior to application.
  - .4 Following completion of new roofing, torch soften and apply a liberal application of approved bulk type mineral granules to cap sheet membrane edges where asphalt has extruded or flowed beyond clean lines and to all surface damage.
  - .5 Splices in delivered rolls of membrane are to be removed. Cut back the roll 450 mm (16") on both sides of the splices and remove prior to installation.
  - .6 Degranulate cap sheet where overlapped by another membrane (i.e EPDM).

### 3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of roofing systems and application will be carried out by testing laboratory designated by Owner and paid for by the Contractor.
- .2 Inspection will be carried out on a daily basis during the entire roof installation procedure.
- .3 Written "Daily" inspection reports to be distributed to Roofing Consultant, and "Others" as required.

### 3.5 CLEANING

- .1 Remove bituminous markings from finished surfaces.
- .2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .3 Repair or replace defaced or disfigured finishes caused by work of this section.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Place materials defined as hazardous or toxic in designated containers.
  - .2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

- .3 Ensure emptied containers are sealed and stored safely.
- .4 Divert unused aggregate materials from landfill to local quarry facility for reuse as reviewed by Departmental Representative.
- .5 Unused paint coating material must be disposed of at official hazardous material collections site as reviewed by Departmental Representative.
- .6 Unused adhesive, sealant and asphalt materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Dispose of unused adhesive, sealant, asphalt materials at official hazardous material collections site approved by Departmental Representative.
- .8 Divert unused gypsum materials from landfill to recycling facility as reviewed by Departmental Representative.

END OF SECTION 07 13 52

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |                                      |                     |
|----|--------------------------------------|---------------------|
| .1 | Air Barriers Descriptive Proprietary | Section 07 27 00.01 |
| .2 | Glazed Aluminum Curtain Walls        | Section 08 44 13    |
| .3 | Gypsum Board Assemblies              | Section 09 21 16    |
| .4 | 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 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT & DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition 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 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 35 21 - LEED Requirements: Construction.
- .2 Verification requirements in accordance with Section 01 35 21 - LEED Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Low-emitting materials.

2.2 INSULATION

- .1 Thermal Batt and blanket mineral wool: non-combustible to ULC CAN 4-S114, zero flame spread and smoke development to ULC S102, comply CAN/ULC-S702-97 Type 1.
  - .1 Thickness: as indicated.
  - .2 Density: more than 32 kg/m<sup>3</sup>, 184 mm thk = 5.9 kg/m<sup>3</sup>, 150 mm thk = 4.8 kg/m<sup>3</sup>, 89 mm thk = 2.8 kg/m<sup>3</sup>
  - .3 Minimum Insulation Value:
    - R10 (RSI 1.76) = 64 mm thk
    - R14 (RSI 2.47) = 89 mm thk
    - R22.5 (RSI 3.96) = 152 mm thk
- .2 Acoustic Batt & blanket mineral wool: Comply Type 1 CAN/ULC-5702-09, 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

**BLANKET INSULATION**

- |    |                                       |   |                              |
|----|---------------------------------------|---|------------------------------|
|    | ASTM E84 (UL 723)                     | Surface Burning Characteristics                     | Flame Spread = 0             |
|    | CAN/ULC S129                          | Smolder Resistance                                  | Smoke Developed = 0<br>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<br>Acoustical Materials | Tested                       |
| .3 | Density: 45 kg/m <sup>3</sup> 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.



## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Steel Decking Section 05 31 00

### 1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .3 Green Seal Environmental Standards
  - .1 Standard GC-03- 93, Anti-Corrosive Paints.
  - .2 Standard GS-11- 97, Architectural Paints.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113- 06, Architectural Coatings.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S101-04, Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .3 CAN/ULC-S705.1-01, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.
  - .4 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

### 1.3 SUBMITTALS

- .1 Submit product data 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 WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .3 Sustainable Design Submittals:
  - .1 LEED Canada- CI Version 1.0-2007. Submittals: in accordance with Section 01 35 21 - LEED Requirements.
- .4 Provide LEED submittals indicating how following requirements will be met.
  - .1 Materials and Resources Credit MRc2.1 Construction Waste Management
  - .2 Materials and Resources Credit MRc5.1 Regionally Materials: 20% Extracted and Manufactured Regionally
  - .3 Indoor Environmental Quality Credit EQc4.2 Low-Emitting Materials: Paints and Coatings :
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

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

#### 1.4 QUALITY ASSURANCE

- .1 Applicators to conform to CUFGA Quality Assurance Program.
- .2 Qualifications:
  - .1 Installer: person specializing in sprayed insulation installations with 5 years documented experience approved by manufacturer.
  - .2 Manufacturer: company with minimum 5 years' experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.
- .3 Mock-up:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up 10 m<sup>2</sup> minimum, of sprayed insulation including one inside corner and one outside corner, door window openings .
  - .3 Mock-up may be part of finished work.
  - .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sprayed insulation work.
- .4 Health and Safety Requirements: worker protection:
  - .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
  - .2 Workers must wear gloves respirators dust masks long sleeved clothing eye protection protective clothing when applying foam insulation.
  - .3 Workers must not eat, drink or smoke while applying foam insulation.

#### 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 WASTE MANAGEMENT AND DISPOSAL

- .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.
- .2 Waste Management and Disposal:

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

## 1.7 SITE CONDITIONS

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Insulation: closed cell medium density spray applied rigid polyurethane foam to CAN/ULC-S705.1. (in checking amendments 1 and 2), Type 1.
  - .1 Long-term thermal resistance (LTTR) for 50mm is RSI 1.83.
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
  - .1 Maximum VOC limit 100 g/l to SCAQMD Rule 1113.
- .3 Physical and chemical properties:

Molecular Weight	NA
pH	7.5 - 8.5
Boiling Point	NE
Melting/Freezing Point	NE
Flash Point	No flashpoint was detected. Flame extinguished @ 85°F during test
Solubility in Water	Slight
Specific Gravity	1.23
Bulk Density	10.3 lb/gal
% Volatile by Volume (Water)	NE
Vapour Pressure	NE
Vapour Density	NE

- .4 Compliance
  - .1 ICC ESR-2003, CCMC 13555-L
  - .2 Class 1-ASTM E-84 (Flame <25, smoke <450)
  - .3 AC 377 (NFPA 286) Appendix X-passed without ignition barrier.
  - .4 CAN/ULC S102
  - .5 UL-723, NFPA 255

- .5 LEED Compliance
  - .1 Min of 4.5% pre-consumer recycled / 3% rapidly renewable content based on weight.
  - .2 VOC level of the finished product is less than 1%.

### 3.0 EXECUTION

#### 3.1 MANUFACTURER'S INSTRUCTION

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

#### 3.2 APPLICATION

- .1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.
- .2 Use primer where recommended by manufacturer.
- .3 Apply sprayed foam insulation to fill up interstitial space, as indicated.

#### 3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

#### 3.4 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.

END OF SECTION 07 21 29.03

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |                                      |                  |
|----|--------------------------------------|------------------|
| .1 | Modified Bituminous Membrane Roofing | Section 07 52 00 |
| .2 | Blanket Insulation                   | Section 07 21 16 |
| .3 | Sheet Metal Flashing & Trim          | Section 07 62 00 |

### 1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
  - .2 CAN/CGSB-19.24M-M90, Multi-Component, Chemical Curing Sealing Compound.
  - .3 CGSB 19-GP-14M-84, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .2 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

### 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 datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 33 – Health Safety Requirements.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Existing Substrate Condition: report deviations, as described in PART 3 -EXAMINATION in writing to Departmental Representative.
  - .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.

### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Applicator: company specializing in performing work of this section with minimum 5 years documented experience with installation of air/vapour barrier systems.
    - .1 Completed installation must be approved by the material manufacturer.
- .2 Mock-Up:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct typical exterior wall panel, incorporating window and frame, insulation, illustrating materials interface and seals.
  - .3 Locate in location as agreed to with Departmental Representative.
  - .4 Mock-up may remain as part of finished work.
  - .5 Allow 72hours for inspection of mock-up by Departmental Representative before proceeding with air/vapour barrier Work.

- .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 Minimum twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of Work, after cleaning is carried out.

#### 1.5 DELIVERY STORAGE AND HANDLING

- .1 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 Avoid spillage: immediately notify Departmental Representative if spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.

#### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

#### 1.7 AMBIENT CONDITIONS

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

#### 1.8 SEQUENCING

- .1 Sequence work in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Charts.
- .2 Sequence work to permit installation of materials in conjunction with related materials and seals.

#### 1.9 WARRANTY

- .1 For sealant and sheet materials the 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to 24 months.

#### 2.0 PRODUCTS

#### 2.1 SUSTAINABLE REQUIREMENTS

- .1 Do Verification requirements in accordance with Section 01 35 21 – LEED Requirements: Contractor's Verification.

## 2.2 SELF ADHESIVE MEMBRANE

- .1 Membrane composed of SBS modified bitumen and a Tri-laminate woven polyethylene face on the top surface. The self-adhesive bottom surface is protected by a silicone release sheet.
- .2 Water Vapour transmission 202 g/m<sup>2</sup> /24 hours/ASTM E96/B (Dessicant).
- .3 Dry Tensile Strength 41 lbf/182N MD, 29 lbf/129N CD, ASTM D 828.
- .4 Average Dry Breaking Force 127 lbf/565N MD, 91 lbf/405N CD, ASTM D 5034.
- .5 Accelerated Aging, Pass, ICC-ES AC 48, 25 cycles.
- .6 Cycling and Elongation, Pass, ICC-ES AC48, 100 cycles at -29°C (20°F).
- .7 Application Temperature Minimum 5°C (41°F).
- .8 Flame Spread Index 0, Class A, ASTM E-84.
- .9 Smoke Developed 105, Class A, ASTM E-84.
- .10 Membrane thickness, Minimum 40 mil.
- .11 Air Permeance, Pass, ASTM E 2178 (Maximum 0.02 L/m<sup>2</sup>s @ 75Pa or 0.004 cfm/ft<sup>2</sup> @ 1.57pcf)  
ASTM E 2357 – assembly, Pass.
- .12 Criteria for Water Resistive Barriers, Pass, ICC-ES AV 38.
- .13 Low Temp Flexibility, Pass, ICC-AC38/3.3.4.
- .14 Peel-adhesion to Unprimed Plywood, PASS, ICC-ES AC48, Control 62 lbf/ft-905N/m, After 7 day water immersion 54 lbf/ft-788N/m, After accelerated aging 72 lbf/ft-1051N/m, After UV exposure 77 lbf/ft-1124N/m
- .15 Water Penetration Resistance around Nails, PASS, AAMA 711-05 and ASTM D 1970 modified.
- .16 Foil-faced self-adhered membrane for curtain wall transition.
- .17 Pre-cured Silicone membrane for curtain wall transition.

## 2.3 SEALANTS

- .1 Sealants in accordance with Section 07 92 10 - Joint Sealing.
- .2 Sealant compatible with membrane as recommended by the manufacturer:
  - .1 Silicone Sealant specifically for use with self-adhered membrane, acceptable product: DOW Corning 758 or equal; for use with pre-cured silicone membrane with bitumenmastic, acceptable product: DOW Corning 795 or equal.
- .3 Primer: recommended by sealant manufacturer as appropriate to application.
- .4 Substrate Cleaner: non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

## 2.4 PRIMER

- .1 Apply primer to plywood according to manufacturer's specification. Ensure proper adhesion and compatibility to the membrane.
  - .1 Mechanically fastened stainless steel termination bar with gumlip edge.
  - .2 Stermination Bar

## 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 GENERAL

- .1 Perform Work in accordance with Sealant and Waterproofers Institute - Sealant and Caulking Guide Specification requirements for materials.
- .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials.

### 3.3 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Report unsatisfactory conditions to Departmental Representative in writing.
- .4 Do not start work until deficiencies have been corrected.
  - .1 Beginning of Work implies acceptance of conditions.

### 3.4 PREPARATION

- .1 All surfaces to receive the membrane must be thoroughly cleaned so as to have removed all concrete spatter, job dirt, laitance, from release agents, curing compounds, or any other substance which could inhibit the adhesion, and long term performance of the membrane.
- .2 All honeycombing in concrete shall be grouted flush prior to application of primer.
- .3 Apply primer as per manufacturer's recommendation to all surfaces to receive the membrane. Use a 2 coat application on gypsum board or plywood substrate.
- .4 Prepare in accordance with manufacturer's instructions.
- .5 Apply a horizontal membrane strip over vertical leg and fasteners of all horizontal cladding supports. Seal top with mastic regular.
- .6 Fill all joints or gaps wider than ¼" with galvanized steel sheet steel or wood backing and apply 12" strip of membrane over joints prior to application of the field membrane. Seal all side laps without factory bitumen self-adhering edge and all top laps with mastic.

### 3.5 APPLICATIONS

- .1 Apply in accordance with manufacturer's instructions.



- .2 All joints within and between back up walls and window frames shall be sealed with a 300 mm. strip of rubberized asphalt membrane.
- .3 Ensure continuity of air barrier. Co-ordinate construction of roof/wall junction to maintain continuity of air barrier from wall to roof. Co-ordinate with construction of exterior walls to maintain continuity of air barrier between various exterior wall construction types.
- .4 Shingle laps to drain. Minimum side and end laps as per manufacturer's recommendation with a minimum of 75mm.
- .5 Membrane shall be mechanically fastened through a metal bar or strap to windows, doors and curtain wall sections, or a properly designed sealant joint provided.
- .6 Lap and seal air barrier membrane over through-wall flashing at base of wall and at all horizontal wall flashings.
- .7 Lap roof membrane flashing over air/vapour barrier membrane at parapets and seal.
- .8 Seal all through-wall equipment flanges with air barrier membrane flashing strips; apply mastic to edges.
- .9 Seal all metal fabrication flanges with air/vapour barrier membrane flashing strips; apply mastic to edges.
- .10 Seal all horizontal drip flashings to air/vapour barrier membrane with minimum 150 mm strips of membrane flashing applied horizontally; apply mastic to edges of flashing membrane.

### 3.6 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.

### 3.7 PROTECTION OF WORK

- .1 Protect finished work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished work is protected from climatic conditions.

END OF SECTION 07 27 00

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Air Barriers Descriptive or Proprietary Section 07 27 00.01.

### 1.2 REFERENCES

- .1 The Aluminum Association Inc. (AAI)
  - .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
  - .2 AAI DAF45-03, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A 167-99 (2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM A 240/A 240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .3 ASTM A 606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
  - .4 ASTM A 653/A 653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5 ASTM A 792/A 792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .6 ASTM B 32-04, Standard Specification for Solder Metal.
  - .7 ASTM B 370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
  - .8 ASTM D 523-89(1999), Standard Test Method for Specular Gloss.
  - .9 ASTM D 822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-20079, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .4 Roofing Contractors Association of B.C. (RCABC)
  - .1 RGC Roofing Practice Manual- Millennium edition.
- .5 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .6 Canadian Standards Association (CSA International)
  - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
  - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
  - .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .7 Green Seal Environmental Standards
  - .1 Standard GS-03-93, Anti-Corrosive Paints.
  - .2 Standard GS-11-97, Architectural Paints.
  - .3 Standard GS-36-00, Commercial Adhesives.

- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .9 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule #1113-04, Architectural Coatings.
  - .2 SCAQMD Rule #1168-05, Adhesives and Sealants.
- .10 British Columbia Sheet Metal Association (SMACNA-BC)
  - .1 Architectural Sheet Metal Manual- 6<sup>th</sup> Edition 2003.

### 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 for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Samples:
  - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.
- .4 Sustainable Design Submittals:
  - .1 LEED Canada- CI 1.0 2007
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

### 1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings: convene pre-installation meeting [one] week prior to beginning work of this Section and, with contractor's representative , 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.

### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Materials and Resources Credit MRc2.1 Construction Waste Management: Divert 50% From Landfill and MRc2.2 Construction Waste Management: Divert 75% From Landfill: prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## 2.0 PRODUCTS

### 2.1 PRE-FINISHED SHEET METAL

- .1 Zinc coated steel sheet: 1 mm (20ga) thickness, commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating, finish enamel coated factory applied coating to CGSB 93-GP-3m Class F29, Custom color to match existing green as approved by Departmental Representative.

### 2.2 PREFINISHED ALUMINUM SHEET

- .1 Prefinished aluminum sheet: 0.81mm (20 gauge).
- .2 Prefinished Aluminum with factory applied polyvinylidene fluoride.
  - .1 Class F2S.
  - .2 Custom Colour selected by Departmental Representative (PVF2) to match paint colour or existing green colour.
  - .3 Specular gloss: 5 units +/-5 in accordance with ASTM D 523.
  - .4 Coating thickness: not less than 25 micrometres.
  - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5units or less and erosion rate less than 20 % to ASTM D 822 as follows:
    - .1 Outdoor exposure period 2500 hours.
    - .2 Humidity resistance exposure period 5000 hours.
  - .6 Applications of PVF2 Coating system by means of spray coating after forming and shaping of flashing elements is not acceptable.

### 2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .3 Underlay for metal flashing: asphalt laminated 3.6 to 4.5 kg kraft paper.
- .4 Sealants.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .6 Fasteners: stainless steel, flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: as recommended by prefinished material manufacturer.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1113.

### 2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable RCABC Standards.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.

- .3 Form pieces in 2400 mm maximum lengths.
  - .1 Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm.
  - .1 Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

## 2.5 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles indicated of 1mm, 20ga thick galvanized steel, or aluminum 0.81 (20ga) thick as indicated on drawings.
- .2 Caulk perimeter flashings with specified sealant where necessary to make a proper seal.
- .3 'S' Lock and caulk end joints in flashing. Provide standing seams with concealed clips at corners. Hem exposed edges of flashing a minimum of 12.5 mm for rigidity.
- .4 Provide flashings with edges turned to form a drip. Make proper allowance for expansion and contraction. Face clip flashings with concealed clips (600 mm) on centres.
- .5 Provide new baked enamel coated galvanized iron base flashings at vents, chimneys, control joints and skylights.
- .6 Carry face metal down exterior face a minimum of 100 mm or as indicated on drawings.
- .7 Provide metal base and cap flashings to extend to within 25 mm of roof surface.
- .8 At vent stacks, install aluminum vent stacks as manufactured by Menzies Metal Products where supplied by this sub-trade. Include for aluminum metal caps.

## 3.0 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 INSTALLATION

- .1 Install sheet metal work in accordance with R.C.A.B.C standards.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal.
  - .1 Secure in place and lap joints 100 mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
  - .1 Flash joints using S-lock forming tight fit over hook strips.
- .5 Lock end joints and caulk with sealant.

- .6 Install pans, where shown around items projecting through roof membrane.

### 3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### 3.4 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 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION 07 62 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Structural Steel for Building Section 05 12 33
- .2 Steel Decking Section 05 31 00

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN-ULC-S101- 04, Standard Methods of fire Endurance Tests of Building Construction and Materials.
  - .2 CAN-ULC-S102- 03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMAL 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 02 81 01 - Hazardous Materials.
- .3 Samples: submit duplicate 300 x 300 mm size sample of exposed fireproofing for approval of texture and colour.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test Reports:
    - .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
    - .2 Submit test results in accordance with CAN- ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
    - .3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, 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.
- .5 Sustainable Design Submittals:
  - .1 LEED Canada CI 1.0 2007

#### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: company person specializing in sprayed-on fireproofing with 5 years documented experience approved by manufacturer.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Mock-up will be used:
    - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
    - .2 For testing to determine compliance with performance requirements.
  - .3 Locate where directed where indicated.
  - .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with fireproofing 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. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative.
- .3 Site Meetings:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations, with contractor's representative and Departmental Representative in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts to:
    - .1 Verify Project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.
  - .2 Prior to start of Work arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work.
- .4 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
  - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
  - .2 Twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of Work, after cleaning is carried out.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver packaged materials in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
  - .1 Store materials indoors in dry location.
  - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
  - .3 Damaged or opened containers will be rejected.



- .4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.
- .5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
- .6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## 1.6 AMBIENT CONDITIONS

- .1 At temperatures less than 5 degrees C, ensure that 5 degrees C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.
- .2 Maintain relative humidity within limits recommended fireproofing manufacturer.
- .3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application is provided.
- .4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

## 2.0 PRODUCTS

### 2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 35 21 - LEED Requirements.

### 2.2 MATERIALS

- .1 Sprayed fireproofing: ULC certified cementitious or asbestos-free mineral fibre fireproofing qualified for use in ULC Designs specified and fungus resistant for 28 days.
- .2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .3 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
  - .1 Colour: white, green.
- .4 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
  - .1 Fireproofing for structural components concealed above ceiling, or within wall, chase, or furred space: minimum average applied dry density of 240 kg per cubic meter and cohesion/adhesion strength of 9.57 kPa.
  - .2 Fireproofing for exposed structural components, except where otherwise specified or indicated: minimum applied dry density of 350 kg per cubic meter and cohesion/adhesion strength of 20.83 kPa.
  - .3 Fireproofing for structural components located in mechanical rooms and storage areas: minimum applied dry density of 640 kg per cubic meter and cohesion/adhesion strength of 350 kPa.
  - .4 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.

- .5 Minimum compressive strength: 48 kPa.
- .6 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
- .7 Dust removal: not exceed 0.25 gram per square meter.

### 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 Substrate: free of material, which would impair bond.
- .2 Verify that painted substrates are compatible and have suitable bonding characteristics to receive fireproofing.
- .3 Remove incompatible materials.
- .4 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.
- .5 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

#### 3.3 APPLICATION

- .1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.
- .2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide following fire resistance ratings.

LOCATION	ULC RATING
Columns supporting 1 floor	N/A
Columns supporting more than 1 floor	N/A
Columns supporting roof	N/A
Floor decks	2 hrs FRR
Floor supports	2 hrs FRR
Roof decks	N/A
Roof supports	N/A

- .3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.
- .4 Tamp smooth, surfaces visible in finished work as indicated.
- .5 Apply curing compound to surface of cementitious fireproofing as required by manufacturer.
- .6 Apply sealer to surface of mineral fibre fireproofing as required by manufacturer in ventilation plenums where fireproofing is to be painted and as indicated.

#### 3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 Inspection and Site Tests:
  - .1 Inspection and testing of fireproofing will be carried out by Testing Laboratory designated by Departmental Representative if required.

### 3.5 PATCHING

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

### 3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Clean surfaces not indicated to receive fireproofing of sprayed material within 24 hours period after application.
- .3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 07 81 00

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Mechanical Divisions 20-25
- .2 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 (ULC)
  - .1 ULC-S115-1995, 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 Part 3.1.9.1.1): 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 02 81 01 - Hazardous Materials.
- .3 Shop Drawings:
  - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
  - .2 Construction details should accurately reflect actual job conditions.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
    - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

## 1.5 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: company specializing in fire stopping installations with 5 years documented experience.
- .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 21 - Construction/Demolition Waste Management and Disposal.

## 2.0 PRODUCTS

### 2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 35 21 - LEED Requirements.

## 2.2 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: 2 hours 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.
- .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.

### 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 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: fire stop system component.
  - .1 Ensure pipe insulation installation precedes fire stopping.

### 3.6 FIELD QUALITY CONTROL

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

### 3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - 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.

### 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.

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Mechanical Divisions 20-25
- .2 Electrical Communications/Electronics/Security Divisions 26-28

### 1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM C 919- 02, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 19-GP-5M- 1984 , Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
  - .2 CAN/CGSB-19.13- M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .3 CGSB 19-GP-14M- 1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
  - .4 CAN/CGSB-19.17- M90, One-Component Acrylic Emulsion Base Sealing Compound.
  - .5 CAN/CGSB-19.24- M90, Multi-component, Chemical Curing Sealing Compound.
- .3 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 General Services Administration (GSA) - Federal Specifications (FS)
  - .1 FS-SS-S-200- E (2)1993 , Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

### 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.
- .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 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .9 Fold up metal banding, flatten, and place in designated area for recycling.

### 1.7 SITE CONDITIONS

- .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.

### 1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 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.
- .4 Standard: For interior and exterior work unless otherwise specified, ensure compatibility of sealants being used and other materials in contact with them, meet LEED® requirement VOC level of 250 g/L for architectural sealant, and conform to the latest editions of the specifications summarized below:

#### 2.2 SEALANT TYPE

- .1 Type 1: Multi-Component chemical cure sealants: unless otherwise specified conform to CAN/CGSB-219.24-M90(TT-00227E-Type 11, Class A) standard, sealing compounds and as otherwise specified to exceed that standard; deliver to site and bear in addition to the product identification name, the qualification number when tested under CAN/CGSB Standard, Type 1 (self-leveling-horizontal joints) Type 2 (non-sag-vertical joints), Class A for glazing standard, Class B for non-glazing standard.
- .2 Type 2: Multi-component chemical sealants: unless otherwise specified conform to CAN/CGSB-1-19.24-M90 (TT-00227E-Type 11, Class A) standard, sealing compounds and as otherwise specified

to exceed that standard; deliver to site and bear in addition to the product identification name, the qualification number when tested under CAN/CGSB standard, Type 1 (self-leveling-horizontal joints) Type 2 (non-sag-vertical joints), Class A for glazing standard, Class B for non-glazing standard.

- .3 Type 3: One component polyurethane sealants: conform at least to CAN/CGSB-2-19.13-M87 (TT-S-00230C) specifications; non-sag type; not fall cohesively or adhesively in a properly designed joint where total expansion does not exceed 25% of the minimum width.
- .4 Type 4: Structural glazing sealant: two part, neutral cure, elastomeric silicone sealant conforming to ASTM C920, Type S, NS, Class 25 standard; designed for joint dynamic movement 25%.
- .5 Type 5: One component elastomeric chemical cure silicone: for joints minimum 6 mm x 6 mm and maximum as directed by product manufacturer; conform to CAN/CGSB-2-19.13-M87 (TT 002230C Type 11, Class A) standard; one component silicone base. (Consultant's written approval shall be required prior to use of this sealant).
- .6 Type 6: Acrylic sealant: conform to CGSB-19-GP-5M.
- .7 Type 7: Silicone caulking: white, mildew resistant.
- .8 Type 8: Partition sealant: acrylic sealant conforming to CGSB 19-GP-5M standard, for exposed to view sealing work; provide around electrical boxes, phone plugs, and other penetrations in partitions scheduled for acoustic separation.

### 2.3 SEALANT SELECTION

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry):  
Sealant type: 1 or 5.
- .2 Metal flashing and metal soffit: Sealant type: 3.
- .3 Structural glazing: Sealant type 4.
- .4 Perimeters of interior frames: Sealant type: 6.
- .5 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: 6.
- .6 Joints at tops of non-load bearing masonry walls at the underside of poured concrete:  
Sealant type: 6.
- .7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant type: 7.
- .8 Exposed interior control joints in drywall: Sealant type: 8.
- .9 Submersion/sealing of areas of standing water: Sealant type 2.

## 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.
  - .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.
  - .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.

END OF SECTION 07 92 00

**DOOR SCHEDULE**

DOOR							FRAME				RATING	REMARKS	LOCATION
No.	Door W (mm)	Opening H (mm)	Type	Mat'l	Finish	Glass Type	Type	Mat'l	Finish	Glass Type			
D01-A	1830	2134	D4	AL	-	TG	-	AL	-	TG		#7, #9	Waiting Room
D01-B	915	2134	D5	AL	-	TG	-	AL	-	TG		#7, #9	Waiting Room
D01-C	915	2134	D2	HM	PTD	TG	F1	PSS	PTD	-		#7	Waiting Room
D02	System Furniture door												Public Counters
D03-A	Movable Wall system door												Interview Room
D03-B	Movable Wall system door											#5, (secured from Rm 1003 side)	Interview Room
D04-A	915	2134	D2	HM	PTD	TG	F1	PSS	PTD	-		#5, #7, #10	Staff Entrance
D04-B	1830	2134	D3	HC	PL	-	F3	WD	PTD	-		Sliding closet door	Locker Area
D04-C	1830	2134	D3	HC	PL	-	F3	WD	PTD	-		Sliding closet door	Locker Area
D05	2250	2134	D3	WD	PL	-	-	WD	PTD	-		#8	Kitchenette
D06	915	2134	D1	WD	PTD	-	F2	PSS	PTD	FTG			Meeting Room
D07	915	2134	D1	WD	PTD	-	F1	PSS	PTD	-		#2, #10	Staff Washroom - W
D08	915	2134	D1	WD	PTD	-	F1	PSS	PTD	-		#2, #10	Staff Washroom - M
D09	915	2134	D1	HM	PTD	-	F1	PSS	PTD	-			Storage Room
D10	915	2134	D1	WD	PTD	-	F2	PSS	PTD	FTG			Meeting Room
D11	915	2134	D1	WD	PTD	-	F1	PSS	PTD	-			Quiet Room
D12	915	2134	D1	HM	PTD	-	F1	PSS	PTD	-	45 mins	#5	Lan Room
D13	915	2134	D1	WD	PTD	-	F2	PSS	PTD	FTG			Manager's Office
D14	915	2134			PTD	-			PTD	-		#5	Secure Room
D15	915	2134	D1	HM	PTD	-	F4	PSS	PTD	WG	45 mins	#5	Print Room
D18	915	2134	D1	WD	PTD	-	F1	PSS	PTD	-			Front Storage
D19	915	2134	D2	HM	PTD	TG	F1	PSS	PTD	-		#5, (secured from Rm 1002-A side) #7	Collaboration Area
D21	915	2134	D1	HM	PTD	TG	F1	PSS	PTD	-		#7	Back Corridor
D22	915	2134	D2	HM	PTD	TG	F1	PSS	PTD	-		#5, (secured from Rm 1002-A side) #7	Assist. Man.'s Off.
D51	915	2134	D1	HM	PTD	-	F1	PSS	PTD				B2 Mail Room
D52	915	2134	D1	HM	PTD	-	F1	PSS	PTD				B2 Storage
D53	915	2134	D1	HM	PTD	-	F1	PSS	PTD				B2 Storage
D54	1830	2134	D6	HM	PTD	-	F5	PSS	PTD			#12	B2 Storage
D61	915	2134	D1	WD	STN	-	F1	PSS	PTD			#10	B1 Female WR
D62	915	2134	D1	WD	STN	-	F1	PSS	PTD			#10	B1 Male WR
D70	915	2134	07	SS	-	ITG	F2	SS	ITG			#1	B1 East Entrance
D71	915	2134	07	SS	-	ITG	F2	SS	ITG			#1	B1 East Entrance

**DOOR SCHEDULE**

DOOR							FRAME				RATING	REMARKS	LOCATION
No.	Door W (mm)	Opening H (mm)	Type	Mat'l	Finish	Glass Type	Type	Mat'l	Finish	Glass Type			
D72	700	1800	D1	WD	PTD	-	F1	WD	PTD	-			B1 Display Case
D73	700	1800	D1	WD	PTD	-	F1	WD	PTD	-			B1 Display Case
D74	1100	2134	D1	HM	S.S/P TD	-	F1	HM	S.S/P TD	-		#11	L.1 P.O Building Entrance Vestibule

**LEGEND**

AL ALUMINUM  
 CG CLEAR GLASS  
 FTG FROST FILMED TEMPERED GLASS  
 ITG INSULATED TEMPERED GLASS UNIT  
 HC HOLLOW WOOD CORE  
 HM HOLLOW METAL  
 MTL METAL  
 PL PLASTIC LAMINATE  
 PSS PRESSED STEEL FRAME  
 PTD PAINT FINISH  
 TG TEMPERED GLASS  
 SS STAINLESS STEEL  
 WD SOLID CORE WOOD  
 WG GEORGIAN WIRED GLASS  
 STN STAINED/CLEAR VARNISHED

**Remarks**

#1 Refer Exterior Elevation drawings  
 #2 Provide ¾" door undercut  
 #3 Refer detail drawings  
 #4 Refer specification  
 #5 Card access and electric strike  
 #6 Future electric strike  
 #7 Security film on glazing  
 #8 Refer Detail for Door Frame  
 #9 Refer Interior Elevation for Storefront Framing  
 #10 Automatic Door Operator  
 #11 Door Leaf facing to Lobby side to be clad with Stainless steel mirror gold/bronze finish to match existing doors in same Lobby. Door Leaf facing tenant space to be painted. Exposed door frame facing lobby side to be clad in S.S mirror gold/bronze finish as per details.  
 #12 Exact size to be verified on site prior to fabrication.

END OF SECTION 08 06 10

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                                 |                  |
|----|---------------------------------|------------------|
| .1 | Rough Carpentry for Minor Works | Section 06 08 99 |
| .2 | Finish Carpentry                | Section 06 20 00 |
| .3 | Door Hardware                   | Section 08 71 00 |
| .4 | Flush Wood Doors                | Section 08 14 16 |
| .5 | Glazing                         | Section 08 80 50 |
| .6 | Interior Painting               | Section 09 91 23 |

1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI 1.0 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
  - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA)
  - .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
  - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- .6 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113-04, Architectural Coatings.
  - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
  - .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.



**1.3 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Provide fire labeled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, and listed by nationally recognized agency having factory inspection services and to ULC fire protection rating.

**1.4 SUBMITTALS**

- .1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware and fire rating and finishes.
  - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and finishes.
  - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .2 Provide submittals in accordance with Section 01 35 21-LEED Requirements.

**1.5 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Contractor's Verification.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**2.0 PRODUCTS**

**2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.
- .3 Interior Door Frames: 16ga

**2.2 DOOR CORE MATERIALS**

- .1 Honeycomb construction:
  - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m<sup>3</sup> minimum sanded to required thickness.
- .2 Stiffened: face sheets honeycomb core.
- .3 Temperature rise rated (TRR): Only if indicated in door schedule, core composition to limit temperature rise on unexposed side of door to 250 degrees C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

**2.3 ADHESIVES**

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
  - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, and sealant/adhesive.

**2.4 PRIMER**

- .1 Touch-up prime CAN/CGSB-1.181.
  - .1 Maximum VOC limit 50 g/L to GC-03.

**2.5 PAINT**

- .1 Field paint steel doors and frames in accordance with Sections 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
  - .1 Maximum VOC emission level 50 g/L to GS-11 to SCAQMD Rule 1113.

**2.6 ACCESSORIES**

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Metallic paste filler: to manufacturer's standard.
- .5 Fire labels: metal riveted.
- .6 Sealant:
  - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .8 Glazing: Refer to Section 08 08 50.
- .9 Make provisions for glazing as indicated and provide necessary glazing stops.
  - .1 Provide removable steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
  - .2 Design exterior glazing stops to be tamperproof.

**2.7 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Interior frames: 1.2 mm welded type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware

using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

- .5 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .6 Manufacturer's nameplates on frames and screens are not permitted.
- .7 Conceal fastenings except where exposed fastenings are indicated.
- .8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

## 2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

## 2.9 FRAMES: WELDED TYPE

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

## 2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .3 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .4 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .5 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .6 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

- .7 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .8 Manufacturer's nameplates on doors are not permitted.

#### 2.13 DOORS: HONEYCOMB CORE CONSTRUCTION

- .1 Form face sheets for interior doors from 1.2 mm sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

#### 2.14 HOLLOW STEEL CONSTRUCTION

- .1 Form face sheets for interior doors from 1.2 sheet steel.
- .2 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.
- .3 Fill voids between stiffeners of interior doors with honeycomb core.

### 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 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

#### 3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

#### 3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1 Hinge side: 1.0 mm.

- .2 Latchside and head: 1.5 mm.
- .3 Finished floor: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

**3.5 FINISH REPAIRS**

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

**3.6 GLAZING**

- .1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION 08 11 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                               |                  |
|----|-------------------------------|------------------|
| .1 | Glazed Aluminum Curtain Walls | Section 08 44 13 |
| .2 | Hardware                      | Section 08 71 00 |
| .3 | Glazing                       | Section 08 80 50 |

1.2 REFERENCES

- |    |   |
|----|---|
| .1 | American Architectural Manufacturers Association (AAMA)   |
| .1 | AAMA 609/610-09, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.  |
| .2 | ASTM International  |
| .1 | ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference. |
| .3 | Canada Green Building Council (CaGBC)   |
| .1 | LEED Canada-CI 1.0 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Commercial Interiors.           |
| .4 | Canadian General Standards Board (CGSB)   |
| .1 | CGSB 1.40-97, Anticorrosive Structural Steel Alkyd Primer.  |
| .2 | CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.  |
| .3 | CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.   |
| .5 | 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.   |
| .6 | Environmental Choice Program (ECP)  |
| .1 | CCD-045-95, Sealants and Caulking Compounds.  |
| .7 | Green Seal Environmental Standards (GS)   |
| .1 | GS-11-2008, 2nd Edition, Paints and Coatings.   |
| .8 | South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards  |
| .1 | SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.  |

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 [doors and frames] 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 VBBL 2007 Schedule B and C-B.
- .2 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:
    - .1 Interior trim and exterior junctions with adjacent construction.
    - .2 Junctions between combination units.
    - .3 Elevations of units.
    - .4 Core thicknesses of components.
    - .5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
    - .6 Location of caulking.
    - .7 Each type of door system including location.
    - .8 Arrangement of reinforcing for hardware and joints.
    - .9 Arrangement of hardware and required clearances.
  - .4 Samples:
    - .1 Submit for review and acceptance of each unit.
    - .2 Submit one 300 x 300 mm corner sample of each type door and frame.
    - .3 Submit sample showing glazing detail, reinforcement, finish and location of manufacturer's nameplates.
    - .4 Frame sample to show glazing stop, door stop, jointing detail, finish.
  - .5 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 50% of construction wastes were recycled or salvaged.
    - .2 Recycled Content:
      - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
    - .3 Low-Emitting Materials:
      - .1 Submit listing of adhesives and sealants paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### 1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual.

#### 1.5 QUALITY ASSURANCE

- .1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.6 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, 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 Store and protect aluminum doors and frames 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
- .5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

**2.0 PRODUCTS**

**2.1 DESIGN CRITERIA**

- .1 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.
- .2 Air infiltration to ASTM E283 – 0.06ctm/ft<sup>2</sup> at a static differential of 6.24 psf
- .3 No leakage to ASTM E331- no leakage at 8 psf static differential as AAMA 501.
- .4 Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of 1/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

**2.2 MATERIALS**

- .1 Aluminum extrusions: to Aluminum Association alloy AA 6063-T5 anodizing quality.
- .2 Fasteners: aluminum finished to match adjacent material.
- .3 Door bumpers: black neoprene.
- .4 Isolation coating: bituminous paint.
- .5 Glass: tempered glass to CAN/CGSB-12.1, Type 2, Class
- .6 Glazing materials: Refer to section 08 80 50 Glazing.
- .7 Sealants: colour selected by Departmental Representative in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Maximum VOC limit: 250 g/L 5% by weight to SCAQMD Rule 1168.



**2.3 INTERIOR ALUMINUM DOORS**

- .1 Construct doors of porthole extrusions with minimum wall thickness of 2.4 mm.
- .2 Door stiles nominal 127 mm wide plus or minus 6 mm.
- .3 Top rail nominal 127 mm wide plus or minus 6 mm.
- .4 Bottom rail nominal 165 mm wide plus or minus 6 mm.
- .5 Reinforce mechanically-joined corners of doors to produce sturdy door unit.
- .6 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
- .7 Hardware: Refer to 08 71 00

**2.4 ALUMINUM FRAMES**

- .1 Construct frames of aluminum extrusions with minimum wall thickness to meet specified performance requirements.
- .2 Frame members 114.3 x 44.5 mm nominal size, for interior centre glazing.
- .3 Frame members.

**2.5 ALUMINUM FINISHES**

- .1 Interior storefront: Clear anodic finish: to designation AA- M12C22A41.

**2.6 FABRICATION**

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames to profiles and maximum face sizes as indicated.
- .3 Provide structural steel reinforcement as required.
- .4 Fit joints tightly and secure mechanically.
- .5 Conceal fastenings.
- .6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 00 - Door Hardware.
- .7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

**3.0 EXECUTION**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum doors and frames 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 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
- .3 Anchor securely.
- .4 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .5 Adjust door components to ensure smooth operation.
- .6 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.
- .7 Glaze aluminum doors and frames in accordance with Section 08 80 50 - Glazing.
- .8 Seal joints to provide weathertight seal at outside and air, vapour seal at inside.
- .9 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within the aluminum work except where exposed use is permitted by Departmental Representative.

### 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 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
  - .3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
  - .4 Clean aluminum with damp rag and approved non-abrasive cleaner.
  - .5 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.
  - .6 Clean glass and glazing materials with approved non-abrasive cleaner.
- .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 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.4 PROTECTION

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

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Rough Carpentry for Minor Works	Section 06 08 00
.2	Finish Carpentry	Section 06 20 00
.3	Metal Doors & Frames	Section 08 11 00
.4	Hardware	Section 08 71 00
.5	Glazing	Section 08 80 50
.6	Interior Painting	Section 09 91 23

1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
  - .1 Quality Standards for Architectural Woodwork latest edition.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
  - .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA A440.2-98, Energy Performance of Windows and Other Fenestration Systems.
  - .2 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.
  - .3 CAN/CSA O132.2 Series-90 (R1998), Wood Flush Doors.
  - .4 CAN/CSA-O132.5-M1992 (R1998), Stile and Rail Wood Doors.
  - .5 CAN/CSA-Z808-96, A Sustainable Forest Management System: Guidance Document.
  - .6 CSA Certification Program for Windows and Doors 00.
- .4 Environmental Choice Program (ECP).
  - .1 CCD-045-92, Sealants and Caulking Compounds.
  - .2 CCD-046-92, Adhesives.
- .5 National Fire Protection Association (NFPA).
  - .1 NFPA 80-1999, Standard for Fire Doors and Fire Windows.
  - .2 NFPA 252-1999, Standard Method of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN-4S104M-80 (R1985), Fire Tests of Door Assemblies.
  - .2 CAN4-S105M-85 (R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.
- .7 LEED CI 1.0 2007 – Commercial Interiors

1.3 SUBMITTALS

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with

Section 01 33 00 - Submittal Procedures. Indicate VOC content:

- .1 For caulking materials during application and curing.
  - .2 For door materials and adhesives.
  - .3 Submit FSC Chain of Custody Certificate.
- 2 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom panel construction and cutouts.

#### 1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit one 300 x 300 mm corner sample of each type wood door.
- .3 Show door construction, core, glazing detail and faces.
- .4 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

#### 1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
  - .1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection:
  - .1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
  - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
  - .3 Protect doors from scratches, handling marks and other damage. Wrap doors.
  - .4 Store doors away from direct sunlight.

#### 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of corrugated cardboard polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.
- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

- .5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

#### 1.8 GUARANTEE

- .1 This section shall furnish the Departmental Representative with a two (2) year M.M.A.B.C. (The BC Chapter of AWMAC) Guarantee Certificate or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork supplied will be in accordance with the Standards incorporated in the AWMAC Quality Standards manual, latest edition.
- .2 The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Section, which appear during a two (2) year period following the substantial completion of the Project.

#### 2.0 PRODUCTS

##### 2.1 WOOD FLUSH DOORS

- .1 Solid core: to CAN/CSA-O132.2.1.
  - .1 Construction:
    - .1 Core: Agfiber particleboard to ANSI A280.1 LD7
  - .2 Face Panels as scheduled:
    - .1 HPVA Architectural "A" grade wood veneer (minimum thickness 1/50") slip match, maple, or oak, to match existing.
    - .2 Paint grade MDO
- .2 Adhesive: Type I (waterproof) no urea formaldehyde for all doors.
- .3 Stiles:
  - .1 CE Compatible with face veneer mill option AWS Type B veneered
  - .2 Standard: AWMAC Custom Grade
- .4 Environmental:
  - .1 All wood in door FSC certified or FSC controlled
  - .2 Manufactured with pre-consumer recycled material

##### 2.3 GLAZING

- .1 Glass: As per Glazing Section 08 80 50

##### 2.4 FABRICATION

- .1 Vertical edge strips to match face veneer.
- .2 Prepare doors for louvres and glazing. Provide to match face veneer glazing stops with mitred corners.
- .3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
- .4 Radius vertical edges of double acting doors to 60 mm radius.

#### 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 INSTALLATION**

- .1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.
- .2 Install labelled fire rated doors to NFPA 80.
- .3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.
- .4 Adjust hardware for correct function.
- .5 Install glazing in accordance with Section 08 80 50 - Glazing.
- .6 Install louvres and stops.
- .7 Secure transom and side panels by means of stops concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

**3.3 ADJUSTMENT**

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

**3.4 CLEANING**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.
- .3 Clean glass and glazing materials with approved non-abrasive cleaner.
- .4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 08 14 16

**1.0 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Non Structural Metal Framing Section 09 22 16
- .2 Gypsum Board Assemblies Section 09 21 16
- .3 Interior Painting Section 09 91 23

**1.2 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Green Seal Environmental Standards (GS)
  - .1 GS-11- 2008, 2nd Edition, Paints and Coatings.
- .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rules 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 access door components and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings showing size, material and locations, interface with adjacent surfaces.
  - .2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.
- .4 Sustainable Design Submittals:
  - .1 LEED Canada- CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Management Plan Waste Reduction Workplan 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.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .4 Regional Materials: submit evidence that project incorporates required percentage 10 20 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

- .5 Low-Emitting Materials:
  - .1 Submit listing of paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### 1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for cleaning and maintenance of stainless steel finishes for incorporation into manual.

#### 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 access doors from nicks, scratches, and blemishes.
  - .3 Apply temporary protective coating to finished surfaces. Remove coating after installation.
    - .1 Use coatings in accordance with manufacturer's written instructions that are easily removable.
    - .2 Leave protective coating in place until final cleaning of building.
  - .4 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements .

### 2.0 PRODUCTS

#### 2.1 ACCESS DOORS

- .1 Sizes: as follows unless indicated :
  - .1 For body entry: 600 x 600 mm minimum.
  - .2 For hand entry: 300 x 300 mm minimum.
- .2 Construction: rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.
- .3 Materials:
  - .1 Tiled or marble surfaces: stainless steel with brushed satin polished finish.
  - .2 Gypsum board surfaces: prime coated steel.
    - .1 Primer: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.



### 3.0 EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 INSTALLATION

- .1 Installation: locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.
  - .1 Tiled or Marble surfaces: in accordance with Section 09 30 13 - Ceramic Tiling 09 30 15.
  - .2 Install masonry surfaces: in accordance with Section 04 05 00 - Common Work Results for Masonry.
  - .3 Install gypsum board surfaces: in accordance with Section 09 21 16 - Gypsum Board Assemblies.

#### 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .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 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

#### 3.4 PROTECTION

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

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |                           |                  |
|----|---------------------------|------------------|
| .1 | Finish Carpentry          | Section 06 20 00 |
| .2 | Sheet Metal Flashing Trim | Section 07 62 00 |
| .3 | Aluminum Doors and Frames | Section 08 11 16 |
| .4 | Glazing                   | Section 08 80 50 |

### 1.2 REFERENCES

- .1 Aluminum Association (AA)
  - .1 AA DAF 45-03 (R2009), Designation System for Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA)
  - .1 AAMA CW-10-04, Care and Handling of Architectural Aluminum From Shop to Site.
  - .2 AAMA CW-11-85, Design Wind Loads and Boundary Layer Wind Tunnel Testing.
  - .3 AAMA T1R-A1-04, Sound Control for Fenestration Products.
  - .4 AAMA 501-05, Methods of Test for Exterior Walls.
  - .5 AAMA 611-98, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
  - .6 AAMA 612-02, Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.
  - .7 AAMA 2603-02, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - .8 AAMA 2605-05, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
  - .9 AAMA 501.1-05 Standard Test Method for Water Penetration of Windows , Curtain Walls and Doors using Dynamic Pressure.
- .3 ASTM International
  - .1 ASTM A 36/A 36M-08, Specification for Carbon Structural Steel.
  - .2 ASTM A 123/A 123M-09, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A 167-99 (2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .4 ASTM A 653/A 653M-09a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5 ASTM B 209-07, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .6 ASTM B 221-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - .7 ASTM E 283-04, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .8 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
  - .9 ASTM E 331-00 (2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
  - .10 ASTM E 413-04, Classification for Rating Sound Insulation.
  - .11 ASTM E 1105-00 (2008), Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by

- Uniform or Cyclic Static Air Pressure Difference.
- .12 ASTM E783-02 (2010), Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
- .13 ASTM E1186-03 (2009) Standard Practices for Air Leakage Site Detection in Building Envelopes Air Barrier Systems.
- .4 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Guide For Commercial Interiors.
- .5 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.108-M89, Bituminous Solvent Type Paint.
  - .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
- .6 CSA International
  - .1 CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA S136-07, North American Specification for the Design of Cold Formed Steel Structural Members.
  - .3 CAN/CSA-S157/S157.1-05, Strength Design in Aluminum/Commentary on CAN/CSA-S157, Strength Design in Aluminum.
  - .4 CSA W59.2-M1991 (R2008), Welded Aluminum Construction.
- .7 Environmental Choice Program (ECP)
  - .1 CCD-045-95 (R2005), Sealants and Caulking Compounds.
  - .2 CCD-047-98 (R2005), Architectural Surface Coatings.
  - .3 CCD-048-98 (R2006), Surface Coatings - Recycled Water-borne.
- .8 Green Seal Environmental Standards (GS)
  - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .9 Society for Protective Coatings (SSPC)
  - .1 SSPC - Paint 20-02 (R2004), Zinc Rich Coating, Type I - Inorganic and Type II - Organic.
  - .2 SSPC - Paint 25 – 97 (R2004) BCS, Zinc Oxide, Alkyd, Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2.
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .11 American Society of Heating, Refrigeration, and Air Conditioning Engineers Inc. (ASHRAE)
  - .1 ASHRAE 90.1-2010, Energy Standard for Buildings except Low-Rise Residential Buildings
- .12 BC Energy Efficiency Act
  - .1 Regulations for Windows, Glazing, Doors and Skylights.
- .13 National Federation Rating Council (NFRC)
  - .1 All rating of Glazing system to be NFRC certified.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: co-ordinate work of this Section with installation of air barrier placement, vapour

retarder placement, flashing placement, components or materials.

#### 1.4 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 curtain wall components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations and water flow diagrams.
  - .2 Report showing system meets performance requirements.
  - .3 Thermal model report showing compliance with effective U-value requirement.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada. Submit VBBL 2007 Schedule B and C-B, AND NBC Schedule C-B as per attached Appendix P in this specification.
  - .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.
- .4 Sample:
  - .1 Submit for review and acceptance each color and finish.
  - .2 Submit one 300 x 300 corner sample.
  - .3 Submit sample showing glazing detail, reinforcement, and finish.
- .5 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 50% of construction wastes were recycled or salvaged.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .3 Regional Materials: submit evidence that project incorporates required percentage 10% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .4 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### 1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazed aluminum curtain wall for incorporation into manual.

#### 1.6 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 Handle work of this Section in accordance with AAMA CW-10.
  - .2 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .3 Store and protect aluminum glazed curtain wall components from nicks, scratches, and blemishes.
  - .4 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
  - .5 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan 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 21 - Construction/Demolition Waste Management and Disposal

#### 1.7 AMBIENT CONDITIONS

- .1 Install sealants when ambient and surface temperature is above 5 degrees C minimum.
- .2 Maintain this minimum temperature during and for 48 hours minimum after installation of sealants.

#### 1.8 WARRANTY

- .1 Refer Section 01 77 00- Closeout Procedures:
- .2 Coating Applicator's Warranty: Applicator agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied, spray coating system finished within warranty period indicated.
  - .1 Exposed Coating: Deterioration includes but is not limited to:
    - .1 Color fading in excess of 5 Delta E Hunter units per ASTM D 2244.
    - .2 Peeling, checking, or cracking of coating adhesion to metal.
    - .3 Chalking in excess of a No.8 when tested per Method D 4214.
    - .4 Corrosion of substrate in excess of a No.6 on cut edges and a No.9 on field surfaces, when measured per ASTM D1654.
  - .2 Warranty Period: 20 years from date of Substantial Completion.

#### 2.0 PRODUCTS

##### 2.1 SYSTEMS

- .1 Description:
  - .1 Vertical and horizontal four-sided capture, stick built glazed aluminum curtain wall system includes thermally broken tubular aluminum sections with self-supporting framing, shop fabricated, factory prefinished, vision glass; related flashings, anchorage and attachment devices.
  - .2 Assembled system to permit re-glazing of individual glass (and infill panel) units from exterior without requiring removal of structural mullion sections.

- .2 Performance Requirements:
  - .1 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC
  - .2 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable codes.
  - .3 Limit mullion deflection to L/240 with full recovery of glazing materials.
  - .4 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.
  - .5 Ensure system is designed to accommodate the following without damage to components or deterioration of seals:
    - .1 Movement within system.
    - .2 Movement between system and perimeter framing components.
    - .3 Dynamic loading and release of loads.
    - .4 Deflection of structural support framing.
    - .5 Shortening of building concrete structural columns.
    - .6 Creep of concrete structural members.
  - .6 Limit air infiltration through assembly to 0.0003 m<sup>3</sup> /s/m<sup>2</sup> of wall area, measured at a reference differential pressure across assembly of 300 Pa as measured in accordance with ASTM E 283.
  - .7 Vapour seal with interior atmospheric pressure of 25 mm sp, 22 degrees C, 40% RH: no failure.
  - .8 Water leakage: none at minimum differential pressure of 700pa, when measured to ASTM E 331
  - .9 Ensure system allows for expansion and contraction within system components when temperature range is 95 degrees C over 12 hour period without causing detrimental affect to system components.
  - .10 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.
  - .11 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
    - .1 Position thermal insulation on exterior surface of air barrier and vapour retarder.
  - .12 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.
  - .13 Reinforce curtain wall system to accommodate window washing guide rails.
    - .1 Supply sufficiently rigid anchors to resist loads caused by equipment platform, without damage to wall system.
  - .14 Air infiltration to CSA-A 440 A fixed, A3 operable
  - .15 Water Leakage to CSA-A 440: B7 fixed , B5 operable.
  - .16 Wind load to CSA-A440 C5.

## 2.2 MATERIALS

- .1 Extruded aluminum: to ASTM B 221.
- .2 Sheet aluminum: to ASTM B 209.
- .3 Anchors: 3-way adjustable hot-dip galvanized cast iron.
- .4 Fasteners: stainless or aluminum, finish to match curtain wall.
- .5 Bituminous paint: CAN/CGSB 1.108, Type 1 2, without thinner.

- .6 Vertical and horizontal glass units:
  - .1 Glass in exterior lights: Refer to Section 08 80 50.
- .7 Fire Safety Materials: see Section 07 84 00 - Fire Stopping.
- .8 Sealant:
  - .1 Perimeter sealant: as per Section 07 92 00
  - .2 Sealant used within system (not used for Glazing).
    - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .9 Fluoropolymer Coating:
  - .1 Coating to be 3-Coat Systems consisting of urethane primer, fluoropolymer color coat, and a clear top coat to seal and protect the entire system.
  - .2 Test coatings in accordance with requirements of AAMA 2605 to verify Compliance with the following:

Dry Film Thickness (nominal) ASTM D1400	0.20 mil primer 1.0 mil topcoat 0.40 mil clear topcoat
Gloss ASTM D523-Standard Test Method for Specular Gloss. Standard @ 60°	25-35
Pencil Hardness ASTM D3363-Standard Test Methods for Film Hardness by Pencil Test	F-2H
Flexibility <sup>2</sup> T-bend, ASTM D4145	0 T-bend; No pick-off
Adhesion ASTM D3359-Standard Test Methods for Measuring Reverse impact 1/16" crosshatch	No adhesion loss
Reverse Impact ASTM D2794-Standard Test Method for Resistance of Organic Coatings to the Effects of Rigid Deformation 1500 x metal thickness (aluminum)	No cracking or adhesion loss
Acid Resistance ASTM D1308-Standard Test Method for Effect of Household Chemical or Clear and Pigmented Organic Finishes 10% muriatic acid-24 hrs. 20% sulfuric acid-18 hrs.	No effect No effect
Alkali Resistance ASTM D1308- Standard Test Method for Effect of Household Chemical or Clear and Pigmented Organic Finishes 10%, 25% NaOH, 1 hr.	No effect
Salt Spray Resistance ASTM B117-Practice for Operating Salt Spray (Fog) Apparatus 5% salt fog @ 95°F	Passes 4000 hrs.  Less than 1/16" avg. creepage from scribe; None or few #8 blisters

Humidity Resistance ASTM D2247-Standard Practice for Testing Water Resistance of Coatings in 100% RH 100% relative humidity @ 95°F	No #8 blisters
Exterior Exposure 10yrs. @ 45°, south Florida ASTM D2244 –Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates ASTM D4214- Test Methods for Evaluating Degree of Chalking of Exterior Point Films.	Max. 5 fade Max.8 chalk

## 2.3 COMPONENTS

- .1 Mullion profile:
  - .1 Vertical members: 50.8 x 153.9 mm nominal minimum dimension.
  - .2 Horizontal members: 50.8 x 153.9 mm nominal minimum dimension.
  - .3 Thermally broken with interior tubular section insulated from exterior pressure plate.
  - .4 Matching stops and pressure plate of sufficient size and strength to ensure adequate bite on glass.
  - .5 Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.
  - .6 Internal mullion baffles to eliminate "stack effect" air movement within internal spaces.
- .2 Flashings: aluminum, finish to match curtain wall mullion sections where exposed, secured with concealed fastening method.
- .3 Air barrier: specified in Section 07 27 00.01 - Air Barriers - Descriptive or Proprietary.
- .4 Entrance Door: Stainless Steel Finish, Stile size, top and bottom rail to match existing.
  - .1 Construct doors of porthole extrusions with minimum wall thickness of 18ga.
  - .2 Door stiles nominal 127 mm wide plus or minus 6 mm.
  - .3 Top rail nominal 127 mm wide plus or minus 6 mm.
  - .4 Bottom rail nominal 165 mm wide plus or minus 6 mm.
  - .5 Reinforce mechanically-joined corners of doors to produce sturdy door unit.
  - .6 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
  - .7 Hardware: Refer to 08 71 00

## 2.4 FABRICATION

- .1 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- .2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof
- .3 Prepare components to receive anchor devices. Install anchors.
- .4 Arrange fasteners and attachments to ensure concealment from view.
- .5 Prepare system components to receive exterior doors, in Section 08 11 16.
- .6 Reinforce interior horizontal head rail to receive window covering track brackets and attachments.
- .7 Reinforce framing members for external imposed loads.
- .8 Visible manufacturer's identification labels not permitted.



- .9 Finishes:
  - .1 Exterior exposed aluminum surfaces: shop applied 3 coats fluoropolymer color coat system to match existing green colour.
  - .2 Interior exposed aluminum surfaces: shop applied 3 coats fluoropolymer color coat system to bone white colour.

## 2.5 SOURCE QUALITY CONTROL

- .1 Perform work in accordance with AAMA GSM-1
- .2 Manufacturer qualifications: company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.
- .3 Perform welding Work in accordance with CSA W59.2.
- .4 Ensure compatibility between components.

## 3.0 EXECUTION

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Verify dimensions, tolerances, and method of attachment with other work.
  - .3 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.
  - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### 3.2 INSTALLATION

- .1 Install curtain wall system in accordance with manufacturer's instructions.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Use alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Use thermal isolation where components penetrate or disrupt building insulation.
- .6 Install sill flashings.
- .7 Install eave edge flashings at sloped glazing system.
- .8 Co-ordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- .9 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal

barrier.

- .10 Install fire-safing in areas as indicated.
- .11 Install operating sash in accordance with Section 08 80 50 - Glazing, to glazing method required to achieve performance criteria.
- .12 Install glass in accordance with Section 08 80 50 - Glazing, to glazing method required to achieve performance criteria. Cover caps to conceal screws and ensure continuous sightline.

### 3.3 SITE TOLERANCES

- .1 Maximum variation from plumb: 1.5 mm/m non-cumulative or 12 mm/30 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Maximum sealant space between curtain wall and adjacent construction: 13 mm.

### 3.4 ADJUSTING

- .1 Adjust operating sash for smooth operation.

### 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 Remove protective material from prefinished aluminum surfaces.
  - .3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
  - .4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
  - .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

END OF SECTION 08 44 13

**1.0 GENERAL**

**1.1 DOCUMENTS**

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

**1.2 RELATED REQUIREMENTS**

- .1 Metal Fabrications Section 05 50 00
- .2 Finishing and Sheet Metal Section 07 60 00
- .3 Sealants and Caulking Section 07 92 00
- .4 Glazing Section 08 80 00

**1.3 REFERENCES**

- .1 ASTM E331, "Test method for water penetration of Exterior Windows, Curtain Walls and Doors by uniform static air pressure differential".
- .2 NRCC/DBR Building Practice Note #234.
- .3 CAN2 – 12.1.M – Glass, Safety, Tempered or Laminated.
- .4 CAN3 – S157 – 1983 – "Strength Design in Aluminum".
- .5 CAN/CGSB – 12.20 – M89 – "Structural Design of Glass in Buildings".
- .6 American National Standards Institute (ANSI): ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

**1.4 DESIGN AND TESTING**

- .1 Structural performance shall be based on CSA Standard CAN3-S157 "Strength Design in Aluminum" and a maximum deflection in a single member of L/360 for wind and snow.
- .2 Design wind, rain and snow pressure on skylight: Refer Structural drawings general notes.
- .3 Thermal movement: Design skylight components to accommodate expansion and contraction caused by exterior metal surface temperatures without buckling or imposing damaging loads on glass, structural members, fasteners, joint seals or other detrimental effects.

**1.5 SUBMITTALS**

- .1 Provide a site mock-up of a section of skylight complete with glazing hardware.
- .2 Submit shop drawings for review in accordance with Section 01 33 00.
- .3 Shop drawings shall be prepared and sealed by a Professional Engineer registered in the Province of British Columbia to indicate the assembly will withstand all design loads imposed upon it, and that connections to the building structure will transfer all loads, reactions and forces to the structure. The said engineer will submit VBBL 2007 Schedule B and Schedule C-B and NBC Schedule B1, B2 and C-B as per attached Appendix P in this specification.
- .4 Clearly detail profiles, construction, assembly, installation for all conditions, flashing, caulking, sealing, provisions for thermal movement, glazing, anchorage attachment to building structure and method of adjustment.
- .5 Provide (4) copies of maintenance data for cleaning and maintenance of aluminum finishes for

incorporation into the owner's operation and maintenance manuals.

**1.6 QUALITY ASSURANCE**

- .1 Skylights shall be installed, glazed and adjusted by experienced personnel in accordance with the manufacturer's instructions and approved shop drawings.
- .2 The Register Professional engineers who prepare the shop drawings shall submit Schedule B and Schedule C of VBBL 2010.

**1.7 PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, handle and store units in accordance with the manufacturer's directions.
- .2 Store units at site on raised wood pallets protected from the elements and corrosive materials. Do not remove from crates or other protective covering until ready for installation.
- .3 Store prefabricated frame assemblies blocked off the ground in an approved manner to prevent warping, twisting, undue strain on assembly or physical abuse and damage.
- .4 Match mark all components for field assembly.
- .5 Glass must be stored with a positive bottom support at right angles to the plane of the glass.

**1.8 WARRANTY**

- .1 Provide a written warranty issued in the name of the contractor and installer stating that the assembly is warranted to perform in accordance with design and performance requirements for a period of not less than five (5) years from the date of substantial performance

**2.0 PRODUCTS**

**2.1 MATERIALS**

- .1 Glass canopy:
  - .1 Approved hardware Manufacturer & product: As shown on drawings.
  - .2 Material to be stainless steel grade 316.
  - .3 Secure locking set screw on machined back nut to reduce vandalism.
  - .4 Glazing to be frosted laminated safety glass laminated to 1.5mm thick polyvinyl butyral (PVB) interlayer. Glass thickness refer to drawings.

**2.2 FABRICATION**

- .1 Fabricate framing from extrusions of size and shape shown on shop drawings.
- .2 Build square, true, accurate to size, and free from defects affecting appearance and performance.
- .3 Conceal fasteners whenever possible.
- .4 Isolate aluminum from dissimilar metals, except small areas of stainless steel, zinc, or white bronze, using shims, barrier tapes, plastic films, or asphalt base paint.

**2.3 FINISHES**

- .1 For glass canopy hardware: standard manufacturer finish (similar to No. 4 Satin).
- .2 All steel components to be No.4 hairline finish stainless.

**3.0 EXECUTION**

**3.1 INSPECTION**

- .1 Inspect the work of other sections upon which the work of this section depends. Proceed only after deficiencies, if any, in the work of other sections have been corrected.
- .2 Ensure that all anchor and setting or installing assemblies or components supplied by the trade for installation by others are properly located and correctly set in place.

**3.2 INSTALLTION**

- .1 Erect and secure assemblies aligned plumb and square, free from warp, twist or superimposed loads, installed to achieve weathertight installation with air/thermal barrier seal to full system.
- .2 Erect in strict accordance with the manufacturer's written instructions and reviewed shop drawings.
- .3 All anchors and fitments shall be concealed. Exposed heads of fasteners not permitted unless specified otherwise. All joints in exposed work shall be flush hairline butt joints.
- .4 Use anchors that will permit sufficient adjustment for accurate alignment.
- .5 Build-in and provide any supplementary reinforcing and bracing required for assembly loads and deflections.
- .6 Build in anchors and other items provided by other trades for incorporation into window system.
- .7 Secure work adequately to structure in a manner not restricting thermal and wind movement. Touch-up any damaged finish.
- .8 Correctly locate and install flashings, deflectors and weep holes to ensure proper drainage of moisture to exterior.
- .9 Ensure that all stops, gaskets, splines, seals, etc., are perfectly aligned and ready to receive glazing as specified herein.

**3.3 ADJUSTING AND CLEANING**

- .1 At completion of work of this section, and continuously as work proceeds, remove all surplus materials, debris and scrap.
- .2 At completion of work, remove all protective surface covering film and wrappings. Clean all glass panels and frames using mild soap or other cleaning agent approved by the aluminum glazed canopy manufacturer.
- .3 Remove all excess glazing or joint sealing materials from exposed surfaces. Clean and polish glass.
- .4 Adjust all hardware for proper function.

END OF SECTION 08 44 29

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Finish Carpentry	Section 06 20 00
.2	Metal Doors & Frames	Section 08 11 00
.3	Aluminum Doors & Frames	Section 08 11 16
.4	Flush Wood Doors	Section 08 14 16
.5	Glazed Aluminum Curtain Walls	Section 08 44 13

1.2 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - .1 ANSI/BHMA A156.1- 2000 , American National Standard for Butts and Hinges.
  - .2 ANSI/BHMA A156.2- 2003 , Bored and Preassembled Locks and Latches.
  - .3 ANSI/BHMA A156.3- 2001 , Exit Devices.
  - .4 ANSI/BHMA A156.4- 2000 , Door Controls - Closers.
  - .5 ANSI/BHMA A156.5- 2001 , Auxiliary Locks and Associated Products.
  - .6 ANSI/BHMA A156.6- 2005 , Architectural Door Trim.
  - .7 ANSI/BHMA A156.8- 2005 , Door Controls - Overhead Stops and Holders.
  - .8 ANSI/BHMA A156.10- 1999 , Power Operated Pedestrian Doors.
  - .9 ANSI/BHMA A156.12- 2005 , Interconnected Locks and Latches.
  - .10 ANSI/BHMA A156.13- 2002 , Mortise Locks and Latches Series 1000.
  - .11 ANSI/BHMA A156.14- 2002 , Sliding and Folding Door Hardware.
  - .12 ANSI/BHMA A156.15- 2006 , Release Devices - Closer Holder, Electromagnetic and Electromechanical.
  - .13 ANSI/BHMA A156.16- 2002 , Auxiliary Hardware.
  - .14 ANSI/BHMA A156.17- 2004 , Self-closing Hinges and Pivots.
  - .15 ANSI/BHMA A156.18- 2006 , Materials and Finishes.
  - .16 ANSI/BHMA A156.19- 2002 , Power Assist and Low Energy Power - Operated Doors.
  - .17 ANSI/BHMA A156.20- 2006 , Strap and Tee Hinges and Hasps.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Guide For Commercial Interiors.
- .3 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 HARDWARE/SECURITY COORDINATION

- .1 Prior to preparation and submittal of hardware list, door hardware supplier's hardware consultant shall arrange a coordination meeting with the following attendees:
  - .1 Hardware supplier's hardware consultant.
  - .2 Facility's Building Maintenance Manager.
  - .3 Departmental Representative.
  - .4 General Contractor.
- .2 The final door hardware lists shall reflect all decisions made at said coordination meeting.

**1.4 ACTION & INFORMAL 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 door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
  - .4 After approval samples will be returned for incorporation in Work.
- .4 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .7 Sustainable Design Submittals:
  - .1 LEED Canada CI Version 1.0. Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 Construction Waste Management:
    - .1 Submit project Construction 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.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .4 Regional Materials: submit evidence that project incorporates required percentage 20 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

**1.6 MAINTENANCE MATERIALS SUBMITTALS**

- .1 Extra Stock Materials:
  - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Tools:
    - .1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

**1.7 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.8 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect door hardware from nicks, scratches, and blemishes.
  - .3 Protect prefinished surfaces with wrapping strippable coating.
  - .4 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.
- .6 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

**1.9 REDUNDANT LOCKSETS**

- .1 Where existing and other lock-bearing devices are to be removed and disposed of: turn-over to Departmental Representative and obtain receipt. In order to maintain building keying security, no existing locksets are to be removed from building.

**1.10 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 30-Closeout Submittals.
  - .2 Supply two sets of wrenches for door closers.



## 2.0 PRODUCTS

### 2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

### 2.2 DOOR HARDWARE

- .1 Locks and latches:
  - .1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
  - .2 Lever handles: plain 64mm x 114mm x 51mm design.
  - .3 Roses: round
  - .4 Normal strikes: box type, lip projection not beyond jamb.
  - .5 Cylinders: key into keying system as noted as directed.
  - .6 Finished to 652, 626 & 630
  - .7 6 pin ( or7) tumbler keying to Maintenance's Master System.
- .2 Butts and hinges:
  - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .3 Exit devices: to ANSI/BHMA A156.3, type & function as listed, grade (1)
  - .1 Auxiliary items: door coordinator.
- .4 Door Closers and Accessories:
  - .1 Door controls (closers): to ANSI/BHMA A156.4, listed in Hardware Schedule, multi-sized sized 1 to though 6 in accordance with ANSI/BHMA A156.4, table A1, finished to 689.
  - .2 Door controls - overhead holders: to ANSI/BHMA A156.8, designated by letter C and numeral identifiers listed in Hardware Schedule, finished to 626.
  - .3 Closer/holder release devices: to ANSI/BHMA listed in hardware schedule, finished to 689.
  - .4 Door co-ordinator: surface for pairs of doors with overlapping astragal.
  - .5 Magnetic holder floor or wall mounted release on fire alarm: finished to 689.
- .5 Door Operators:
  - .1 Power-operated pedestrian doors: to ANSI/BHMA A156.10.
  - .2 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.
- .6 Auxiliary locks and associated products: to ANSI/BHMA A156.5, numeral identifiers listed in Hardware Schedule, finished to 626.
  - .1 Cylinders: type as listed, finished to 626, for installation in deadlocks provided with special doors as listed in Hardware Schedule. Key into keying system [as noted] [as directed].
- .7 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule as listed below, finished to 626 or 630.
  - .1 Architectural door trim: to ANSI/BHMA A156.6, listed in Hardware Schedule as listed below, finished to 626 or 630
  - .1 Door protection plates: kick plate type as listed, 1.27 mm thick stainless steel 1 edges, finished to 630.
  - .2 Push plates: type as listed, 1.27 mm thick stainless steel 1 edge, as listed, finished to 630.
  - .3 Push/Pull units: type as listed, finished to 630.
- .8 Sliding and folding door hardware: to ANSI/BHMA A156.14 finished to 626.

- .1 Heavy sliding doors (over 91 kg): box track, commercial series hanger and double sidewall overhead style track supports, as listed in above standard for door weight.
- .2 Bi-passing sliding door hardware: double leg aluminum track without fascia and commercial series steel hangers, as listed in above standard for door weight
- .3 Accessory item: door pulls stops double roller guides with channel in door type commercial grade
- .9 Auxiliary hardware: to ANSI/BHMA A156.16, listed in Hardware Schedule finished to 626 or 630.
- .10 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene weather seal, recessed in door bottom surface mounted recessed in door face, closed ends, adjustable automatic retract mechanism when door is open, clear anodized finish.
- .10 Thresholds: 127mm wide x full width of door opening, extruded aluminum mill finish, serrated surface, with lip and vinyl door seal insert.
- .11 Weatherstripping:
  - .1 Head and jamb seal:
    - .1 Adhesive backed neoprene vinyl covered foam material.
  - .2 Door bottom seal:
    - .1 Extruded aluminum frame and [closed cell neoprene vinyl sweep, clear anodized finish.
- .12 Astragal: overlapping, Primed steel meeting stiles Pile
- .13 Barrier Free Pneumatic Door Operator:
  - .1 Heavy duty pneumatically assisted door closer, capable of multi-door operation, complete with actuators, control boxes, pneumatic tubing and compressed air source.
  - .2 Self-contained control box/compressor combination for independent operation of two door leaves.
  - .3 Control boxes: complete with electric strike relay.
  - .4 Mount operators on either push or pull sides of doors as required to place them inside rooms.
  - .5 Actuation of operators by push button.
  - .6 Electrical box and actuator: Hardwired low voltage actuator with stainless steel 114 mm round plate, engraved blue filled with handicap symbol. Box 51 mm wide x 102 mm high x 50 mm deep single gang electrical box, flush mounted in wall, locations indicated.
  - .7 Supply switched line voltage to control box. Locate switch adjacent to box.
  - .8 Supply low voltage wiring to each actuator and 6 mm diameter air tubing to each operator.
  - .9 Mount control box in location as directed by Departmental Representative.
- .14 Electric Strikes
  - .1 Weatherproof type includes all accessories, transformer and housing. Conduit by Division 26, connection by Division 28.

### 2.3 MISCELLANEOUS HARDWARE

- .1 Indexed key control system: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers, wall mounted, type 50% expandable colour enamel paint finish.

2.4 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.5 KEYING

- .1 Doors, padlocks and cabinet locks to be keyed to grand master keyed as directed and as noted in Hardware Schedule. Prepare detailed keying schedule in conjunction with Departmental Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply (five) 5 master keys for each master key or grand master key group.
- .4 Supply 5 keys for each lock.
- .5 Stamp keying code numbers on keys and cylinders.
- .6 Supply construction cores.
- .7 Hand over permanent cores and keys to Departmental Representative.
- .8 All core to be high security interchangeable core.

2.6 KEYS

- .1 Use standard construction cylinders for locks for Contractor's use during the construction period.
- .2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.
- .3 Upon completion of each phase of the construction, the Departmental Representative will, in conjunction with the lock manager:
  - .1 Prepare an operational keying schedule.
  - .2 Accept the operational keys and cylinders directly from the lock manufacturer.
  - .3 Arrange for removal and return of the construction cores and install the operational core in all locks.

2.7 ADDITIONAL DOOR HARDWARE SCHEDULED ELSEWHERE

- .1 Refer to Division 28- Electronic Safety and Security, for additional door items including, but not limited to the following:
  - .1 Access and intrusion control panels.

- .2 Card readers.
- .3 Door Contracts.
- .4 Intrusion detection.

- .2 Refer to Division 26-Electrical for all wiring and conduit for above items.

### 3.0 EXECUTION

#### 3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction.
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Install key control cabinet.
- .7 Use only manufacturer's supplied fasteners.
  - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores locks when directed by Departmental Representative.
  - .1 Install permanent cores and ensure locks operate correctly.

#### 3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

#### 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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .3 Remove protective material from hardware items where present.
  - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.

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

### 3.4 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
  - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
  - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
  - .3 Lock key cabinet and turn over key to Departmental Representative.
- .2 Maintenance Staff Briefing:
  - .1 Brief maintenance staff regarding:
    - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
    - .2 Description, use, handling, and storage of keys.
    - .3 Use, application and storage of wrenches for door closers locksets and fire exit hardware.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

### 3.5 PROTECTION

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

### 3.6 FINISH HARDWARE SCHEDULE

- .1 Double Doors D01-A: Key Group A
  - .1 6 Ea. Hinges A1
  - .2 1 Ea. Exit device active door D1
  - .3 1 Ea. Exit device inactive door D2
  - .4 3 Ea. Cylinders B1 (Group A)
  - .5 2 Ea. pulls J1
  - .6 2 Ea. Closers C1
  - .7 2 Ea. Floor stop F1
  - .8 2 Ea. Mag Holders C6
  - .9 1 Set Astragal M1
  - .10 1 Ea. Door contact F5
- .2 Single Door D01-B: Key Group A
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Exit device D3
  - .3 1 Ea. Cylinder pull J2
  - .4 2 Ea. Cylinders B1 (group A)
  - .5 1 Ea. Closer C2
  - .6 1 Ea. Kickplate J3
  - .7 1 Ea. Astragal M2
  - .8 1 Ea. Door contact F5
- .3 Single Door D01-C: Key Group A
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Exit device D5

- .3 2 Ea. Cylinders B1 (group A)
- .4 1 Ea. Cylinder pull J2
- .5 1 Ea. Closer C3
- .6 1 Ea. Kickplate J3
- .7 1 Ea. Astragal M2
- .8 1 Ea. Door contact F5
  
- .4 Doors D02:
  - .1 1 Ea. Lock set B3 Key Group B
  - .2 1 Ea. Wall stop F3

Note: Contractor to replace existing door lockset which comes with the door with the specified new lockset.
  
- .5 Single Door D04-A: Key Group A
  - .1 2 Ea. Hinges A1
  - .2 1 Ea. Hinges A3
  - .2 1 Ea. Exit device D4

Card reader, power supply, junction box  
Wiring, conduits and all hookups by electrical

  - .5 1 Ea. pull J1
  - .4 1 Ea. Cylinders B1 (group A)
  - .5 1 Ea. Closer C8
  - .6 1 Ea. Kick plate J3
  - .7 1 Ea. Astragal M2
  - .8 1 Ea. Viewer F2
  - .9 1 Ea. Door contact F5

Note: Door to be secured on the pull side and readily operable on the push side.
  
- .6 Single Door D04-B & D04-C
  - .1 2 Set H1 ea dr
  
- .7 Double Door D05
  - .1 2 Set H1 ea dr
  
- .8 Single Doors D06, D10, D11, D18
  - .1 3 Ea. Hinges A2
  - .2 1 Ea. Latch set B2
  - .3 1 Ea. Wall stop F3
  
- .9 Single Door D07, D08
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Pull J4
  - .3 1 Ea. Push plate J5
  - .4 1 Ea. Closer C8
  - .5 1 Ea. Wall stop F3
  - .6 1 Ea. Kick plate J3
  
- .10 Single Door D09: Keyed different and Master Keyed
  - .1 3 Ea. Hinges A2
  - .2 1 Ea. Lock set B3
  - .3 1 Ea. Cylinders B1 (KD)
  - .4 1 Ea. Closer C4

- .5 1 Ea. Wall stop F3
- .6 1 Ea. Kick plate J3
  
- .11 Single Door D12: Keyed different  
Single Door D14, D15: Key Group C  
Single Door D19 & D22: Key Group B
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Lock set B3
  - .3 1 Ea. Cylinders B1
  - .4 1 Ea. Electric strike F4
  - .5 1 Ea. Closer C4
  - .6 1 Ea. Wall stop F3
  - .7 1 Ea. Kick plate J3
  - .8 1 Ea. Door contact F5
  - .9 Note: Card readers, power supply, junction  
Request to exit switch and all hookups by. Division 26.Note: Door to be secured on the pull side and readily operable on the push side.
  
- .12 Single Door D13: Keyed different and Master Keyed
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Lock set B4
  - .3 1 Ea. Cylinders B1
  - .4 1 Ea. Wall stop F3
  
- .13 Single Door D52 & D53
  - .1 3 Ea. Hinges A2
  - .2 1 Ea. Lock set B3
  - .3 1 Ea. Cylinders B1
  - .4 1 Ea. Wall stop F3
  - .5 1 Ea. Kick plate J3
  
- .14 Double Doors D54:
  - .1 6 Ea. Hinges A2
  - .2 2 Ea. Flush bolts J6
  - .3 1 Ea. Lock set B3
  - .4 1 Ea. Cylinders B1 (Group A)
  - .5 2 Ea. Floor stop F1
  - .6 2 Ea. Kick plates J7
  - .7 1 Set Astragal M3
  
- .15 Single Door D51
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Lock set B5
  - .3 1 Ea. Cylinders B1
  - .4 1 Ea. Closer C3
  - .5 1 Ea. Floor stop F1
  - .6 1 Ea. Kick plate J3
  
- .16 Single Door D21: Key Group A
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Exit device D5

- .3 2 Ea. Cylinders B1 (group A)
- .4 1 Ea. Cylinder pull J2
- .5 1 Ea. Closer C3
- .6 1 Ea. Kick plate J3
- .7 1 Ea. Astragal M2
- .8 1 Ea. Viewer F2
- .9 1 Ea. Door contact
  
- .17 Doors D03-A:
  - .1 1 Ea. Lock set B3 Key Group B
  - .2 1 Ea. Wall stop F3
  - .3 1 Ea. Viewer F2
  
- .18 Doors D03-B:
  - .1 1 Ea. Lock set B3 Key Group B
  - .2 1 Ea. Electric strike F4
  - Card reader, power supply, junction box
  - Wiring, conduits and all hookups by electrical
  - .3 1 Ea. Closer C4
  - .4 1 Ea. Wall stop F3
  - .5 1 Ea. Door contact F5
  - .6 1 Ea. Astragal M4

Note: Door to be secured on the pull side and readily operable on the push side.
  
- .19 Single Door D61 & D62
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Pull J4
  - .3 1 Ea. Push plate J5
  - .4 1 Ea. Closer C8
  - .5 1 Ea. Wall stop F3
  - .6 1 Ea. Kick plate J3
  
- .20 Single Door D70 & D71
  - .1 3 Ea. Hinges A1
  - .2 1 Ea. Dead Lock B6
  - .3 1 Ea. Pull J1a
  - .4 1 Ea. Operator C8
  - .5 1 Ea. Wall stop F3
  
- .21 Single Door D72 & D73
  - .1 3 Ea. Hinges A2
  - .2 1 Ea. Dead Lock B6
  - .3 1 Ea. Pull J2
  - .4 1 Ea. Wall stop F3

### 3.7 DOOR HARDWARE TYPE

- .1 HINGES:
  - A1 – Hinge 5 Knuckle-.180 gauge-114mm x 101mm x Non Removable Pin x 652
  - A2 – Hinge 5 Knuckle-.134 gauge- 114mm x 101mm x Non Removable Pin x 652
  - A3 –Concealed Circuit Electric 12 wire Hinge 5 Knuckle-.180 gauge-114mm x 101mm x 652



- .2 LOCKS, DEADBOLTS AND PRIVACYS:
- |                |                             |     |
|----------------|-----------------------------|-----|
| B1 - Cylinder  | Type x length x cam to suit | 626 |
| B2 - Latch set | ANSI F01                    | 626 |
| B3 - Lock set  | ANSI F07                    | 626 |
| B4 - Lock set  | ANSI F13                    | 626 |
| B5 - Lock set  | ANSI F05                    | 626 |
| B6 – Dead Lock | ANSI E06081                 | 626 |
- .3 CLOSERS:
- Note: Include thru-bolts and grommet nuts fasteners.
- C1 – Closer Institutional, non sized, rigid parallel arm x delayed action x 689
- C2 - Closer non sized, Jamb mount compression spring buffer arm x delayed action x 689
- C3 - Closer Institutional, non sized, compression spring buffer arm x delayed action x 689
- C4 - Closer Institutional, non sized, regular arm x delayed action x 689
- C6 - Mag Holder Floor mounted, concealed wiring, 120VAC 689
- Note: -Wiring/conduits/rectifiers/transformers/power to holder  
and all hookups to holder and fire alarm by electrical.
- .4 OPERATORS:
- C8– Operator see 2.2.13
- .5 EXIT DEVICES:
- D1 - Exit Device Narrow Stile concealed vertical rod for narrow stile  
aluminum doors night latch function less pull x cylinder  
dogging x 626 (ANSI A156.3 – 2008-Grade 1)
- D2 - Exit Device Narrow Stile concealed vertical rod for narrow stile  
aluminum doors exit only x cylinder dogging x 626(ANSI A156.3 – 2008-Grade 1)
- D3 - Exit Device Narrow Stile concealed vertical rod for narrow stile  
aluminum doors night latch function less pull x battery  
alarm kit with key override x 626 (ANSI A156.3 – 2008-Grade 1)
- D4 - Exit Device Mortise lock night latch function less pull x momentary electric latch  
retraction x 626 (ANSI A156.3 – 2008-Grade 1)
- D5 - Exit Device Mortise lock night latch function less pull x battery  
alarm kit with key override x 626 (ANSI A156.3 – 2008-Grade 1)
- D6 - Exit Device Mortise lock night latch function less pull x with key override x 626 (ANSI  
A156.3 – 2008-Grade 1)
- .6 AUXILIARY HARDWARE:
- F1 - Floor stop Low dome 28.57mm high x 50mm Dia solid cast x 626
- F2 - Viewer with full 140 degrees of visibility x 626
- F3 - Wall stop Cast concealed mount, concave bumper with back plate x 626
- F4 - Electric Strike Fire rated, 12 VDC, 1500Lbs holding, 19mm keeper depth, Fail secure x 630
- F5 - Concealed door contact  
Installed by hardware supplier  
All conduits, wiring and hookups by electrical

- .7 ARCHITECTURAL DOOR TRIM:  
J1 - Pull Semi-circular-354mm CTC (see Rockwood RM4552 x type 12 mount) x 630 to match existing  
J1 - Reuse existing pulls Set x Back to Back mounting  
J2 - Cylinder Pull 50mm x 95.5mm x 31.8mm cylinder hole x 630  
J3 - Kick Plate 254mm x width less 38mm x 630  
J4 - Pull 25mm dia x 305mm with base plates x 630  
J5 - Push Plate 101mm x 406mm x 630  
J6 - Flush Bolts Lever extension x 19mm bolt throw x 19mm rod B/S x 304mm rod len x 38mm adjustable bolt head x 22mm/171mm face plate x dust proof strike x 626  
J7 -Kick Plate 254mm x width less 25mm x 630
- .8 THRESHOLDS, SEALS, DOOR BOTTOMS, ASTRAGAL  
M1 - Meeting Stile Set split astragals with snap covers & pile insert x height  
M2 -Astragal 3.5mm x 3.17 x silicone insert x height  
M3 -Astragal 50.08mm x 3.2mm x height welded to door by door supplier  
M4 -Astragal Strike latch guard x 630
- .9 SLIDING DOOR HARDWARE:  
H1 - Bypass door track & hardware nylon wheels max weight 100 kg  
with roller guides on floor & channel in door. Acceptable products or equal: KrisTack KT40  
with KT146B brackets quantity to suit opening, pulls to Gallery AF7 x 630 on the outside and  
Gallery 950 x 630 on the inside, Fascia, and the balance of hardware by door supplier

END OF SECTION 08 71 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Metal doors and frames	Section 08 11 00
.2	Aluminum Door and Frames	Section 08 11 16
.3	Glazed Aluminum Curtain Walls	Section 08 44 13
.4	Glass Canopy	Section 08 44 29
.5	Security Films	Section 08 07 53

1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C 542-05, Standard Specification for Lock-Strip Gaskets.
  - .2 ASTM D 790-07e1, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .3 ASTM D 1003-07e1, Standard Test Method for Haze and Luminous Transmittance of Plastics.
  - .4 ASTM D 1929-96 (R2001) e1, Standard Test Method for Determining Ignition Temperature of Plastics.
  - .5 ASTM D 2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
  - .6 ASTM E 84-10, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .7 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .8 ASTM F 1233-08, Standard Test Method for Security Glazing Materials and Systems.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
  - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
  - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
  - .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
  - .5 CAN/CGSB-12.6-M91, Transparent (One-Way) Mirrors.
  - .6 CAN/CGSB-12.8-97, Insulating Glass Units.
  - .7 CAN/CGSB-12.8-97, (Amendment), Insulating Glass Units.
  - .8 CAN/CGSB-12.9-M91, Spandrel Glass.
  - .9 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
  - .10 CAN/CGSB-12.11-M90, Wired Safety Glass.
  - .11 CAN/CGSB-12.12-M90, Plastic Safety Glazing Sheets.
  - .12 CAN/CGSB-12.13-M91, Patterned Glass.
- .4 Environmental Choice Program (ECP)
  - .1 CCD-045-95(R2005), Sealants and Caulking Compounds.
- .5 Glass Association of North American (GANA)

- .1 GANA Glazing Manual - 2008.
- .2 GANA Laminated Glazing Reference Manual - 2009.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

### 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 glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .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 50% of construction wastes were recycled or salvaged.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .3 Regional Materials: submit evidence that project incorporates required percentage 10 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .4 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions requirements.
- .4 Samples: Provide 2 glazed units samples in accordance with Section 01 33 00- Submittal Procedures.
- .5 Shop Drawings:
  - .1 Provide shop drawings in accordance with Section 01 33 00- Submittal Procedures:
    - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of British Columbia, Canada. Submit Schedule B and C-B per VBBL 2007 and NBC Schedule B1, B2 and C-B as per attached Appendix P in this specification.
    - .2 Shop drawing consist of steel framing installation details. Indicate sizes, spacing, location and quantities.

### 1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
  - .3 Protect prefinished aluminum surfaces with wrapping.
  - .4 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

## 1.7 AMBIENT CONDITIONS

- .1 Ambient Requirements:
  - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
  - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

## 1.8 WARRANTY

- .1 Provide manufacturer's warranty in writing for insulating glass units against failure of seal of enclosed air space and deposits on inner faces of glass detrimental to vision for a period of 2 years from date of Substantial Performance of Work.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Design Criteria:
  - .1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
    - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
  - .2 Size glass to withstand wind loads, dead loads and positive and negative live loads to National Building Code.
  - .3 Limit glass deflection to 1/200 with full recovery of glazing materials.
- .2 Flat Glass:
  - .1 Float Glass: to CAN/CGSB-12.3, glazing quality, 6 mm thick.
  - .2 Interior Safety Glass: to CAN/CGSB-12.1, transparent 6 mm thick minimum, refer to drawing.
    - .1 Type 2-tempered.
    - .2 Class B-float.
  - .3 Silvered mirror glass: 6 mm thick.
    - .1 Type 1A-float glass for normal use Edges ground and polished.

- .4 Wired Glass: to CAN/CGSB-12.11, 6 mm thick.
  - .1 Type 1-polished both sides (transparent).
  - .2 Wire mesh styles 3-square.
- .5 Exterior Safety Glasses for Glass Canopy: To CAN/CGSB-12.1.
  - .1 Tempered: Free of tong marks in final position.
  - .2 Laminated: 2 layers of tempered glass laminated to 1.5mm thick polyvinyl butyral (PVB) interlayer, thickness refer to drawings.
- .6 Insulated glass unit: performance requirements for insulated glass units with 13 mm air space and two 6 mm lites, interior lite clear, shall be as follows:
  - .1 Transmittance: UV-18%, Visible-70%, Total Solar Energy-32%.
  - .2 Outdoor reflectance: Visible-11%, Total Solar Energy-29%.
  - .3 U-Value BTU/Hr./Ft./°F: Winter 0.29 Summer 0.28
  - .4 Solar heat gain coefficient: 0.38
  - .5 Shading coefficient: 0.43
  - .6 Low-E coating on #2 surface.
- .7 Exterior Atrium Skylight Safety Glass: to CAN CGSB-12.1
  - .1 Heat-strengthen
  - .2 Laminated: 2 layers for 10mm thickness glass laminated to 1.5mm thick polyvinyl butyral (PVB) interlayer.
  - .3 Transmittance: Visible-82%, total Solar Energy -53%.
  - .4 Outdoor Reflectance: Visible-8%, total Solar Energy-9%.
  - .5 V-Value BTU/Hr/Ft/°F Water: 0.95. Summer 0.86.
  - .6 Solar heat gain coefficient: 0.65.
  - .7 Shading Coefficient: 0.75
  - .8 Glass to be coated with Low-E Coating.

## 2.2 ACCESSORIES

- .1 Setting blocks: neoprene Shore A durometer hardness to ASTM D 2240, minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height.
- .2 Spacer shims: neoprene Shore A durometer hardness to ASTM D 2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape:
  - .1 Preformed butyl compound Shore A durometer hardness to ASTM D 2240; coiled on release paper; black colour. Width x thickness recommended by manufacturer to suit installation.
- .4 Glazing splines: resilient neoprene, extruded shape to suit glazing channel retaining slot, black colour as selected.
- .5 Glazing clips: manufacturer's standard type.
- .6 Lock-strip gaskets: to ASTM C 542.
- .7 Mirror attachment accessories:
  - .1 Stainless steel clips.
  - .2 Mirror adhesive, chemically compatible with mirror coating and wall substrate.

### 3.0 EXECUTION

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
  - .1 Verify that openings for glazing are correctly sized and within tolerance.
  - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
  - .3 Visually inspect substrate in presence of Departmental Representative.
  - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .5 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 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

#### 3.3 INSTALLATION INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- .1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and install against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/3 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of light or unit.
- .5 Install removable stops, with spacer shims inserted between glazing and applied stops at 600 mm intervals, 6 mm below sight line.
- .6 Fill gaps between light and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- .7 Trim protruding tape edge.

#### 3.4 INSTALLATION: MIRRORS

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Set mirrors with clips. Anchor rigidly to wall construction.
- .3 Set in frame.
- .4 Place plumb and level.

#### 3.5 INSTALLATIONS: GLAZING FILM

- .1 Prepare surfaces using the methods recommended by the manufacturer for achieving the best

- result for the substrate under the project conditions.
- .2 Install in accordance with manufacturer's instructions.
  - .3 Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
  - .4 After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

### 3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
    - .1 Remove traces of primer, caulking.
    - .2 Remove glazing materials from finish surfaces.
    - .3 Remove labels.
    - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
  - .1 Do not mark heat absorbing or reflective glass units.
- .3 Repair damage to adjacent materials caused by glazing installation.



## 1.0 GENERAL

### 1.1 SUMMARY

- .1 Section Includes:
  - .1 Security and safety film placed on glass surfaces for increased security protection and to improve resistance to glass breakage.
  - .2 Sustainable requirements for construction and verification.
    - .1 Section 01 35 21 LEED Requirements.
- .2 Related Requirements
  - .1 Glazing Section 08 80 50.

### 1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
  - .1 ANSI Z97.1- 1984 (R1994), Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.
- .2 International Window Film Association (IWFA)
  - .1 IWFA Visual Quality Standard for Applied Window Film 1999.
- .3 Consumer Product Safety Commission Publications (CPSC)/Code of Federal Regulations (CFR)
  - .1 CPSC, 16 CFR 1201 CAT I.
  - .2 CPSC, 16 CFR 1201 CAT II.
- .4 General Services Administration (GSA)
  - .1 GSA-TS01- 2003, Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- .5 Government of Canada
  - .1 Canada Labour Code, WHMIS datasheets.
- .6 Underwriters laboratories of Canada (ULC)
  - .1 ULC-S332- 93, Standard for Burglary Resisting Material.
  - .2 UL-972- 02, Burglary resisting Glazing Material.
- .7 The American Society for Testing and Materials (ASTM) Publications:
  - .1 ASTM D882-95a Tensile Properties of Plastic Film and Sheeting - Tensile, Elongation, Break and Flexibility (Young's Modulus)
  - .2 ASTM D1004-94a Initial Tear Resistance of Plastic Film and Sheeting - Initial Force to Tear (Graves Area).
  - .3 ASTM D2582-93 Puncture-Propagation Tear Resistance of Plastic Film and Sheeting.
  - .4 ASTM F1642-96 Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings, as per US Governments GSA Test Standard Protocol.
  - .5 ASTM D1044 Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion.
  - .6 ASTM E84-94 Surface Burn Characteristics of Building.

**1.3 DEFINITIONS**

- .1 Safety: reduction of risk of injury, loss or death of persons due to accidental, natural or unintentional causes.
- .2 Security: reduction of risk of injury, loss or death of persons due to intentional actions of others.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit one 300 x 300 mm sample of film installed on 7 mm thick clear plate glass for each specified type.
- .4 Submit test reports in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit test reports from approved independent testing laboratory, certifying film's compliance with specified requirements.
- .5 Submit Closeout Submittals in accordance with Section 01 78 00 - Closeout Submittals.
  - .1 Provide operation and maintenance data for window film for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2 Follow manufacturers written instructions for care and maintenance of security and safety film.
  - .3 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of security film.

**1.5 QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
  - .2 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Canada Labour Code.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with section 01 61 00 - Common Product Requirements.
- .2 Provide and maintain dry, off-ground weatherproof storage.
- .3 Store rolls of film flat on cross supports. Do not stand rolls of film on end.
- .4 Remove from storage, in quantities required for same day use.
- .5 Store materials in accordance with manufacturers written instructions.
- .6 Waste Management and Disposal:
  - .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal , and with Waste Reduction Workplan.

- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely.

#### 1.7 WARRANTY

- .1 Work of this Section 08 87 53 - Security Films 12 months warranty period is extended to 10 years from date of Substantial Completion.
- .2 Contractor hereby warrants that Security and Safety Film will stay in place without delaminating, peeling or blistering for 10 years from date of Substantial Completion.
- .3 Ensure warranty includes items as follows:
  - .1 Maintaining adhesion properties without blistering, bubbling or delaminating from glass surface.
  - .2 Maintaining appearance without discolouration.
  - .3 Removing, replace and reapply defective materials.
  - .4 In event of product failure under warranty terms, remove and re-apply film without glass replacement at no cost to Departmental Representative.

#### 1.8 MAINTENANCE DATA

- .1 Provide operation and maintenance data for window film for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 2.0 PRODUCTS

##### 2.1 MATERIALS

- .1 Materials and resources in accordance with Section 01 35 21 LEED Requirements.
- .2 Security Film: - General: polyester film, abrasion resistant coating and release liner.
  - .1 Number of Laminated Micro Layers: 39 layers
  - .2 Film Thickness (inches and mm): 0.006 inches nominal (0.152mm)
  - .3 Tensile Strength (ASTM D882-95a in PSI) : 30,000 PSI
  - .4 Elongation (ASTM D882-95a in stretch %): 140%
  - .5 Break Strength (ASTM D882-95a in lbs. per inch width): 180 lbs.
  - .6 Young's Modulus (ASTM D882-95a in PSI) : >500,000 PSI
  - .7 Graves Area Tear (ASTM D1004-94a in lbs.%) : >1150 lbs.%
  - .8 Puncture Propagation Tear (ASTM D2582-93 in lbs.) : 19.2 lbs.
  - .9 Safety Impact Test (ANSI Z97.1) : unlimited
  - .10 Safety Impact Test (CPSC 16 CFR): Category II 400 ft. lbs.
  - .11 Large Scale Explosive Open-air Test (ASTM F1642-96) : Level 2
  - .12 Adhesive Peel Strength (ANSI Z97.1) : >2,500 grams/ inch
  - .13 Adhesive after Intensified Weathering (CPSC 1201.4) : >3,500 grams/ inch
  - .14 Abrasion Resistance Test (ASTM D-1044 in % change of haze) : <6%
  - .15 Surface Burn Characteristics (ASTM E84) : Class A Interior Use
  - .16 Types:
    - .1 SCGF 1- Optically Clear
    - .2 SCGF 3- Frosted
  - .17 Refer to Interior Finish Material and Colour Schedule.
- .3 Frost Performance Characteristics.
  - .1 Shading Coefficient :0.44
  - .2 Visible Light Reflectance :43%
  - .3 Visible Light Transmittance: 21%

- .4 Heat Transmission Coefficient : 5.9 W/m<sup>2</sup>K
- .5 Flammability :ASTM E84 Class 1(A)

## 2.2 FABRICATION

- .1 Shop installation of security film to glass panels:
  - .1 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
  - .2 Examine glass under natural daylight and identify cracks, blisters, bubbles, discoloration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems.
  - .3 View glass from 2.0 m minimum. Report findings to Departmental Representative.
  - .4 Proceed with Work only after receipt of written approval from Departmental Representative.
    - .1 Install security film to glass panels ensuring no blisters, bubbles, scratches, edge defects or distortions.
    - .2 Cut film edges straight and square to within 3 mm of edge of panel.
    - .3 Deliver glass panels complete with security film installed and labels intact and legible to site in accordance with section 01 61 00 - Common Product Requirements.

## 3.0 EXECUTION

### 3.1 PREPARATION

- .1 Clean glass before beginning installation using neutral cleaning solution.
- .2 Ensure no deleterious material adheres to glass by scraping surface of glass using industrial razors.
- .3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
- .4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discoloration, edge defects or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems. Report findings to Departmental Representative.
- .5 Proceed with Work only after receipt of written approval from Departmental Representative.
- .6 Before beginning Work, place absorbent material at frame to absorb moisture accumulation generated by film application.

### 3.2 INSTALLATION

- .1 Field Installation of Security Film to Glass Windows:
  - .1 Install film in the same manner as tested.
  - .2 Remove any window stops and window sealing device.
  - .3 Ensure no deleterious material adheres to glass by scraping surface of glass using industrial razors.
  - .4 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
  - .5 Examine glass under natural daylight and identify cracks, blisters, bubbles, discoloration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. Report findings to Departmental Representative before starting Work.

- .6 Proceed with Work only after receipt of written approval from Departmental Representative.
- .7 Install security film to glass windows ensuring no blisters, bubbles, scratches or distortions.
- .2 Cut film edges straight and square.
- .3 Ensure film is installed behind window stops.
- .4 Cut edges 3 mm maximum from edge of glass sealing device in accordance with manufacturers written instructions.
- .5 Apply and attach film to glass in accordance with manufacturer's written instructions.
- .6 Splicing:
  - .1 Splice film only when glass is greater in width than film.
  - .2 Splice film only after receipt of written approval from Departmental Representative.
  - .3 Use overlapped factory edges only.
  - .4 Ensure maximum overlap of 3 mm.
- .7 Use only water and film slip solution on glass to facilitate positioning of film.
- .8 Ensure removal of excess water from between film and glass.
- .9 Remove left over material from work area and return work area to original condition.

### 3.3 INSTALLER'S INSPECTION

- .1 Visual Inspection: in accordance with IWFA - Visual Quality Standard for Applied Window Film.
- .2 Remove and replace film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2.0 m minimum after 30 day period.
- .3 Remove and replace without glass replacement, film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2.0 m minimum after 30 day period.

### 3.4 FINAL CLEANING

- .1 Wash interior and exterior of each glass panel and film using cleaning solution recommended by film manufacturer.

### 3.5 VERIFICATION

- .1 Verification requirements in accordance with Section 01 35 21 LEED Requirements, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Local/regional materials.
  - .6 Low-emitting materials.

[illegible]

**ROOM FINISH SCHEDULE**

**LEGENDS**

<b><u>FLOOR</u></b>		<b><u>BASE</u></b>		<b><u>WALLS</u></b>		<b><u>CEILINGS</u></b>	
CONC	Sealed Concrete	CT	Ceramic Tiles	CT	Ceramic Tile	ACT	Suspended T-Bar w/ Acoustic Ceiling Tiles
CPT	Carpet	VB	Vinyl Base	PT	Painted	EXP	Painted Exposed Ceiling
PRT	Porcelain Tiles					GWB	GWB Ceiling Paint Finish
VT	Vinyl Tiles						

**GENERAL NOTES**

- .1 All wall finishes and wall base to be continuous behind chalkboard, tackboard, projection screen, lockers and benches.
- .2 Vertical bulkheads/down drops to be finished same as horizontal U.O.N.
- .3 Return wall finishes into window frames at jambs and head U.O.N.
- .4 Wall finishes to extend down to floor with applied base over.
- .5 All exposed services to be painted as adjacent wall U.O.N.
- .6 Refer to Interior Elevations (Dwg. # A20-22) and Layout Plan (Dwg. # A12) for paint color.
- .7 All change of flooring in hallways must extend to the room side of the door frame U.O.N.
- .8 Refer to drawing for change of flooring, interior elevation, ceiling design and details.
- .9 Make good and level existing slab to receive flooring.
- .10 Make good existing wall to paintable condition prior to applying new painting.
- .11 All GWB to be moisture resistant in washrooms.

**REMARKS**

- #1 Refer to Washrooms Floor Plan (Dwg. #A34) and Washrooms Interior Elevations (Dwg. # A35) for finishes details.
- #2 Refer to Layout Plan (Dwg. # A12) for location of change of floor finishes.

END OF SECTION 09 06 00.13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                              |                  |
|----|------------------------------|------------------|
| .1 | Joint Sealants               | Section 07 92 00 |
| .2 | Non-Structural Metal Forming | Section 09 22 16 |
| .3 | Ceramic Tiling               | Section 09 30 13 |
| .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 475-02 (2007), 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 840-08, 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 1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .8 ASTM C 1280-99, 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-09a, Standard Specification for Gypsum Wallboard.
- .3 Association of the Wall and Ceilings Industries International (AWCI)
  - .1 AWCI Levels of Gypsum Board Finish-97.
- .4 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .5 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.



- .6 Green Seal Environmental Standards (GS)
  - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .8 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 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 50 of construction wastes were recycled or salvaged.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .3 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 Develop Construction Waste Management Plan 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 21 - Construction/Demolition 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.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Standard board: to ASTM C 1396/C 1396M regular, 127mm and 19 mm thick and Type X, 127 mm and 19 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges tapered.
- .2 Gypsum sheathing board: to ASTM C 1396/C 1396M, regular, 12.7mm and 18 mm thick and Type X, 12.7mm and 19 mm thick, 1200 mm wide x maximum practical length.
- .3 Backing board and coreboard: to ASTM C 1396/C 1396M regular, 127mm 19 mm thick and Type X, 127mm and 9 mm thick, bevelled edges.
- .4 Water-resistant board: to ASTM C 1396/C 1396M regular, 12.7mm and 19 mm thick and Type X, 12.7mm and 19mm thick, 1220 mm wide x maximum practical length.
- .5 Glass mat water-resistant gypsum backing board: to ASTM C 1178/C 1178M, 12.7 and 19 mm thick, 1200 mm wide x maximum practical length.
- .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 Stud adhesive: to CAN/CGSB-71.25.
- .10 Laminating compound: as recommended by manufacturer, asbestos-free.
- .11 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.
- .12 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.

- .13 Polyethylene: to CAN/CGSB-51.34, Type 2.
- .14 Insulating strip: rubberized, moisture resistant, 3 mm thick cork closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.
- .15 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 Do application of gypsum sheathing to ASTM C 1280.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840 except where specified otherwise.
- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .10 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.
- .11 Furr openings and around built-in equipment, cabinets, access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

### 3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .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 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with [6] mm gap where boards abut other work.
- .4 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to laundry sinks. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .5 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.
- .6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .7 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.
- .8 Install gypsum board with face side out.
- .9 Do not install damaged or damp boards.
- .10 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:
      - .1 At water resistant backing at ceramic tile locations. Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
      - .2 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.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.6 PROTECTION

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

END OF SECTION 09 21 16

1.0 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C 645- 00, Specification for Nonstructural Steel Framing Members.
  - .2 ASTM C 754- 00 , Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 Green Seal Environmental Standards (GS)
  - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .4 Environmental Choice Program (ECP).
  - .1 CCD-047a - 98, Paints - Surface Coatings.
  - .2 CCD-048- 98, Surface Coatings - Recycled Water-borne.
- .5 Association of Wall and Ceiling Contractors of BC (AWCC)
  - .1 Specification Standards Manual

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 VBBC 2007 Schedule B and C-B and NBC Schedule B1, B2 and C-B as per attached Appendix P in this specification.
  - .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.
- .4 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 50 of construction wastes were recycled or salvaged.

- .2 Recycled Content:
  - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
- .3 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 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.

#### 1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

### 2.0 PRODUCTS

#### 2.1 MATERIALS

- .1 Steel Studs & Steel Stud Furring:
  - .1 Conform to CAN/CGSB-7.1-M86, non-loadbearing; C-shape, hot dipped galvanized steel studs with Z180 (G60) zinc coating to ASTM A525-86, roll formed from ASTM A446/A446M-85, Grade A steel.  
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 A446/A446M-85, Grade A to conform to ASTM C645-83. Zinc coating shall be Z180 (G60) to ASTM A525-86. Steel I-studs, J-tracks, T-splines, L-runners, fasteners shall be of design and 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 to ASTM A525-86, 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 to ASTM A525-86, 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:

<u>Area</u>	<u>Size of Hangers</u>
Up to 1.15m <sup>2</sup>	3.6 mm (9 ga.) diameter galvanized wire.
Up to 1.48 m <sup>2</sup>	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.

<u>Maximum Spacing of Hangers</u>	<u>Maximum Spacing of Main Runners</u>
900mm	1200mm
1000mm	1000mm
1200mm	900mm

- .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.

<u>Maximum 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 Consultant 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 screws crimp method 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 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Extend partitions to ceiling height except where noted otherwise on drawings.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.
- .16 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .17 Install two continuous beads of acoustical sealant insulating strip under studs and tracks around perimeter of sound control partitions.

- .18 Provide clearances and isolation felt to ensure no contact between steel stud system and adjacent metal components to eliminate electrolytic action.

### 3.2 CHASE WALLS

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

### 3.3 SHAFT WALL ERECTION

- .1 At shaft wall partitions, use the methods of assembly as used in the fire test specimen to maintain fire and sound ratings. Coordinate with Section 09 29 00, Gypsum Board.
- .2 Coordinate construction of shaft walls to suit installation of services.

### 3.4 CEILING AND SOFFIT SUSPENSION

- .1 Hangers:
  - .1 Ensure hangers for suspended gypsum board ceilings support independent of walls, columns, pipes, ducts, and are erected plumb and securely anchored to structural frame or imbedded in concrete slabs. Do not use powder actuated fasteners/anchors.
  - .2 Space hangers at 1200mm maximum centers along runner channels and not more than 150mm from boundary walls, interruptions of continuity and change in direction.
  - .3 Provide at least 25mm clearance at walls.
- .2 Runner Channels:
  - .1 Space channels at max. 900mm centers and not more than 150mm from boundary walls, interruptions of continuity and change in direction. Provide clearance of at least 25mm at walls.
  - .2 Run the channels transversely to structural framing members.
  - .3 Where splices are necessary, lap members at least 200mm and wire each end with 2 loops. Avoid clustering or lining up splices.
  - .4 Attach to rod hangers by bending hanger sharply under bottom flange of runner and securely wire in place with a saddle tie.
- .3 Cross Furring:
  - .1 Erect furring channels transversely across runner channels, or other supports.
  - .2 Space furring channels at 400mm centers and not more than 150mm from boundary walls, openings, interruptions in ceiling continuity and change in direction. Provide a clearance of at least 25mm at walls.
  - .3 Secure furring channels to each support with clips or double 1.22 mm (18 ga.) dia. wire ties. Splice joints by nesting and tying channels together.
  - .4 Level furring channels to a maximum tolerance of 1:1000.
- .4 At openings, including ceiling access panels, in ceiling suspension system that interrupts the main carrying channels of furring channels, reinforce grillage with 19mm cold rolled channels, wire tie to top and parallel to main runner channels, extend 19mm channels minimum 300mm past each end of openings.

### 3.5 WALL FURRING

- .1 Place furring channels attached to masonry or concrete surfaces at 400mm o.c. and not more than 100mm from corners and openings.
- .2 Secure flanges to wall with hardened nails, power actuated fasteners or equivalent fastenings.

Maximum spacing 600 mm alternating to opposite flanges.

**3.2 CLEANING**

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

END OF SECTION 09 22 16

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                             |                  |
|----|-----------------------------|------------------|
| .1 | Rough Carpentry             | Section 06 10 00 |
| .2 | Non Structural Metal Frames | Section 09 22 16 |
| .3 | Gypsum Board                | Section 09 29 00 |

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
  - .1 A 641, Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .2 C 28, Specification for Gypsum Plasters.
  - .3 C 35, Specification for Inorganic Aggregates for Use in Gypsum Plaster.
  - .4 C 37, Specification for Gypsum Lath.
  - .5 C 59, Specification for Gypsum Casting and Molding Plaster.
  - .6 C 841, Specification for Installation of Interior Lathing and Furring.
  - .7 C 842, Specification for Application of Interior Gypsum Plaster.
  - .8 C 847, Specification for Metal Lath.
  - .9 C 587, Specification for Gypsum Veneer Plaster.
  - .10 C 1002, Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
  - .11 Gypsum Construction Guide 102171 and Plaster Resource Manual, 110753; National Gypsum Company.

1.3 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data: Manufacturers' specifications and installation instructions for each product specified.
- .3 Submit a 300 mm long sample of the plaster mold to be replicated to Departmental Representative for review.

1.4 QUALITY ASSURANCE

- .1 Mock-Ups:
  - .1 Construct mock up in accordance with Section 01 45 00 Quality Control.
  - .2 Construct mock-up of appropriate 1500mm long plaster mold.
  - .3 Mock-up may be part of finished work if acceptable to Departmental Representative.
  - .4 Qualifications:  
Fabricator: company must have minimum 15 years of experience in fabricating plaster mold or similar gypsum plaster based decorative, completed minimum 5 projects within the last 5 years for producing similar plaster mold, and with sufficient capacity to produce and deliver required units without causing delays.

1.5 DELIVERY, STORAGE, AND 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 SITE CONDITIONS

- .1 Environmental Requirements: Comply with ASTM C 842.

## 2.0 PRODUCTS

- .1 Metal Lath:
  - .1 Diamond Mesh Lath: Expanded metal lath with 6mm (5/16 in) wide diamonds, weighing 1.13kg (2.5 lbs) and 16g/sm (3.4 lbs. per sq. yd), galvanized or painted steel, and complying with ASTM C 847.
  - .2 Self-Furring Lath: Expanded metal lath with 3mm (5/16 in) wide diamonds, weighing 1.13kg (2.5 lbs) and 16g/sm (3.4 lbs per sq. yd), with self-furring dimples to hold the lath 6 mm (1/4 in) away from the substrate, galvanized or painted steel, and complying with ASTM C 847.
  - .3 Rib Lath: Expanded metal with 3mm (1/8 in) deep solid metal ribs at 38 mm(1-1/2 in) o.c., weighing 1.25 kg (2.75 lbs) and 16g/sm (3.4 lbs. per sq. yd), galvanized or painted steel, and complying with ASTM C 847.
  - .4 Rib Lath: Expanded metal with opposed, U shaped, 3.75mm (3/8 in) deep, solid metal ribs at 50 mm(1-15/16 in. o.c); weighing 16g/sm (3.4 lbs. per sq. yd); galvanized or painted steel; and complying with ASTM C 847.
- .2 Gypsum Plaster:
  - Base Plaster: Gypsum neat plaster complying with ASTM C 28.
  - Base Plaster: Gypsum plaster with mill-mixed perlite aggregate complying with ASTM C 28.
  - Finish Plaster: Gypsum gauging plaster complying with ASTM C 28.
  - Finish Plaster: Gypsum moulding plaster complying with ASTM C 59.
  - Finish Plaster: Gypsum plaster for smooth finish complying with ASTM C 587.
  - Finish Plaster: Gypsum plaster for textured finish complying with ASTM C 587.
  - Finish Plaster: Gypsum plaster for smooth finish complying with ASTM C 587.
  - Finish Plaster: Gypsum Plaster for smooth finish with extended set time complying with ASTM C 587.
- .3 Sand: ASTM C 35.
- .4 Water: Potable.

## 2.3 ACCESSORIES

- .1 Expansion Joints: Two piece formed zinc joint with slipped connection for 12.7mm (1/2 in.), 19mm (3/4 in.) and 22mm (7/8 in.) grounds, galvanized.
- .2 Beam Furring Clip: Spring steel wire clip to fit beam flanges from 6mm (1/4 in.) to 25mm (1 in.) thick.
- .3 Tie Wire: Manufacturer's standard soft, annealed steel protected by Class 1 zinc coating and manufactured in accordance with ASTM A 641.
- .4 Fasteners:
  - Nails: As recommended by the manufacturer.
  - Screws: ASTM C 954 or ASTM C 1002 or both with heads, threads, points, and finish as recommended by the manufacturer.

## 2.4 MIXES

- .1 Proportions and Procedures: In accordance with ASTM C 842 and the manufacturer's recommendations.

## 3.0 EXECUTION

### 3.1 INSTALLATION

- .1 In accordance with the following ASTM Standards and manufacturer's recommendations:
  - .1 ASTM Standards:

Metal Lath, Gypsum Lath, and Accessories: C 841.

Gypsum Plaster: C 842.

.1 Manufacturer's Recommendations:

"Gypsum Construction Guide" 102171 and "Plaster Resource Manual," 110753;  
National Gypsum Company.

.2 Tolerances: For flatness of surface, do not exceed 6mm (1/4 in.) in 2440mm (8 ft.) for bow or warp of surface and for plumb and level.

### 3.2 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.

END OF SECTION 09 23 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- |    |                                    |                  |
|----|------------------------------------|------------------|
| .1 | Gypsum Board Assemblies            | Section 09 21 16 |
| .2 | Resilient Flooring for Minor Works | Section 09 65 99 |
| .3 | Tile Carpeting                     | Section 09 68 13 |

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
  - .1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
  - .2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
  - .3 CTI A118.4-92, Specification for Latex Cement Mortar (included in ANSI A108.1).
  - .4 CTI A118.5-92, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).
  - .5 CTI A118.6-92, Specification for Ceramic Tile Grouts (included in ANSI A108.1).
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C 144-04, Specification for Aggregate for Masonry Mortar.
  - .2 ASTM C 207-06, Specification for Hydrated Lime for Masonry Purposes.
  - .3 ASTM C 847-06, Specification for Metal Lath.
  - .4 ASTM C 979-05, Specification for Pigments for Integrally Coloured Concrete.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-M86 (R1988), Vapor Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2 CGSB 71-GP-22M-78 (AMEND.), /Adhesive, Organic, for Installation of Ceramic Wall Tile.
  - .3 CAN/CGSB-75.1-M88, Tile, Ceramic.
  - .4 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .4 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007 LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
  - .2 CAN/CSA-A3000-03(R2006), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .6 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 Terrazzo Tile and Marble Association of Canada (TTMAC)
  - .1 Tile Specification Guide 09 30 00 2009/2010, Tile Installation Manual.
  - .2 Tile Maintenance Guide 2000.



### 1.3 SUBMITTALS

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Include manufacturer's information on:
    - .1 Ceramic tile, marked to show each type, size, and shape required.
    - .2 Chemical resistant mortar and grout (Epoxy and Furan).
    - .3 Cementitious backer unit.
    - .4 Dry-set cement mortar and grout.
    - .5 Divider strip.
    - .6 Elastomeric membrane and bond coat.
    - .7 Reinforcing tape.
    - .8 Levelling compound.
    - .9 Latex cement mortar and grout.
    - .10 Commercial cement grout.
    - .11 Organic adhesive.
    - .12 Slip resistant tile.
    - .13 Waterproofing isolation membrane.
    - .14 Fasteners.
- .2 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Base tile: submit duplicate, full size sample of each colour, texture, size, and pattern of tile.
  - .2 Floor tile: submit duplicate, full size sample of each colour, texture, size, and pattern of tile.
  - .3 Granite tile: duplicate, full size sample of each colour, texture, size, and pattern of tile.
  - .4 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
  - .5 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.
- .3 Sustainable Design Submittals:
  - .1 LEED Canada-Commercial Interiors Version 1.0-2007

### 1.4 QUALITY ASSURANCE

- .1 Quality Assurance Submittals:
  - .1 Manufacturer's Instructions: manufacturer's installation instructions.

### 1.5 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

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

### 1.7 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

- .2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

## 1.8 MAINTENANCE

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
  - .3 Maintenance material same production run as installed material.

## 2.0 PRODUCTS

### 2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

### 2.2 FLOOR TILE

- .1 Porcelain tile: to CAN/CGSB-75.1, Type 4, Class MR1 (02 -3.0%), V2 or less variation.  
PRT-1  
Size: 300mm x 600mm x 10mm
  - .2 Water Absorption: Conform to ISO 10545-3,  $\leq 0.5\%$ .
  - .3 Deep Abrasion Resistance: Conform to ISO 10545-6,  $\leq 175\text{N/mm}^3$
  - .4 Chemical Resistance: ISO 10545-13,  $\geq \text{UB}$
  - .5 Frost Resistance: ISO 10545-12, no damage/100 cycles.
  - .6 Colour & Pattern: Refer to Interior Finish Material and Colour Schedule.
- .2 PRT-2
  - .1 Size: 300mm x 600mm x 10mm.
  - .2 Chemical Resistance: Yes to household chemicals.
  - .3 Friction Coefficient: Wet  $\geq 0.60$ , Dry  $\geq 0.60$
  - .4 Frost Resistance: Yes
  - .5 Recycled Content: 4.5% pre-consumer content.
  - .6 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.
- .3 PRT-3
  - .1 Size: 150mm x 600mm x 10mm.
  - .2 Chemical Resistance: Yes to household chemicals.
  - .3 Friction Coefficient: Wet  $\geq 0.60$ , Dry  $\geq 0.60$
  - .4 Frost Resistance: Yes

- .5 Recycled Content: 4.5% pre-consumer content.
- .6 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.

### 2.3 WALL TILE

- .1 Ceramic tile: to CAN/CGSB-75.1, Type 5, Class MR 4, V2 or less variation.
  - .1 CT-1
    - .1 Size 305 mm x 200 mm x 8mm
    - .2 PEI: 3
    - .3 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.
  - .2 CT-2
    - .1 Size 200 mm x 50 mm x 8mm
    - .2 PEI: 3
    - .3 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.
  - .3 CT-3
    - .1 Size: 50 mm x 405 mm
    - .2 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.
  - .4 CT-4, CT-5, CT-6 & CT-7
    - .1 Size: 200 mm x 510 mm x 10 mm
    - .2 Chemical Resistance: Yes to household chemicals.
    - .3 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.
  - .5 CT-8
    - .1 Size: 152 mm x 305 mm x 8 mm
    - .2 Surface & Edge: Glossy, round finished edges.
    - .3 Type: Glass
    - .4 Colour & Pattern: refer to Interior Finish Material and Colour Schedule.

### 2.4 GRANITE FLOOR SLAB & CLADDING

- .1 Granite floor slab and cladding shall match existing sawn/sliced grey Nelson Island solid black granite in colour, size and texture, to approved sample as submitted.

### 2.5 MORTAR AND ADHESIVE MATERIALS

- .1 Cement: to CSA-A5, type 10.
- .2 Sand: to ASTM C 144, passing 16 mesh.
- .3 Hydrated lime: to ASTM C 207, in accordance with TTMAC Installation Manual.
- .4 Latex additive: formulated for use in cement mortar and thin set bond coat.
- .5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.
- .6 Adhesives:
  - .1 Maximum VOC limit 65 g/L to SCAQMD Rule 1168.

### 2.6 BOND COAT

- .1 In accordance with TTMAC Installation Manual.

### 2.7 GROUT

- .1 Colouring Pigments:
  - .1 Pure mineral pigments, lime-proof and non-fading, complying with ASTM C 979.

- .2 Colouring pigments to be added to grout by manufacturer.
- .3 Job coloured grout are not acceptable.
- .4 All grouts: Colour as selected by Departmental Representative (premium grades).
- .2 Cement Grout: to ANSI A108.1.
  - .1 Use one part white cement to one part white sand passing a number 30 screen.
- .3 Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, sanded mix for floors, unsanded mix for walls and floors with polished tiles commercial tile grout.
- .4 All grout: Colour as selected by Departmental Representative (premium grade).

## 2.8 ACCESSORIES

- .1 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.
- .2 Divider strips: between tile and carpet flooring: 5mm thick stainless steel, depth to suit.
- .3 Transition Strips: purpose made metal extrusion; zinc type.
- .4 Reducer Strips: purpose made metal extrusion; zinc type; maximum slope of 1:2.
- .5 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.
- .6 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .7 Floor sealer and protective coating: to tile and grout manufacturers' recommendations.
- .8 Edge Protection: For all exterior corners of tile surfaces. L-shaped profile with 3.2 mm wide top section and vertical section forming visible surface, integrated. Trapezoid-perforated anchoring leg and an 87° sloped vertical wall protection, material to be aluminum, in anodized or color-coated finish. Allow for 4 colours from manufacturers standard options width to suit thickness.

## 2.9 MIXES

- .1 Cement:
  - .1 Scratch coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, and latex additive where required. Adjust water volume depending on water content of sand.
  - .2 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.
  - .3 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
  - .4 Mortar bed for walls and ceilings: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand.
  - .5 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
  - .6 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.
  - .7 Measure mortar ingredients by volume.

- .2 Dry set mortar: mix to manufacturer's instructions.
- .3 Organic adhesive: pre-mixed.
  - .1 Adhesives: maximum VOC limit to SCAQMD Rule 1168.
- .4 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .5 Adjust water volumes to suit water content of sand.

#### 2.10 PATCHING AND LEVELLING COMPOUND

- .1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
  - .1 Compressive strength - 25 MPa.
  - .2 Tensile strength - 7 MPa.
  - .3 Flexural strength - 7 MPa.
  - .4 Density - 1.9.
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 48 hours after application.

#### 2.11 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

### 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 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2009/2010, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.

- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Make internal angles square, external angles rounded.
- .9 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .10 Install divider strips at junction of tile flooring and dissimilar materials.
- .11 Allow minimum 24 hours after installation of tiles, before grouting.
- .12 Clean installed tile surfaces after installation and grouting cured.

**3.3 WALL TILE**

- .1 Install in accordance with TTMAC detail, for suitable substrates and applicable conditions.

**3.4 FLOOR TILE**

- .1 Install in accordance with TTMAC details for suitable substrates and applicable conditions.

**3.5 BASE TILE**

- .1 Install in accordance with TTMAC detail for suitable substrates and applicable conditions.

**3.6 FLOOR SEALER AND PROTECTIVE COATING**

- .1 Apply in accordance with manufacturer's instructions.

**3.7 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.8 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Gypsum Board Assemblies Section 09 21 16.

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C 635/C 635M- 07, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
  - .2 ASTM C 636/C 636M- 08, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  - .3 ASTM E 1477- 98a (2008), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI 1.0 -2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-92.1- M89, Sound Absorptive Prefabricated Acoustical Units.
- .4 Green Seal Environmental Standards (GS)
  - .1 GS-11- 2008, 2nd Edition, Paints and Coatings.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113- A2007, Architectural Coatings.
- .7 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102- 2007, Standard Method of Test for 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 ceiling panels and ceiling suspension system and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- 3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada. The Engineer shall submit Letters of Assurance of VBBL 2007 and NBC Schedule B1, B2 and C-B as per attached Appendix P in this specification along with sealed shop drawings and Schedule B and C-B and NBC Schedule B1, B2 and C-B as per attached Appendix P in this specification on completion of the work.

- .2 Submit reflected ceiling plans for special grid patterns as indicated.
- .3 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, change in level details, and acoustical unit support at ceiling fixture lateral bracing and accessories .
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate full size samples of each type of acoustical units.
- .5 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit calculations on end-of-project recycling rates salvage rates, and landfill rates per Construction Waste Management Plan.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .3 Regional Materials: submit evidence that project incorporates required percentage 10 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .4 Low-Emitting Materials:
    - .1 Submit listing of touch-up paints used in building, comply with VOC and chemical component limits or restriction requirements.

#### 1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.
- .3 Extra materials to be from same production run as installed materials.
- .4 Clearly identify each type of acoustic unit, including colour and texture.
- .5 Deliver to Departmental Representative, upon completion of the work of this section.
- .6 Store where directed by Departmental Representative.
- .7 Operation and Maintenance Data: submit operation and maintenance data for ceiling materials installed in the work for incorporation into manual.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.



- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store materials inside, level, under cover. Protect from weather, damage from construction operations and other causes, in accordance with manufacturer's printed instructions.
  - .3 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.
  - .4 Store and protect acoustic ceiling materials from nicks, scratches, and blemishes.
  - .5 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## 2.0 PRODUCTS

### 2.1 INTERIOR FINISH MATERIAL & COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and may list specific manufacturer's related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

### 2.2 COMPONENTS

- .1 Acoustic units for suspended ceiling system: to CAN/CGSB-92.1.
  - .1 ASTM E1264 Classification: Type III, Form 2.
  - .2 Pattern CE, Fire Class A.
  - .3 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
  - .4 Smoke development Classification 50 or less in accordance with CAN/ULC-S102.
  - .5 Noise Reduction Coefficient (NRC) designation of 0.70 to ASTM C423.
  - .6 Light Reflectance (LR) range of 0.85 to ASTM E 1477.
  - .7 CAC Rating: 35.
  - .8 Edge type: Angled, tegular, 9.4 mm (15/16")
  - .9 Colour: White.
  - .10 Size: 610 mm x 1220 mm x19 mm
  - .11 Shape: flat.
  - .12 VOC Formaldehyde: No Added.
  - .13 Warranty: Minimum 30 year performance guarantee.
  - .14 Refer to Interior Finish Material and Colour Schedule.
- .2 Acoustical Suspension:
  - .1 Intermediate duty system to ASTM C 635.

- .2 Basic materials for suspension system: commercial quality cold rolled steel, zinc coated.
  - .3 Suspension system: non fire rated, two directional exposed tee bar grid.
  - .4 Exposed tee bar grid components: shop painted satin sheen, white colour. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
  - .5 Hanger wire: galvanized soft annealed steel wire, 3.6 mm diameter for access tile ceilings.
  - .6 Hanger inserts: purpose made.
  - .7 Carrying channels: of size, thickness and weight to carry spans; painted galvanized steel. Where spans exceed 1200mm use channels of adequate strength.
  - .8 Accessories: splices, clips, wire ties, retainers and wall moulding flush reveal, to complement suspension system components, as recommended by system manufacturer.
  - .9 ULC-approved hold-down clips where noted and required.
- .3 Performance/Design Criteria:
- .1 Maximum deflection: 1/360th of span to ASTM C 635 deflection test.

### 2.3 ACCESSORIES

- .1 Touch-up paint : in accordance with manufacturer's recommendations for surface conditions:
- .1 Paint: VOC limit 250 g/L maximum to and GS-11 and SCAQMD Rule 1113.

### 3.0 EXECUTION

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions prior to acoustical ceiling installation.
  - .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 Installation: in accordance with ASTM C 636 except where specified otherwise.
- .2 Suspension System:
  - .1 Erect ceiling suspension system after work above ceiling has been inspected by Departmental Representative
  - .2 Secure hangers to overhead structure using attachment methods as indicated acceptable to Departmental Representative.
  - .3 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
  - .4 Lay out system according to reflected ceiling plan. Where not indicated, layout centerline of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width
  - .5 Install wall moulding to provide correct ceiling height.
  - .6 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers grilles and speakers.
  - .7 Support at light fixtures diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
  - .8 Interlock cross member to main runner to provide rigid assembly.

- .9 Ensure finished ceiling system is square with adjoining walls and level within 1:1000.
- .3 Acoustic Panels:
  - .1 Install acoustical panels and tiles in ceiling suspension system.
  - .2 Co-ordinate ceiling work with work of other sections such as interior lighting, fire protection communication, and intrusion and detection systems.

### 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 reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.4 PROTECTION

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

END OF SECTION 09 51 99

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Gypsum Board Assemblies Section 09 21 16
- .2 Tile Carpeting Section 09 68 13

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C 501-84 (2009), Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by Taber Abraser.
  - .2 ASTM D 2047-04, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
  - .3 ASTM F 1066-04, Standard Specification for Vinyl Composition Floor Tile.
  - .4 ASTM F 1303-04 (2009), Standard Specification for Sheet Vinyl Floor Covering with Backing.
  - .5 ASTM F 1344-10, Standard Specification for Rubber Floor Tile.
  - .6 ASTM F 1861, Standard Specification for Resilient Wall Base.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI 1.0 -2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .4 National Floor Covering Association (NFCA) Specification Manual.

### 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 flooring, adhesive, primer, sealer, and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements, Section 01 35 43 - Environmental Procedures.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate 300 x 300 mm sample pieces of sheet material.
  - .4 Submit duplicate full size samples of each type of tile.
  - .5 Submit 300 mm long base and edge strips.
- .4 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.

- .2 Recycled Content:
  - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
- .3 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
- .4 Low-Emitting Materials:
  - .1 Submit listing of adhesives primers used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### 1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for resilient flooring for incorporation into manual.
- .3 Extra Materials.
  - .1 Provide 10% extra materials of each colour, pattern, and type flooring materials required for project maintenance use.
  - .2 Extra material to be in the same container and from same production run as installed materials.
  - .3 Clearly identify each container of tile flooring and each container of adhesive.
  - .4 Deliver to Departmental Representative upon completion of the work of this Section.
  - .5 Store where directed by Departmental Representative.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect resilient flooring 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.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.6 SITE CONDITIONS

- .1 Ensure high ventilation rate, with maximum outside air, during installation.

- .1 Vent directly to outside.
- .2 Do not let contaminated air recirculate through a district or whole building air distribution system.
- .3 Maintain extra ventilation for 1 month minimum after building occupation.

## 2.0 PRODUCTS

### 2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

### 2.2 RESILIENT TILE FLOORING MATERIALS

- .1 Solid Vinyl Tile; to ASTM F1700
  - .1 **VT-1**
    - .1 Category: Luxury Vinyl Tile (LVT) to ASTM F1700 Class III (Printed Film), Type B-Embossed Surface
    - .2 Minimum Binder Content: 90% clear wear layer, 34% intermediate coloured layer, 34% each base layer.
    - .3 Form: Plank 152.4 mm W x 1219.2 mm L
    - .4 Gauge: 3.2mm overall (nominal), 0.5 mm wear layer (nominal)
    - .5 Fire Test Data: ASTM E648, Class I- 0.45 or more watts/cm<sup>2</sup>, ASTM E662, Smoke Developed: 450 or less.
    - .6 Static Load Limit: ASTM F970 (modified), 250 psi (17.6kg/cm<sup>2</sup>)
    - .7 Light Relativity: 10-14%
    - .8 Wood Look Pattern, refer to Interior Finish Material and Colour Schedule
  - .2 **VT- 3**
    - .1 Category: Conductive/Static Dissipative vinyl tile to ASTM F1700, Class I (monolithic) Type A-smooth surface.
    - .2 Minimum Binder Content: 34% each ply or layer
    - .3 Size: 615 mm x 615 mm
    - .4 Gauge: 2.0 mm
    - .5 Fire Test Data: ASTM E648, Class I, ASTM E662, Smoke Developed 450 or less.
    - .6 Static Load Limit: ASTM F970, 250 psi (1500 lb/in<sup>2</sup>)
    - .7 Slip Resistance: ASTM D2047, 0.6 for flat surface
    - .8 Electrical Resistance: ASTM F150, 1x10<sup>6</sup> - 10<sup>8</sup> ohms surface to ground
    - .9 Recycled Content: 51% pre- consumer
    - .10 Non-directional Pattern, refer to Interior Finish Material and Colour Schedule

- .2 Vinyl Composition Tile; to ASTM F1066
  - .1 **VT- 2**
    - .1 Category: Non-asbestos formulated commercial vinyl composite tile to ASTM F1066 Class 2 (through pattern)
    - .2 Size: 305mm x 305mm
    - .3 Gauge: 3.2mm
    - .4 Fire Test Data: ASTM E648, Class I, ASTM E662, Smoke Developed 450 or less.
    - .5 Static Load Limit: ASTM F970, 125 psi (8.79kg/cm<sup>2</sup>)
    - .6 Recycled Content: 10% post-consumer
    - .7 Floor Score Indoor Air Quality: SCS certified
    - .8 NSF/ANSI -332 Certification: Gold

### 2.3 ACCESSORIES

- .1 Resilient base (**VB**): to ASTM F1861, type TV, Group 1, continuous, top set, complete with premoulded end stops and external corners, toeless for carpeted area, toe for other areas:
  - .1 Type: vinyl, 2.0 mm thick.
  - .2 Style: cove.
  - .3 Height: 101.6 mm.
  - .4 Lengths: cut lengths minimum 2400 mm.
  - .5 Colour: Refer to Interior Finish Material and Colour Schedule.
- .2 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
  - .1 Adhesives: VOC limit 50 g/L maximum to SCAQMD Rule 1168.
  - .2 Primer: in accordance with manufacturer's recommendations for surface conditions:
    - .1 VOC limit: 100 g/L maximum to SCAQMD Rule 1113
- .3 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.
- .4 Metal edge strips: extruded aluminum, smooth, mill finish, stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .5 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.
  - .1 Coating: VOC limit 50 g/L maximum to SCAQMD Rule 1113.

### 3.0 EXECUTION

#### 3.1 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section, co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

### 3.2 PREPARATION

- .1 Prepare for installation in accordance with manufacturer's written recommendations.
- .2 Remove sub-floor ridges and bumps and fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface.
  - .1 Prohibit traffic until filler is completely cured and dry.
- .4 Seal concrete slab as recommended by resilient flooring manufacturer's written instructions.
- .5 For existing Terrazzo flooring, properly cleanse substrate using degreasing solution. Grind any highly polished or irregular surfaces. Fill any low spots, holes, chips and seams that may telegraph through the new flooring. Test for porosity and use the appropriate adhesive application method. Perform bond tests prior to all installations.

### 3.3 BOND TEST

- .1 Using the flooring and adhesive suitable for the subfloor, install a 610 x 610mm (2' x 2') section following the recommended installation procedures select areas next to walls, columns, or other light traffic areas. Tape the perimeter with duct tape to prevent edge drying of the adhesive. After 48 hours, the adhesive should be dry and the flooring should be difficult to remove.

### 3.4 APPLICATION - FLOORING

- .1 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .2 Resilient tile flooring:
  - .1 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern.
  - .2 Border tiles: half tile width minimum.
  - .3 Install flooring to square grid pattern with joints aligned.
- .3 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.
- .4 Cut flooring neatly around fixed objects.
- .5 Continue flooring over areas which will be under built-in furniture.
- .6 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .7 Terminate resilient flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .8 Install metal edge strips at unprotected or exposed edges where flooring terminates.

### 3.5 APPLICATION - BASE

- .1 Lay out base to keep number of joints at minimum.
- .2 Clean substrate and prime with one coat of adhesive.



- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.
- .7 Cope internal corners using pre-moulded corner units for right angle external corners and formed straight base material for external corners of other angles.
- .8 Use toeless type base where floor finish will be carpet, coved type elsewhere.
- .9 Install toeless type base before installation of carpet on floors.

### 3.6 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.
  - .1 Remove excess adhesive from floor, base and wall surfaces without damage.
  - .2 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect new floors in accordance with manufacturer's printed instructions.
- .3 Repair damage to adjacent materials caused by resilient flooring installation.

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |                                    |                  |
|----|------------------------------------|------------------|
| .1 | Cast-In-Place-Concrete             | Section 03 30 00 |
| .2 | Ceramic Tiling                     | Section 09 30 13 |
| .3 | Resilient Flooring for Minor Works | Section 09 65 99 |
| .4 | Tile Carpeting                     | Section 09 68 13 |

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C 241- 90 (R2005), Standard Method for Abrasion Resistance of Stone Subject to Foot Traffic.
  - .2 ASTM D 2370- 98 (R2002), Standard Test Method for Tensile Properties of Organic Coatings.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI 1.0 -2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System and Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34- M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2 CAN/CGSB-25.20- 95, Surface Sealer for Floors.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2- 04, Concrete Materials and Methods of Concrete Construction/ Methods of Test for Concrete.
  - .2 CAN/CSA-A3000- 03 (R2006), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .3 CSA G30.5- M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168- 05, Adhesives and Sealants Applications.
- .7 Terrazzo, Tile and Marble Association of Canada (TTMAC)
  - .1 Maintenance Guide.
  - .2 TTMAC/CSCTEK-AID 09 40 00, Portland Cement Terrazzo Digest.
  - .3 TTMAC standard 3001.
  - .4 TTMAC/CSC Architectural Specification Study on Terrazzo (Portland Cement).

### 1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide Sustainable Submittals:
  - .1 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.

- .3 Sustainable Design Submittals:
  - .1 LEED Canada CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.
- .4 Submit proof of manufacturer's ISO 9001 registration and compliance to Departmental Representative.
- .5 Submit proof of manufacturer's ISO 14001 registration and compliance to Departmental Representative.
- .6 Provide product data in accordance with Section 01 33 00 - Submittal Procedures, supplemented as follows:
  - .1 Submit four copies of TTMAC Maintenance Guide for inclusion in operations and maintenance manual prepared and submitted in Section 01 78 00 Closeout Submittals. Provide specific warning of maintenance practices or materials that may damage or disfigure finished work.
  - .2 Submit product data and WHMIS MSDS sheets for floor sealer products.
- .7 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Indicate layout of divider strips, and expansion joints.
- .8 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit duplicate 300 x 300 x 20 mm thick samples of each color terrazzo.
  - .2 Manufacturer's Field Reports: manufacturer's field reports specified.
- .9 Closeout Submittals:
  - .1 Provide maintenance data as set out in TTMAC publication for terrazzo work for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: trained and experienced in tile work. Company must be registered as members in good standing with Terrazzo, Tile and Marble Association of Canada. If requested by, Departmental Representative. Submit listing of at least three previously completed projects of similar size and scope.
- .2 Supplier: a member in good standing with Terrazzo, Tile and Marble Association of Canada, providing materials meeting the minimum standards of TTMAC.
- .3 Mock-ups: construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .1 Provide mock-up for evaluation of surface finishes and workmanship.
  - .2 Construct mock-up 10 m<sup>2</sup> of each type of Portland cement terrazzo including one inside corner, one outside corner and change of material.
  - .3 Construct mock-up where directed.
  - .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.
  - .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
  - .6 Sustainable Requirements:
    - .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:
  - .1 Deliver materials to job site just prior to installation.
  - .2 Store materials inside, in dry location, protected from freezing, staining and damage, away from heavy traffic areas.
  - .3 Deliver and store materials in manner to prevent damage.
  - .4 Ensure materials remain in original wrapping and containers until used.
  - .5 Store cementitious materials on a dry surface.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
- .2 Ventilation:
  - .1 Provide continuously during and after installation. Run system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of installation.
  - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Temperature:
  - .1 Maintain air temperature and structural base temperature at terrazzo installation area above 12 degrees C for 24 hours prior to, during, and for 24 hours following installation.

**2.0 PRODUCTS**

**2.1 COMPONENTS**

- .1 Cement:
  - .1 To CAN/CSA-A3000.
  - .2 Type 10, grey for underbed.
  - .3 White for topping.
  - .4 6 % air-entrainment.
- .2 Sand, fine and coarse aggregates:
  - .1 To CSA-A23.1/A23.2
  - .2 Clean, washed, locally available.
  - .3 Oval aggregate.
- .3 Water: potable.
- .4 Marble chips:
  - .1 Graded in accordance with TTMAC standard.
  - .2 Abrasion resistance to ASTM C 241.
  - .3 No deleterious or foreign matter.
    - .1 Recycled Content: 20 % post-consumer content, 50 % post-industrial content.
- .5 Pigments:
  - .1 Compatible with Portland cement.
  - .2 Alkali-resistant, colour-stable.
  - .3 Lime-proof mineral.
- .6 Epoxy bonding agent: two components, epoxy resin and epoxy hardener conforming to following performance properties after cure schedule of 28 days at 25 degrees C.
  - .1 Viscosity: mixed viscosity not less than 0.04 Pa.s or more than 0.5 Pa.s.

- .2 Gel time: not less than half hour at 20 degrees C.
- .3 Flexibility: Gardiner flexibility test, passes bending over 12 mm mandrel, without cracking.
- .4 Elongation: ASTM D 2370, minimum 10%.
- .5 Bond strength: 2 MPa, with 100% concrete failure at minimum coverage, test concrete specimen minimum compressive strength 20 MPa.
- .6 Coverage: 0.3 L/m<sup>2</sup> minimum, dry film thickness not less than 0.2 mm.
- .7 Divider strips: 5 mm thick Aluminum in bronze colour, with depth of 40mm to match existing.
- .8 Accessories: base caps and base divider strips, separator strips, purpose made and of same material to match divider strips.
- .9 Reinforcing steel: billet steel, grade 300 plain deformed bars.
- .10 Welded steel wire fabric: to 50 x 50 x 1.6 x 1.6 mm wire, galvanized, in flat sheets only.
- .11 Slip sheet: polyethylene sheet to CAN/CGSB-51.34, Type 2, 0.05 mm thick.
- .12 Non-slip aggregate: aluminum oxide of size and colour to match marble chips.
- .13 Non-slip inserts: zinc brass 10 x 10 x 0.8 mm thick, dove-tail shaped channels, with anchors.
- .14 Non-slip material for inserts: fine aluminum oxide and cement epoxy mixture in selected colours.
- .15 Curing compound: to manufacturers standard.
- .16 Cleaning compound: to TTMAC standard 1001,1002,1003,1004.
- .17 Sealants:
  - .1 To CAN/CGSB-25.20.
  - .2 Sealants:
    - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .18 Finishing compound: to TTMAC standard 3001.
  - .1 Sealant:

## 2.2 MIXES

- .1 Slurry coat: cement and water mixed to creamy paste.
- .2 Underbed: 1 part cement to 4 parts sand by volume.
- .3 Terrazzo topping: to match existing Terrazzo flooring 100 kg chips to 40 kg cement mixed dry, colours and chip size to match existing.

## 3.0 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTION

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

### 3.2 WORKMANSHIP

- .1 Do terrazzo work in accordance with TTMAC/CSC Architectural Specification Study on Terrazzo (Portland Cement) except where specified otherwise.

### 3.3 INSPECTION

- .1 Examine and repair any existing defects or cracks in existing area to receive terrazzo which may affect proper execution of terrazzo work.
- .2 Ensure tolerances of concrete slab work do not deviate from tolerance set for finished terrazzo floor.
- .3 Terrazzo contractor to start work only when all defects are corrected.

### 3.4 INSTALLATION

- .1 Install terrazzo after concrete slabs have cured 28 days.
- .2 Install divider strips true and level to detailed pattern.
- .3 Install non-slip channel inserts aggregate on ramps and stairs where indicated.
- .4 Apply non-slip aggregate at rate of 1.25 kg/m<sup>2</sup> to designated surfaces.
- .5 Install covers at building expansion joints.
- .6 Install control joints above control joints in subfloor.
- .7 Provide mat recesses with frames made up using divider strips.
- .8 Produce terrazzo finished surfaces to match existing.
- .9 Floors:
  - .1 Monolithic terrazzo: provide 40 mm minimum terrazzo topping bonded to concrete base slab.
  - .2 Bonded terrazzo: to TTMAC detail No. 1.
  - .3 Floating standard terrazzo: to TTMAC detail No. 2.
  - .4 Venetian terrazzo: to TTMAC detail No. 2V.
  - .5 Epoxy bonded terrazzo: provide 16 mm maximum topping and epoxy concrete adhesive underbed bonded to concrete base slab.

### 3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### 3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Clean, seal and finish terrazzo surfaces to TTMAC recommendations.

1.0 GENERAL

1.1 RELATED WORK

- |    |                        |                  |
|----|------------------------|------------------|
| .1 | Cast-in-Place Concrete | Section 03 30 00 |
| .2 | Ceramic Tiling         | Section 09 30 13 |

1.2 REFERENCE

- |    |               |  |
|----|---------------|--|
| .1 | ASTM C109-08  | Compressive Strength of Hydraulic Cement Mortars.  |
| .2 | ASTM D2047-04 | Static Coefficient of Friction of Polish Coated Floor Surfaces as Measured by the James Machine. |
| .3 | ASTM E648-10  | Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.              |
| .4 | MIL D 3134J   | Deck Covering Materials.   |

1.3 SUBMITTALS

- |    |   |
|----|---|
| .1 | In accordance with Section 01 33 00, Submittal Procedures.  |
| .2 | Provide Sustainable Submittals:   |
| .1 | Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.                          |
| .3 | Sustainable Design Submittals:  |
| .1 | LEED Canada CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.   |
| .4 | Flooring Manufacturer's Literature and Data: Printed installation instructions for conditions indicated.  |
| .5 | Certificates: Indicating materials conform to specified requirements. Indicating flooring manufacturer's approval of underlayment, adhesive and cleaners. |
| .6 | Samples: Terrazzo Tile, 150mm square (each color and pattern to be used).   |

1.4 QUALITY ASSURANCE

- |    |  |
|----|--|
| .1 | Installer has technical qualifications, experience, trained personnel and facilities to install specified items. Approval will not be given, however, where experience record is one of unsatisfactory performance.  |
| .2 | Manufacturer's product submitted has been in satisfactory and efficient operation on three installations similar or equivalent to this project for three years. Submit list of installations. List shall include name of project, and owner and location of project. |

1.5 DELIVERY

- |    |   |
|----|---|
| .1 | Deliver materials to job in manufacturer's original unopened containers, free of damage, with manufacturer's brand name marked thereon. |
|----|---|

**1.6 STORAGE**

- .1 Store materials in a protected area. Storage area shall be kept dry and temperature of storage area shall not be lower than 10 degrees C (50 degrees F) or higher than 32 degrees C (90 degrees F).

**1.7 PROJECT CONDITIONS**

- .1 Tiles shall not be installed until all other work that could cause damage to the finish flooring has been completed. Maintain a temperature of not less than 21 degrees C (70 degrees F) in spaces where tile is to be installed for at least 48 hours before, during and after the laying of tiles. Bring tile into such spaces and allow it to condition at not less than 21 degrees C (70 degrees F) at least 48 hours before installing. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter.

**1.8 WARRANTY**

- .1 Extend warranty period to 2 years from date of substantial completion.

**2.0 PRODUCTS**

**2.1 TERRAZZO TILE**

- .1 Terrazzo tile shall consist of marble/granite minimum 25mm chips embedded in a flexible thermo-set resin matrix. Tiles shall be minimum 25 mm thick, custom sizes to match tile pattern as shown on drawing. colour and chip size to match existing white colour terrazzo flooring. Slab shall have a smooth polished finish with uniform color distribution of chips. Marble chips shall be graded to 6mm maximum size. Granite chips shall be manufacturer's standard gradation. Tile shall have the following properties.

TABLE I - MARBLE TERRAZZO TILE		
PROPERTY	TEST METHOD	VALUE
Compressive strength Water absorption Hardness	ASTM 109 Mil.Spec.MIL-D-3134 Barcol Hardness	51.7 Mpa (7500 psi) minimum 0.4 percent maximum Resin 78, Marble at 25 degrees C 55-85
Coefficient of Friction Flame Resistance	ASTM D2047 ASTM E645	0.70 0.45 watt/cm square minimum

TABLE II GRANITE TERRAZZO TILE		
Compressive strength Water absorption Hardness at 25 degrees C	ASTM C109 Mil. Spec. MIL-D-3134 Barcol Hardness	35.8 MPa (5,200 psi) 0.4 percent maximum Resin 70, 55-85
Coefficient of Friction Flame Resistance minimum//	ASTM D2047 ASTM E648	0.70 0.45 watt/cm square



**2.2 ADHESIVE**

- .1 Shall be terrazzo tile manufacturer's standard product or a product recommended by the terrazzo tile manufacturer.

**2.4 METAL DIVIDING STRIPS**

- .1 Extruded aluminum, butt-type, approximately 6 mm wide with depth to set top surface flush with top of tile and with bevel at exposed edge. Edge strips shall have countersunk holes, near each end and spaced at no more than 300 mm (8 inches) on center for securement.

**3.0 EXECUTION**

**3.1 GENERAL**

- .1 Provide flooring on floor surfaces where shown on the drawings.

**3.2 SUBSTRATE PREPARATION**

- .1 concrete floors (new construction): fill holes and cracks with approved mortar. Concrete floors shall be free of curing compounds, grease, dirt, loose particles and other foreign matter that would prevent adhesion. Remove projecting irregularities by chipping or grinding smooth. Fill depressions and level uneven surfaces with underlayment. Then rinse subfloors and allow them to dry thoroughly before applying adhesive.

**3.3 MOISTURE TEST**

- .1 After concrete floor surfaces have been cleaned spread small patches of adhesive to be used, in several locations in each room and allow to dry overnight. If the adhesive can be peeled easily from the floor surfaces, the floor is not sufficiently dry. The test shall be repeated until the adhesive adheres properly. Lay tile flooring when the adhesive adheres tightly to the subfloor.

**3.4 INSTALLATION**

- .1 Install tile in accordance with the tile manufacturer's approved installation instructions, except as specified herein. Lay design symmetrical about center lines of rooms. Joints shall be tight, and inconspicuous as possible, and in true alignment. Cut tile to fit snugly at pipes and other fixed vertical surfaces. Seal joints at pipes with adhesive. Remove spots or smears of adhesive immediately. Make entire surfaces of finished tile floors smooth, straight, and free from bleeding adhesive, buckles, waves or projecting tile edges upon completion. Remove any surface film on back of base due to mold release agents as recommended by base manufacturer, before applying base adhesive.
  - 1. Install metal dividing and transition strips as shown on drawing.
  - 2. Bleeding of adhesive on finished floors is considered cause for rejection. Replace damaged tiles.
- .2 Metal Edge Strips: Secure strips with No. 10 aluminum alloy, counter sunk flathead machine screws with expansion sleeves. Provide metal edge strips, in one piece, at any exposed edges of tile.
- .3 Transition Strips: Apply transition strips with adhesive continuous, between granite tile finish floors and terrazzo tile floors.

**3.5 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and

periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Clean, seal and finish terrazzo surfaces to TTMAC recommendations.

END OF SECTION 09 66 16

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |                                    |                  |
|----|------------------------------------|------------------|
| .1 | Ceramic Tiling                     | Section 09 30 13 |
| .2 | Resilient Flooring for Minor Works | Section 09 65 99 |

### 1.2 REFERENCES

- .1 American Association of Textile Chemists and Colorists (AATCC)
  - .1 AATCC Test Method 16- 2004, Colorfastness to Light.
  - .2 AATCC Test Method 23- 2005, Colorfastness to Burn Gas Fumes.
  - .3 AATCC Test Method 129- 2005, Colourfastness to Ozone in the Atmosphere Under High Humidities.
  - .4 AATCC Test Method 134- 2006, Electrostatic Propensity of Carpets.
  - .5 AATCC Test Method 171- 2005, Carpets: Cleaning of; Hot Water Extraction Method.
  - .6 AATCC Test Method 175- 2008, Stain Resistance: Pile Floor Coverings.
  - .7 AATCC Test Method 189- 2007, Fluorine Content of Carpet Fibers.
- .2 ASTM International
  - .1 ASTM D 297- 93 (2006), Standard Test Methods for Rubber Products-Chemical Analysis.
  - .2 ASTM D 1335- 05, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
  - .3 ASTM D 2661- 08, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
  - .4 ASTM D 1667- 05, Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
  - .5 ASTM D 3574- 08, Standard Test Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams.
  - .6 ASTM D 3936- 05, Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
- .3 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-4.2 No. 22- 2004, Textile Test Methods - Colourfastness to Rubbing (Crocking).
  - .2 CAN/CGSB-4.2 No.27.6M- 2004, Textile Test Methods - Flame Resistance - Methemine Tablet Test for Textile Floor Coverings.
  - .3 CAN/CGSB-4.2 No. 76- 94 /ISO 2551: 1981 , Textile Test Methods - Machine-Made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions.
  - .4 CAN/CGSB-4.2 No.77.1- 94 /ISO 4919: 2000, Textile Test Methods - Carpets - Determination of Tuft Withdrawal Force.
  - .5 CAN/CGSB-4.129- 93 (R1997), Carpets for Commercial Use.
- .5 Carpet and Rug Institute (CRI)
  - .1 CRI Carpet Installation Standard 2009.
  - .2 CRI Green Label Indoor Air Quality Testing Program.
  - .3 CRI Green Label Plus Indoor Air Quality Testing Program.

- .6 Environmental Choice Program (ECP)
  - .1 CCD-152- 2009, Flooring Products, Commercial Non-modular Textile Flooring.
- .7 Health Canada
  - .1 C.R.C., c.923- 10, Hazardous Products Act - Carpet Regulations, Part II of Schedule 1.
- .8 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .9 National Floor Covering Association (NFCA)
  - .1 National Floor Covering Specification Manual 2007.
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113- A2007, Architectural Coatings.
  - .2 SCAQMD Rule 1168- A2005, Adhesives and Sealants Applications.
- .11 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102- 07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S102.2- 07, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- .1 .1 Pre-Installation Meetings:
  - .2 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other construction sub-trades.
    - .4 Review manufacturer's written installation instructions and warranty requirements.
- .2 Sequencing: Comply with manufacturer's written recommendations for sequencing construction operations.
- .3 Scheduling: schedule with other work in accordance with Section 01 32 16.07.

### 1.4 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 each carpet tile, under-cushion, adhesive, carpet protection, subfloor patching compound and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements 01 35 21 - LEED Procedures.
- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with 01 33 00 Submittal Procedures.

- .2 Information on shop drawings to indicate:
  - .1 Nap: direction, open edges, special patterns.
  - .2 Cutouts: show locations where cutouts are required.
  - .3 Edgings: show location of edge moldings and edge bindings.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate samples, size 610 mm X 610 mm, of each type of carpet tile specified and duplicate tiles for each colour selected, 150 mm length binder bars, and divider strips.
- .5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test and Evaluation Reports:
  - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: submit manufacturer's installation and storage instructions.
- .8 Manufacturers Reports:
  - .1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance with specifications.
- .9 Sustainable Design Submittals:
  - .1 LEED Canada- NC Version 1.0. Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 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 50% of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .5 Low-Emitting Materials:
    - .1 Submit listing of adhesives and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.
    - .2 Submit listing of carpet, carpet backer and adhesive used in building, showing compliance with CRI Green Label, Green Label Plus Indoor Air Quality Test Program.
- .10 Qualification Statements:
  - .1 Compliance: to CAN/ULC-S102 and CAN/ULC-S102.2.
  - .2 Testing: passes testing requirements of:
    - .1 Green Label Plus Indoor Air Quality Testing Program.
  - .3 Tuft bind: meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2

No.77.1.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for installed products for incorporation into manual.
- .3 Warranty Documentation: submit warranty documents specified in Section 1.10.

**1.6 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra stock materials in accordance with Section 01 78 00 Closeout Submittals: deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
  - .1 Quantity: provide minimum 5 % of each colour, pattern and type of carpeting and adhesives required for the carpeting materials.
  - .2 Delivery, storage and protection: comply with Owner's requirements for delivery and storage of extra materials.

**1.7 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Prequalification: compliance with Health Canada regulations under "Hazardous Products Act", Part II of Schedule 1, to CAN/CGSB-4.2 No. 27.6.
- .2 Qualifications:
  - .1 Manufacturer: capable of providing field service representation during construction and approving application method.
  - .2 Flooring Installer:
    - .1 Experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.
    - .2 Certified by carpet manufacturer prior to tender submission.
    - .3 Must not sub-contract labour without written approval of Departmental Representative.
    - .4 Responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturer's written instructions.

**1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
  - .3 Store and protect carpet tile and adhesive in original containers or wrapping with manufacturer's seals and labels intact.
  - .4 Store and protect carpet tile and accessories in location as directed by Departmental Representative.

- .5 Store carpet and adhesive at minimum temperature of 18 degrees C and relative humidity of maximum 65% for minimum of 48 hours before installation.
- .6 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.
- .7 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .8 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 35 21 - LEED Requirements.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.9 SITE CONDITIONS

- .1 Ambient Conditions:
  - .1 Moisture: ensure substrate is within moisture limits and alkalinity limits recommended by manufacturer. Prepare moisture testing and provide report to Departmental Representative.
  - .2 Temperature: maintain ambient temperature of not less than 18 degrees C from 48 hours before installation to at least 48 hours after completion of work.
  - .3 Relative humidity: maintain between 10% and 65% for 48 hours before, during and 48 hours after installation.
  - .4 Ventilation:
    - .1 Departmental Representative will co-ordinate operation of ventilation system during installation of carpet. Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.
    - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities. Provide fans with HEPA filters.
    - .3 Provide continuous ventilation during and after carpet application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of carpet installation.
  - .5 Install carpet after space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

#### 1.10 WARRANTY

- .1 Manufacturer's warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and does not limit other rights Owner may have under Contract Documents.
- .2 Warranty period: 10 years commencing on date of substantial performance of work.
  - .1 Work of this Section is guaranteed against deterioration and failure of materials and workmanship detrimental to appearance and performance under normal traffic conditions,
  - .2 Warranty covers labour and repair or replacement of defective components.

#### 2.0 PRODUCTS

##### 2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

- .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

## 2.2 MATERIALS

- .1 Manufacturers:
  - .1 Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.
- .2 Description:
  - .1 Sustainability Characteristics:
    - .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction 01 35 21 - LEED Requirements.
    - .2 Adhesives: VOC limit 50 150 g/L maximum to SCAQMD Rule 1168 GS-36.
    - .3 Primer Sealer : in accordance with manufacturer's recommendations for surface conditions:
      - .1 VOC limit:100 g/L maximum to SCAQMD Rule 1113
    - .4 Carpet and Accessories:
      - .1 Green Label Plus certified.
      - .2 10 % minimum Post-consumer recycled content.

## 2.3 PERFORMANCE

- .1 Flammability: certified for flammability to Health Canada regulations under "Hazardous Products - Carpet Regulations", Part II of Schedule 1.
- .2 Flame Spread: maximum flame spread rating 300, maximum smoke developed classification 500 when tested to CAN/ULC-S102.2.
- .3 Smoke Development: 450 or less per ASTM E 662.
- .4 Dry Breaking Strength: to ASTM D 2661, minimum acceptable tear strength in both length and width:
  - .1 11.3 kg for carpets installed by glue down installation.
- .5 Wear: maximum 10 % of pile face fiber by weight for 10 years.
- .6 Edge Ravel: none for 10 years.
- .7 Static Resistance: permanent static control to AATCC 134, 3000 V maximum at 20% RH and 22 degrees C.
- .8 Static Generation: less than 3.0 kV per AATCC 134 for 10 years.
- .9 Tuft Bind: Tuft Lock: to ASTM D 1335 CAN/CGSB-4.129, minimum acceptable 1.6 kilograms for



cut pile product 3.6 for loop pile product.

- .10 De-lamination of Secondary Backing: Lamination Strength of Secondary Backing: to ASTM D 3936, minimum acceptable peel strength of 1.6 kg/25 mm.
- .11 Stain resistance: to AATCC 175, 8.
- .12 Soil Resistance: 350 ppm fluorine minimum Fluorine Durability Level to AATCC 189.
- .13 Colourfastness to light: to CAN/CGSB-4.2 No.18.3 AATCC 16.
- .14 Colourfastness to atmosphere: to AATCC 129 and AATCC 23.
- .15 Colourfastness to crocking: to CAN/CGSB-4.2 No. 22.
- .16 Indoor Air Quality Certification: certified to CRI Green Label Plus IAQ requirements.
- .17 Antimicrobial Chemicals: to ASTM E 2471-05, no added antimicrobials.

#### 2.4 FABRICATION

- .1 Type CPT : 609 mm x 609 mm .
- .2 Face construction:
  - .1 Synthetic Non-Woven.
- .3 Pile fibre: to CAN/CGSB-4.129 .
  - .1 Nylon:
    - .1 Type: Nylon 6.6.
- .4 Face Fiber Denier: minimum 18.
- .5 Dyeing Method: 95% solution dyed/5 % yarn dyed.
- .6 Tufted Carpet Backing: to CAN/CGSB-4.129.
  - .1 Primary Tufting Substrate: Non-Woven Synthetic Fabric.
  - .2 Pre-Coat: Thermoplastic Polymer.
- .7 Stitches: 40.9 pu/10cm.
- .8 Gauge: 50.4 rows/10cm.
- .9 Pile Height Average: 4.7mm.
- .10 Finished Pile Height: minimum 0.5 mm average.
- .11 Face Pile Weight:1017g/sqm.
- .12 Dimensional Stability: maximum + 0.15% to CAN/CGSB-4.2 No. 76/ISO 2551.

#### 2.5 TILE CUSHION BACKING

- .1 Density: urethane 224 kg/m<sup>3</sup>; EVA and PVC 240 kg/m<sup>3</sup> to ASTM D 3574.

- .2 Compression force deflection, minimum: urethane 34.5 kN/m<sup>2</sup> to ASTM D 3574.
- .3 Compression deflection, minimum: EVA and PVC 48.3 kN/m<sup>2</sup> to ASTM D 1667.
- .4 Compression set at 50%, maximum: urethane 15% to ASTM D 3574.
- .5 Compression set at 25%, maximum: EVA and PVC 10% to ASTM D 3574.
- .6 Ash content, maximum: urethane 50%; EVA and PVC 50% to ASTM D 297.
- .7 Anti-microbial Resistance: to AATCC 174, 2 mm minimum halo of inhibition for gram positive bacteria.
  - .1 1 mm minimum halo of inhibition for gram negative bacteria.
  - .2 Ensure no fungal growth.

## 2.6 ACCESSORIES

- .1 Edge Strips:
  - .1 Metal:
    - .1 Hammered surface aluminum installed.
    - .2 Floor flange minimum 38 mm wide, face minimum 16 mm wide.
    - .3 Finish: clear anodic coating.
- .2 Adhesive:
  - .1 Multi-purpose Adhesive Type: recommended by carpet tile manufacturer for direct glue down installation.
  - .2 Pressure Sensitive Type: recommended by carpet tile manufacturer for direct glue down installation of speciality backed carpet tiles.
  - .3 Mill-applied Adhesive Type: fully cured. Combination of pre-applied adhesive and tile to meet carpet only VOC emissions criteria of Carpet and Rug Institute Green Label Plus Indoor Air Quality Certification Program.
  - .4 Pre-applied Adhesive: non-transferable.
  - .5 On site application VOC limit: 50 150 g/L maximum to SCAQMD Rule 1168.
  - .6 Adhesive in compliance with CCD-152.
- .3 Transition Mouldings:
  - .1 Carpet edge / reducer strip: Stainless steel, to suit.
- .4 Carpet protection: non-staining heavy duty kraft paper.
- .5 Concrete floor sealer/primer :
  - .1 VOC limit: 100 g/L maximum to SCAQMD Rule 1113.
- .6 Subfloor patching compound: Portland cement base filler mix with latex and water to form cementitious paste.

## 3.0 EXECUTION

### 3.1 INSTALLERS

- .1 Use experienced and qualified technicians to carry out assembly and installation of tile carpet.

### 3.2 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section, co-ordinate with Section

01 71 00 - Examination and Preparation.

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

### 3.3 PREPARATION

- .1 Subfloor Preparation:
  - .1 Inspect concrete and existing terrazzo flooring and determine special care required to make it suitable for carpet.
  - .2 Fill and level cracks 3 mm wide or protrusions over 0.8 mm with appropriate and compatible latex polymer fortified patching compound.
  - .3 Comply with manufacturer's written recommendations for maximum patch thickness.
  - .4 Prime large patch areas with compatible primer.
  - .5 Ensure concrete substrates are cured, clean and dry.
  - .6 Ensure concrete substrates and existing terrazzo flooring are free of paint, dirt, grease, oil, curing or parting agents, and other contaminants, including sealers, that interfere with the bonding of adhesive.
  - .7 Where powdery or porous concrete surface is encountered, apply primer compatible with adhesive to provide a suitable surface for glue-down installation.
- .2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.
  - .1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.
- .3 Tile Carpeting Preparation:
  - .1 Pre-condition carpeting: following manufacturer's written instructions.

### 3.4 BOND TEST

- .1 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .2 Resilient tile flooring:
  - .1 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern.
  - .2 Border tiles: half tile width minimum.
  - .3 Install flooring to square grid pattern with joints aligned.
- .3 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.
- .4 Cut flooring neatly around fixed objects.
- .5 Continue flooring over areas which will be under built-in furniture.
- .6 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .7 Terminate resilient flooring at centreline of door in openings where adjacent floor finish or colour is

dissimilar.

- .8 Install metal edge strips at unprotected or exposed edges where flooring terminates.

### 3.5 INSTALLATION

- .1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI Carpet Installation Standard and co-ordinate with Section 01 73 00 - Execution .
- .2 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.
- .3 Perform Bond Test over existing terrazzo flooring services prior to full installation.
- .4 Install carpet tile after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.
- .5 Install carpet tile as per manufacturer's recommendation. This can include quarter-turn 90 degree format, monolithic, random, quarter turn ashlar, horizontal, herringbone or vertical ashlar.
- .6 Snugly join carpet tiles in completed installation.
  - .1 Measure distance covered by 11 carpet tiles (10 joints) and ensure distance is in compliance with manufacturer specifications.
  - .2 Do not trap yarn between carpet tiles.
- .7 Apply thin film of pressure-sensitive adhesive according to manufacturer's recommendations.
- .8 Ensure finished installation presents smooth wearing surface free from conspicuous seams, burring and other faults.
- .9 Use material from same dye lot.
  - .1 Ensure colour, pattern and texture match within visual areas.
  - .2 Maintain constant pile direction.
- .10 Fit around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.
- .11 Extend carpet tiles into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- .12 Install carpet tiles smooth and free from bubbles, puckers, and other defects.
- .13 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

### 3.6 SITE QUALITY CONTROL

- .1 Site Tests and Inspections:
  - .1 Co-ordinate site test with Section 01 45 00 - Quality Control.
- .2 Manufacturer's Field Services:
  - .1 Co-ordinate manufacturer's services with Section 01 45 00 - Quality Control. Have manufacturer review work involved in handling, installation / application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify

- compliance of work with Contract.
- .2 Manufacturer's field services: 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:
  - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
  - .2 Twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of Work, after cleaning is carried out.
- .4 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

### 3.7 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.
    - .1 Vacuum carpets clean immediately after completion of installation.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Prohibit traffic on carpet for period of 24 hours minimum after installation and until adhesive is cured.
- .3 Install carpet protection to satisfaction of Departmental Representative.
- .4 Repair damage to adjacent materials caused by tile carpeting installation.

**1.0 GENERAL****1.1 RELATED REQUIREMENTS**

- |    |                                 |                   |
|----|---------------------------------|-------------------|
| .1 | Rough Carpentry for Minor Works | Section 06 08 99. |
| .2 | Finish Carpentry                | Section 06 20 00. |
| .3 | Architectural Woodwork          | Section 06 40 00. |
| .4 | Gypsum Board Assemblies         | Section 09 21 16. |
| .5 | Interior Painting               | Section 09 91 23. |

**1.2 REFERENCES**

- |    |  |
|----|--|
| .1 | American Society for Testing and Materials International (ASTM)  |
| .1 | ASTM C 423- 07, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.                                  |
| .2 | Canada Green Building Council (CaGBC)  |
| .1 | LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors. |
| .3 | Canadian Standards Association (CSA International)   |
| .1 | CSA B111- 1974 (R2003), Wire Nails, Spikes and Staples.  |
| .4 | Health Canada/Workplace Hazardous Materials Information System (WHMIS)   |
| .1 | Material Safety Data Sheets (MSDS).  |
| .5 | South Coast Air Quality Management District (SCAQMD), California State   |
| .1 | SCAQMD Rule 1113- 04, Architectural Coatings.  |
| .2 | SCAQMD Rule 1168- 05, Adhesives and Sealants Applications.   |
| .6 | Underwriter Laboratories of Canada (ULC)   |
| .1 | CAN/ULC-S702- 97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.   |

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- |    |  |
|----|--|
| .1 | Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.   |
| .2 | Provide product data in accordance with Section 01 33 00 - Submittal Procedures.   |
| .3 | Provide samples in accordance with Section 01 33 00 - Submittal Procedures.  |
| .1 | Submit duplicate sample of each of the following:  |
| .1 | Fabric: Submit manufacturer's standard size swatches of material indicated as facing for acoustic wall panels, showing full range of colors, textures, and patterns available for each type required.                                    |
| .2 | Core Material: Submit 210 x 280 mm samples of each core material used showing full range of materials, thicknesses, acoustics, and density.  |
| .3 | Track: Submit samples of manufacturer's "track" showing full range of edge profiles, thicknesses, and details for each type of acoustical panel. Where more than one edge profile is used on a panel, clearly show how each edge profile |

transitions into a different edge profile.

- .4 Sustainable Design Submittals:
  - .1 LEED Canada- NC Version 1.0, CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.

#### 1.4 QUALITY ASSURANCE

- .1 Contractor: Provide verifiably genuine products for each type of wall panel as produced by the manufacturer(s), including recommended primers, adhesives, and sealants. The manufacturer's published product literature shall clearly indicate compliance of wall panels with requirements indicated.
- .2 Both individual components and finished assemblies shall meet the following as appropriate:
  - .1 Fire Performance Characteristics: Provide acoustical wall panels with surface burning characteristics as indicated below, as determined by testing assembled materials and construction according to ASTM E-84 Class A, by a testing organization acceptable to authorize having jurisdiction.
    - .1 Flame Spread: 25 or less
    - .2 Smoke Developed: 450 or less
  - .2 Sound Absorption Characteristics: Provide acoustical wall panels with a noise reduction coefficient (NRC) of 0.5 or better.
  - .3 Be free of volatile organic compounds (VOCs).
  - .4 Fungi Resistance Certification of core material in accordance with ASTM C 1338.
- .3 The installation work of this section must be performed by an installer that has completed a formal training approved by the manufacturer of the system used.
- .4 Mock up
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up full height and 2 full panels width to indicate method of assembly, installation and fixing.
  - .3 Construct mock-up where directed.
  - .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Commence installation after building enclosed and dust generating activities are completed.
- .2 Permit wet work to dry prior to commencement of installation.
- .3 Maintain uniform minimum temperature of 15 degrees C and relative humidity of 20- 40% prior to, during and after installation.

#### 1.6 DELIVERY, STORGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Protect the Fabric, core material and track from excessive moisture in shipment, storage and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not

deliver material until wet work such as concrete and plaster has been completed.

.3 Waste Management and Disposal:

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

## 1.7 MAINTENANCE

.1 Extra Materials:

- .1 Provide extra materials of fabric, core material, tracks and adhesive in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide fabric, core materials and tracks for maintenance use amounting to 15% of gross wall area for each pattern and type required for project.
- .3 Provide sufficient adhesive to install extra material provided.
- .4 Extra materials from same production run as installed materials.
- .5 Identify each package of materials including colour and type, and each container of adhesive.
- .6 Deliver to Departmental Representative, upon completion of the work of this section.
- .7 Store where directed by Departmental Representative.

## 2.0 PRODUCTS

### 2.1 MATERIALS

.1 Acoustic Stretched-fabric Wall Panel

.1 Track:

- .1 Rigid vinyl framework with serrated clamping jaws. One-piece section, size and profiles as indicated on drawings.
- .2 Track must be of sufficient strength to securely hold fabric in place after repeated applications.

.2 Core Material:

- .1 Material: Fiberglass or Rockwool material, free of surface defects and sanded as required to a uniform thickness, with less than 2mm variance.
- .2 Density: 105 kg/cu.m (+/- 10%), consistent throughout.
- .3 Thickness: 25mm thick, and fit within track's perimeter.
- .4 Edges: chemically hardened to withstand moderate impact.
- .5 Noise reduction coefficient (NRC) designation: 0.85
- .6 Frequency ( $H^2$ ) and Absorption Coefficient:

125	0.03
250	0.37
500	0.89
1000	1.10
2000	1.09
4000	1.05

.3 Fabric:

- |    |                                  |                              |
|----|----------------------------------|------------------------------|
| .1 | Contents:                        | 100% Recycles Polyester      |
| .2 | Weight:                          | 15.0 +/- 1.0 oz./linear yard |
| .3 | Width:                           | 1676mm Useable               |
| .4 | Pattern Repeat:                  | None                         |
| .5 | Breaking Strength (ASTM D 5034): | 240 lbs. Min-Warp and Fill   |



.6	Tear (ASTM D 2261):	35lbs. Min-Warp and Fill
.7	Moisture Regain (ASTM D 2654):	1.0% Max.
.8	Colorfastness to Light (AATCC 16E):	40hrs.
.9	Colourfastness to Crocking (AATCC 8):	Class 4 min.-Dry, Class 4 min.-Wet
.10	Flammability to ASTM E-84	Class 1 or A
.11	Dimensional Stability to ASTM D6207:	Passes
.12	Color:	White

.4 System Design Requirements:

- .1 Stretched fabric panel system shall consist of continuous perimeter and intermediate mounting extrusions that are site fabricated, and applied directly to the wall surface or with use of shim.
- .2 Fabric face shall be stretched over core materials and tucked into the track's locking jaws, leaving fabric floating above core surface. Installation of fabric shall not utilize any adhesives, nails, tacks, screws, sewn seams, thermally bonded seams, or tape. The finish shall be flat and wrinkle free.
- .3 Systems shall allow for removal and replacement of fabric from individual panels. Removal of fabric shall provide access to surface behind fabric. Fabric shall be removable and replaceable without dismantling, removal, damaging, or replacement of the track extrusions or core material.
- .4 All fabrics shall be evaluated by the contractor for suitability with its system, the intended application, and for warranty purposes. When uncertain, the contractor should consult with the system manufacturer.

- .2 Staples, nails and screws: to CSA B111, non-corrosive finish, type recommended by acoustic unit manufacturer.

### 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 EXISTING CONDITIONS

- .1 Examine the condition of the substrate and the conditions under which the work of the Section is to be performed. Notify the Departmental Representative in writing of any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner satisfactory to the installer.

#### 3.3 INSTALLATION

- .1 Field measure each wall area, which is to receive the acoustical panels to establish the exact Layout of the units as shown on drawings. Comply with manufacturer's printed instructions for installation.
- .2 Apply framework in the areas to receive the acoustical wall treatment as shown on the drawings. Secure the framework with suitable mastic and special, heavy duty; 25mm diverging staples located not more than 50mm on center. Other fasteners may be used as required for specific substrates, providing they are strict accordance with the manufacturer's printed instructions and comply with governing regulations and fire resistance rating requirements specified.
- .3 Install framework plumb and straight, flush in proper alignment.
- .4 Install the sub-surface material, continuous and flush, to the shoulder of the track.
- .5 Cut the fabric from each roll marking and maintaining sequence of drops and matching direction

- of weave for sequential and uniform installation.
- .6 Install the fabric from the face side after the framework is securely fastened to insure perfect horizontal and vertical grain alignment.
  - .7 The fabric shall be stretched tautly, evenly and smoothly and be free of defects and flaws.
  - .8 No stapling or gluing of fabric to core or channels will be permitted.
  - .9 Penetrations through the face of fabric of any kind (i.e. staples, nails, etc.) will be prohibited.
  - .10 Prewrapped, prefabricated, or wood ground systems do not meet the intent of this specification.
  - .11 Z-Clip, Velcro or Glued installation techniques do not meet the intent of this specification.
  - .12 Sewn seams of any type (thread or ultra-sonic welds) do not meet the intent of this specification.
  - .13 Installation shall be timely and installers shall be courteous and cooperate with other trades.

### 3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Keep acoustic installation and all components clean. Remove blemishes immediately.
- .3 Clean exposed surfaces of acoustical wall panels. Trim and remove all loose threads.
- .4 Remove surplus materials, rubbish and debris resulting from the installation and leave areas of installation in a neat, clean condition.

### 3.5 PROTECTION

- .1 Use polyethylene to protect finished acoustical wall treatment from damage.
- .2 Remove prior to substantial completion.

### 3.6 INTERIOR FINISH MATERIAL & COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Metal Fabrications Section 05 50 00

1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Environmental Protection Agency (EPA)
  - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - February 2004.
  - .2 Standard GPS-1- 05, MPI Green Performance Standard for Painting and Coatings.
- .5 National Fire Code of Canada.
- .6 Society for Protective Coatings (SSPC)
  - .1 Systems and Specifications, SSPC Painting Manual 2005.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Contractor: to have a minimum of five years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
  - .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work
  - .3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson 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.
- .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.

- .8 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 Consultant, 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.
- .9 Standard of Acceptance:
  - .1 Wall: No defects visible from a distance of 1000mm at 90° to surface.
  - .2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .10 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.
- .11 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.
- .12 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" E1, E2, E3 ratings based on VOC (EPA Method 24) content levels.
- .2 Green Performance in accordance with MPI Standard GPS-

**1.5 SCHEDULING**

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

**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 33 00 - Submittal Procedures. Indicate VOCs during application.
- .3 Samples:
  - .1 Submit triplicates 200 x 300 mm sample panels of each paint, stain, or clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
    - .1 3 mm plate steel for finishes over metal surfaces.
    - .2 10 mm hardboard plywood for finishes over wood surfaces.
    - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
    - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
  - .2 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.
  - .3 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.
  - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .5 Manufacturer's Instructions:
    - .1 Submit manufacturer's installation instructions.
  - .6 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.
  - .7 Provide LEED Submittals:
    - .1 Co-ordinate submittals requirements in accordance with Section 01 35 21 - LEED Requirements.

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 & HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:
  - .1 Deliver and store materials in original containers, sealed, with labels intact.
  - .2 Labels: to indicate:
    - .1 Manufacturer's name and address.
    - .2 Type of paint or coating.
    - .3 Compliance with applicable standard.
    - .4 Colour number in accordance with established colour schedule.
  - .3 Remove damaged, opened and rejected materials from site.
  - .4 Provide and maintain dry, temperature controlled, secure storage.
  - .5 Observe manufacturer's recommendations for storage and handling.
  - .6 Store materials and supplies away from heat generating devices.
  - .7 Store materials and equipment in well-ventilated area with temperature range 7 degrees C to 30 degrees C.
  - .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
  - .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative
  - .10 Remove paint materials from storage only in quantities required for same day use.
  - .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
  - .12 Fire Safety Requirements:
    - .1 Provide one 9 kg Type ABC dry chemical 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 the National Fire Code of Canada.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
  - .3 Material which cannot be reused must be treated as hazardous waste and disposed of in

- an appropriate manner.
- .4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
  - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
  - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
  - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .7 Set aside and protect surplus and uncontaminated finish materials: \_\_\_\_\_. Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.
- .8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

#### 1.9 AMBIENT CONDITIONS

- .1 Heating, Ventilation and Lighting:
  - .1 Ventilate enclosed spaces in accordance with Section 01 35 33 Health and Safety Requirements.
  - .2 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place 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.
  - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
  - .4 Co-ordinate use of existing ventilation system with Owner General Contractor Departmental Representative and ensure its operation during and after application of paint as required.
  - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
  - .6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:
    - .1 Ambient air and substrate temperatures are below 10 degrees C.
    - .2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.
    - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
    - .4 Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperature.

- .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
- .2 Perform no painting work when maximum moisture content of substrate exceeds:
  - .1 12 % for concrete and masonry (clay and concrete brick/block).
  - .2 15 % for wood.
  - .3 12 % for plaster and gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "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 noted herein.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.
  - .4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
  - .5 Do not apply paint when:
    - .1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.
    - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
    - .3 Surface to be painted is wet, damp or frosted.
  - .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
  - .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
  - .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
  - .9 Paint occupied facilities in accordance with approved schedule 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 latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems: to be products of single manufacturer.
- .3 Only qualified products with E2 E3 "Environmentally Friendly" ratings are acceptable for use on



this project.

- .4 Use only MPI listed L rated materials.
- .5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
  - .1 Be water-based.
  - .2 Be non-flammable biodegradable.
  - .3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
  - .4 Be manufactured without compounds which contribute to smog in the lower atmosphere.
  - .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .6 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada.
- .7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .8 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.
- .9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
  - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
  - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.
- .11 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.
- .12 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 50.0 ppm weight/weight total product.
  - .3 Cadmium in excess of 1.0 ppm 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.
- .13 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the 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.

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

## 2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative .
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

## 2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss 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 7 -High Gloss Finish	More than 85	

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

## 2.5 EXTERIOR PAINTING SYSTEMS

- .1 Concrete Vertical Surfaces: (including horizontal soffits)
  - .1 EXT 3.1C - Waterborne light industrial insert gloss level coating.
- .2 Structural Steel and Metal Fabrications:
  - .1 EXT 5.1B - Waterborne light industrial insert gloss level coating (over inorganic zinc).
- .3 Wood panel (horizontal soffit panel)
  - .1 EXT 6.4H-Varnish, semi gloss.

## 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 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

### 3.3 EXAMINATION

- .1 Exterior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency minimum of one week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.
- .2 Exterior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.
- .3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.
- .4 Where "special" repainting or recoating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer to provide as part of 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

### 3.4 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces

- as directed by Departmental Representative.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
  - .4 Protect passing pedestrians, building occupants and general public in and about building.
  - .5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.
  - .6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
  - .7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative.

### 3.5 APPLICATION

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

- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

### 3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.
- .4 Paint fire protection piping red.
- .5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

### 3.7 FIELD QUALITY CONTROL

- .1 Inspection:
  - .1 Field inspection of exterior painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
  - .2 Advise Departmental Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
  - .3 Co-operate with inspection firm and provide access to areas of work.
- .2 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### 3.8 RESTORATION & CLEANING &

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of 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
- .6 Proceed in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using

means and materials that are not detrimental to affected surfaces.

**3.9 COLOUR SCHEDULE**

- .1 Steel fabrications at Galleria Entrance.
- .2 Existing Concrete soffit under Granville Ramp.
- .3 Existing pipings under Granville Ramp.

END OF SECTION 09 91 13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Metal Fabrications	Section 05 50 00
.2	Finish Carpentry	Section 06 20 00
.3	Architectural Woodwork	Section 06 40 00
.4	Metal Doors & Frames	Section 08 11 00
.5	Flush Wood Doors	Section 08 14 16
.6	Room Finish Schedule	Section 09 06 00

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, latest edition.
- .5 National Fire Code of Canada - 1995
- .6 Society for Protective Coatings (SSPC)
  - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.
- .7 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

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.
- .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.
- .8 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 Consultant, 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.
- .9 Standard of Acceptance:
  - .1 Wall: No defects visible from a distance of 1000mm at 90° to surface.
  - .2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .10 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.
- .11 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.



- .12 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
- .13 Construction requirements: in accordance with Section 01 35 21 - LEED Requirements: Construction.

#### 1.4 PERFORMANCE REQUIREMENTS

- .1 Environmental Performance Requirements:
  - .1 Provide paint products meeting MPI "Environmentally Friendly" E1, E2, E3 ratings based on VOC (EPA Method 24) content levels.
- .2 Green Performance in accordance with MPI Standard GPS-

#### 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 33 00 - Submittal Procedures. Indicate VOCs during application.
- .3 Samples:
  - .1 Submit triplicates 200 x 300 mm sample panels of each paint, stain, or clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
    - .1 3 mm plate steel for finishes over metal surfaces.
    - .2 10 mm hardboard plywood for finishes over wood surfaces.
    - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
    - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
  - .2 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.
  - .3 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.
  - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .5 Manufacturer's Instructions:

- .1 Submit manufacturer's installation instructions.
- .6 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.
- .7 Provide LEED Submittals:
  - .1 Co-ordinate submittals requirements in accordance with Section 01 35 21 - LEED Requirements.

#### 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 21 - Construction/Demolition 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 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.
    - .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 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .3 Provide paint materials for paint systems from single manufacturer.
- .4 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.
- .5 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .6 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .7 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.
- .8 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.
- .9 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.
- .10 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.
- .11 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .12 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .13 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.
- .14 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.
- .15 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 Refer to Interior Finish Material and Colour Schedule, Section 09 06 00 Finish Schedule and drawings for identification and location of colours.
- .2 Interior Finish Material and Colour Schedule:
  - .1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
  - .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
  - .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option
- .3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

## 2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. 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 7 -High Gloss Finish	More than 85	

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

## 2.5 INTERIOR PAINTING SYSTEMS –NEW CONSTRUCTION

- .1 Concrete horizontal surfaces: floors:
  - .1 INT 3.2G - Waterborne concrete floor sealer.
- .2 Structural steel and metal fabrications: columns, beams, joists:
  - .1 INT 5.1B - Waterborne light industrial gloss level 5 coating.
- .3 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.
- .4 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
  - .1 INT 5.3K - Waterborne light industrial gloss level 3 coating (over waterborne primer).
- .5 Dressed lumber: including doors, door and window frames, casings, mouldings:
  - .1 INT 6.3A - High performance architectural latex gloss level 3 finish.
- .6 Wood paneling and casework: partitions, panels, shelving, millwork:
  - .1 INT 6.4J - Polyurethane varnish insert gloss level 5 finish.
- .7 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
  - .1 INT 9.2A - Latex gloss level 3 finish (over latex sealer) for wall typical, gloss level 1 for ceiling.
- .8 Bituminous coated surfaces: cast iron pipe, concrete, etc.:
  - .1 INT 10.2A - Latex gloss level 3 finish.
- .9 Concrete masonry units: smooth and split face block and brick:
  - .1 INT 4.2A-Latex gloss level 3 finish.
- .10 Wood Veneer Door & Door Frame:
  - .1 INT 6.3F premium grade gloss level 3 finish.

## 2.6 INTERIOR REPAINTING SYSTEMS

- .1 Structural Steel and Metal Fabrications:
  - .1 RIN 5.1B Waterbourne light industrial gloss level 5 coating.
- .2 Galvanized Metal: doors, frames, railings, misc steel, pipes, overhead decking, ducts, etc.
  - .1 RIN 5.3B Waterbourne light industrial gloss level 3 coating.
- .3 Aluminum: (unanodized)
  - .1 RIN 5.4E Waterbourne light industrial gloss level 3 coating.
- .4 Plaster and Gypsum Board Surfaces: gypsum wallboard, drywall, "sheet rock type material", etc.
  - .1 RIN 9.2A Latex, gloss level 3 finish for wall typical, gloss level 1 finish for ceiling typical.
- .5 Wood Veneer Door, Door Frame and wood handrail:
  - .1 INT 6.3F premium grade gloss level 3 finish.

## 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.
- .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:
- .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.
- .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.
- .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 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 Standard of Acceptance:
  - .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.
- .5 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
- .6 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .7 Cooperate with inspection firm and provide access to areas of work.
- .8 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 patters 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.

### 3.10 PAINT COLOUR SCHEDULE

- .1 To be issued as a separate document. Refer to Item 2.2 Colours of this section.

**1.0 GENERAL**

**1.1 DESCRIPTION**

- .1 Work related to this Section incorporates the complete manufacture and installation of interior and exterior environmental graphics including, but not limited to: directional signage, FIP signage, code-required signs, general identification signage, hoarding graphics, glazing and film.

**1.2 RELATED REFERENCES**

- .1 Gypsum Board Assemblies      Section 09 21 16
- .2 Electrical      Division 26

**1.3 SUBMITTALS**

- .1 Submit in accordance with section 01 33 00 Submittal Procedures:
- .2 Samples:
  - .1 Submit 2 sets of color samples of each color, 300mm x 300mm. Show anticipated range of color and texture. One set of samples will be retained by the Departmental Representative, the other returned to Sign Contractor as control samples.
  - .2 Submit 2 sets of samples of each naturally finished material 300mm x 300mm. Show anticipated range of texture.
  - .3 Provide tempered laminated glass samples with beveled edges, frosted opalescent interlayer and clear anti-reflective glass.
  - .4 Provide operating samples for all specified LED lighting products or approved alternates.
  - .5 Provide production material and mounting hardware for review.
  - .6 Duly reviewed and approved sign samples shall be the minimum workmanship and quality standard for reference until completion of the Work.
  - .7 Duly reviewed sign type samples shall be retained by the Signage Contractor until released by the Departmental Representative, at which time they may be incorporated in the permanent Work.
  - .8 Adjustments made on samples by the Departmental Representative are not intended to change the Contract Price. If adjustments affect the value of the Work, state such in writing for approval by the Departmental Representative, prior to proceeding with the Work.
- .3 Fabricated Sign Samples and Sign Products:
  - .1 Type A1: Samples of stainless steel finishes and etching.
  - .2 Type A23: Provide full size sample of a washroom pictogram on painted aluminum panel.
  - .3 Type A40: Provide full size sample of map digitally printed on painted aluminum panel.
  - .4 Type A70: Provide full size sample of a portion of the Transit ID and Station Identification background on a white acrylic panel. Complete with power and illumination for lighting and testing.
- .4 Mock-ups:

Provide mock-ups, full size for review in shop and on site. Provide mock-ups as follows:

  - .1 Type A1: Complete and finished assembly for shop and field review. Accepted mock-up may be installed as final product.

- .2 Type A4.1: Complete and finished sign section with characters "R" and "S". Complete with backing plate, raceway channel, power and illumination for lighting and testing. For shop and field review. Accepted mock-up letters may be used as part of final product.
- .3 Type A20: Complete and finished assembly for shop and field review. Accepted mock-up may be installed as final product.
- .4 Type A40: A section of an Interior Building Directory Wall that must include part of the maple leaf pattern, 3mm thick aluminum lettering including painted "light blue" and mirror polished faces with sandblasted returns, silk-screened and / or digitally printed graphics, at least three lines of changeable panels, aluminum channel top and sides painted "black", and a side panel. For shop review. Accepted mock-up may be used as part of final product.
- .5 Type A60: A section of the Passport Canada Primary ID freestanding that must include the Maple Leaf pattern, illuminated FIP panel, aluminum channel top and sides painted "black", and side panels. Complete with power and illumination for lighting and testing. For shop and field review. Accepted mock-up may be used as part of final product.
- .6 Type A63: Complete and finished assembly for shop and field review. Accepted mock-up may be installed as final product.
- .7 Type B1.1: Complete and finished assembly for shop and field review. Complete with power and illumination for lighting and testing. For shop and field review. Accepted mock-up may be installed as final product.
- .8 Type B3: Complete and finished assembly of a Women Washroom ID for shop and field review. Accepted mock-up may be installed as final product.
- .9 Type B6: Complete and finished assembly for shop and field review. Accepted mock-up may be installed as final product.
- .10 Type C1: Complete and finished assembly of banner hardware, mounting plates, vertical and horizontal structural members, lighting and tensioned banner material, for shop review. Accepted mock-up may be installed as final product.
  - .1 All mock-ups shall be fully fabricated, complete with all fastenings, accessories, lettering and symbols to fully indicate the quality of materials, fabrication and workmanship for the project.
  - .2 Mock-ups identified for field review will be reviewed on site for final location with the Departmental Representative. Mock-ups installed for field review and accepted may be installed as the final product subject to the site being ready to accept the installed product.
- .5 Manufacturer's Literature: Manufacturer's printed specifications, anchorage details, installations and maintenance instructions.
- .6 Shop Drawings:
  - .1 Submit shop drawings to illustrate details of Work on maximum sheet size 610mm by 914mm.
  - .2 Shop drawings, which are to be provided by the Sign Contractor, will be used as the final construction documents and must include all construction, engineering and installation details for the complete implementation of the designs described herein. This also extends to any required sign bases unless otherwise indicated on the Technical Drawings.
  - .3 All drawings shall be signed and sealed by an engineer registered in the Province of British Columbia. The said engineer is to provide VBBL 2007 Schedule B and C and NBC Schedule B1, B2 and Schedule C-B as attached in Appendix P in this specification prior to substantial completion.
  - .4 The Signage Contractor shall provide dimensioned shop drawings for all signs clearly showing elevations, sections, dimensions, materials, typographic layouts, fabrication

methods, external finishes, anchorage, electrical connections and other details of construction as well as details related to engineering and other construction responsibilities. Signage Contractor shall be responsible for all construction installation and internal supports for a safe and permanent installation of all signs. Furnish location detail drawings for signs supported or anchored to other construction. Use metric dimensions throughout.

- .5 Shop drawings shall include complete details of fasteners (diameter, length, type, and material).
  - .6 Shop drawings shall indicate wiring diagrams, terminal box locations, lamp centres and overlaps, access panels and electrical components specifications and power loads.
  - .7 Clearly identify all shop drawings by title and number and reference to applicable contract drawings. Identify all deviations from contract drawings.
- .7 Artwork:
- .1 Electronic templates for artwork to be provided by the Consultant. Consultant will provide artwork for the following: FIP and non-FIP standard and custom symbols (pictograms); Facility bi-lingual signature and street names; Maple Leaf Pattern & Motif; Map Style Guides and Directional Arrow. Templates will be provided to the Signage Contractor as Illustrator (.ai) or Adobe PDF (.pdf) files.
  - .2 Artwork of all variations for messaging point of view map orientations and map content to be laid out by the Signage Contractor and provided to the Consultant for approval.
  - .3 All artwork to be submitted in either full size hardcopy or electronic form as Illustrator (.ai) or Adobe PDF (.pdf). Provide digitally printed map proofs for all map locations and "You Are Here" orientations.
- .8 The Departmental Representative reserves the right to add and otherwise modify sign text and lettering layout during the submittal reviews at no additional cost to the Owner.
- .9 Sustainability Standards Certification:
- .1 Construction Waste Management (CWM)
  - .2 Recycled Content:
    - .1 Provide listing of recycled content products used, including details of required percentages of recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

#### 1.4 QUALITY ASSURANCE

- .1 The intent of the contract documents is to provide everything necessary for a complete contract. All drawings and specifications are mutually dependent. In the event of a discrepancy or an error, neither one rules over the other. Notify Consultant if any discrepancies arise for direction on how to proceed.
- .2 The Consultant must be notified of any variations of conditions as shown on these drawings. It shall be the Sign Contractor's responsibility to obtain and utilize the most current and up-to-date plans and specifications for all construction and installation work.
- .3 Work done and material furnished shall be of superior quality in every respect.
- .4 The Owner shall reserve the right to reject any shop drawings, samples, or other submittals, as well as any finished product or installation that does not meet or exactly equal the standard of quality established. Any such decision will be considered final and not subject to recourse.
- .5 The Sign Contractor must guarantee that only new materials are being used for this work.

- .6 Products must be made accessible for quality control inspection at any time.
- .7 Any claims for work carried out on instructions by others will not be accepted or honored.
- .8 Guarantees and tolerances for both product and installation to be stated by the Contractor upon bidding on this work.
- .9 The Departmental Representative must be notified of any variations of conditions as shown on the drawings. It is the responsibility of the Sign Contractor to obtain and utilize the most current and up to date plans and specifications for all construction and installation work.
- .10 The Sign Contractor shall be responsible for field measurements as needed to verify or supplement dimensions indicated herein and shall be responsible for accurate fit of signs upon installation.
- .11 Details shown on the drawings herein shall be maintained for exterior appearance. The Sign Contractor may change interior construction shown on these details to conform to his shop practices. Engineering for structural integrity and a safe permanent installation shall be the sole responsibility of the Sign Contractor. The Sign Contractor and/or the Engineer will determine which signs will require to be engineered.
- .12 Fabrication and Installation's Pre-qualifications:
  - .1 Must demonstrate that its main (primary) business is designing and manufacturing signs.
  - .2 Must have a successful track record of multiple successful installations of signage of similar project scope, complexity and value and of meeting deadlines, and controlling costs.
  - .3 Must demonstrate it has sufficient resources and a qualified team with a proven record of performing large projects on time, shall have sufficient capacity and resources to manage, manufacture, construct, install and maintain all sign structures.
  - .4 Must demonstrate through satisfactory references and project examples that it has proven experience and qualifications in the type of work identified for all aspects of the project. References and project examples must show proven and built, including photos and project descriptions.
  - .5 The Owner reserves the right to reject any tender should the Owner determine insufficient or irregular information exists as to the bidder's qualifications, ability, experience, capacity.
  - .6 Reference checks may be conducted. A minimum of three (3) references to be provided including contact names and telephone numbers, for which completed work similar to that called to this project within the last five (5) years. Preferably, at least one of the completed projects should be in the city of Vancouver.
- .13 Supervision
  - .1 Work of this Section shall be executed under the continuous supervision and direction of a Site Supervisor with a min. of 5 years signage related field experience relative to the scope of the project.
  - .2 Sign manufacturer shall provide one foreman per crew with a min. of 5 years installation experience who shall be in charge during installations.

#### 1.5 DELIVERY AND STORAGE

- .1 Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.



- .2 Deliver signs only when the site and mounting services are ready for installation work to proceed.
- .3 Store products in dry condition inside enclosed facilities.
- .4 Delivery of materials and/or completed work will be coordinated with the Departmental Representative. All costs for delivery, including labour to load and unload, and trucking, shall be the responsibility of the Contractor; coordinating the delivery timing and building route with the Departmental Representative. As the Facility should be considered a construction site and onsite storage is limited, it will be necessary for the Signage Contractor to store materials offsite and deliver in a "just-in-time" fashion, according to schedule of installation.
- .5 All deliveries shall be made during regular work hours and extended or overtime hours shall not be allowed without explicit approval by the Departmental Representative with a minimum of three (3) days advance notice. All deliveries must be scheduled with the Departmental Representative.
- .6 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits, and the Contract Documents and shall not unreasonably encumber the site with any materials or equipment.
- .7 Packaging Waste Management:
  - .1 Remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.6 APPLICABLE PUBLICATIONS & CODES

- .1 Canadian National Building Code 2010
- .2 The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- .3 AAMA 2605, High Performance Organic Coatings on Architectural Extrusions and Panels
- .4 AAMA CW- 10, Care and Handling of Architectural Aluminum from Shop to Site
- .5 ANSI, H35.1M Alloy and Temper Designation Systems for Aluminum (Metric)
- .6 ASTM A653/A653M, Specification for Steel Sheet, Zinc- Coated (Galvanized) or Zinc- Iron Alloy- Coated (Galvanealed) by the Hot- Dip Process
- .7 ASTM B209M, Standard Specification for Aluminum and Aluminum- Alloy Sheet and Plate Metric
- .8 ASTM B221M, Standard Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes Metric
- .9 ASTM D1781, Standard Test Method for Climbing Drum Peel for Adhesives
- .10 ASTM F738M, Specification for Stainless Steel Metric Bolts, Screws, and Studs.
- .11 CAN/CGSB- 1.108- M, Bituminous Solvent Type Paint
- .12 CAN/CGSB- 12.12- M, Plastic Safety Glazing

- .13 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installations
- .14 CSA 651-12, Accessible Design for the Built Environment
- .15 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
- .16 TAC; MUTCDC.
- .17 NAAMM, The National Association of Architectural Metal Manufacturers.
- .18 Vancouver Building By-Law 1999 | Vancouver Fire By-Law (VFBL) No. 7004
- .19 Treasury Board of Canada Secretariat | Federal Identity Program (FIP)
- .20 Canadian Standards Association (CSA)
- .21 Ensure the work will meet all applicable codes, legislation and regulations.
- .22 The Departmental Representative must have on file the Signage Contractor's current certificates of insurance covering liability and worker's compensation. These documents must be sent directly from the Contractor's insurance company.
- .23 All Contractors, Subcontractors must perform their work in accordance with all local codes and all governing codes, regulations, ordinances and laws that have jurisdiction over such work; and by-laws having jurisdiction whether or not indicated or noted on the drawings. If the Contractor observes that any portion of the Contract Document is in disagreement therewith in any respect, the Contractor shall promptly notify the Departmental Representative and the Consultant and any necessary changes shall be accomplished by appropriate modification.
- .24 The Signage Contractor shall maintain workman's compensation and disability insurance, comprehensive public liability, bodily injury, and property damage insurance, as required by law and the Owner.

#### 1.7 SITE INSPECTION

- .1 Signage Contractor shall verify and confirm existing site conditions and secure site measurements affecting the Work of this section at the site before commencing or completing fabrication.
- .2 General signage locations are shown on signage plan drawings – exact location to be confirmed with the Departmental Representative. Architectural elevations, floor plans and reflected ceiling plans are to be consulted for specific site, location, and elevation details.
- .3 Signage Contractor shall notify the Departmental Representative and the Consultant in writing of unacceptable substrates, detrimental conditions or dimensional discrepancies.
- .4 Beginning work indicates acceptance of substrate and subsequent modifications will become the Signage Contractor's complete responsibility.

#### 1.8 OPERATIONS & MAINTENANCE

- .1 The Sign Contractor shall arrange a meeting with the Departmental Representative on site for a final on-site demonstration/review of all electrical and mechanical sign components to ensure all signs are in full functional working order prior to completion of the Project.

- .2 The Sign Contractor to provide an Operating and Maintenance Manual including detailed technical information, all as-built documents and records describing operation and maintenance of individual products or systems.

#### 1.9 WARRANTY

- .1 The Sign Contractor to warranty materials, fabrication and installation including work by sub-trades.
- .2 The Sign Contractor shall submit a written statement that all products supplied shall be unconditionally guaranteed for one year to be free from defects such as cracking, peeling, abnormal fading or discolouration, delaminating, or other adverse conditions due to quality of any materials or workmanship in manufacture or installation.
- .3 Electrical components shall have an unconditional warranty period of one-year covering products, materials and installation work.
- .4 Conduct an inspection in the presence of the Departmental Representative and the Consultant upon completion of installation and prior to end of warranty period.
- .5 During the warranty period, the Sign Contractor agrees to restore defective work to the standard of Performance Specifications without cost to the Departmental Representative, including materials and labor. The Sign Contractor agrees to restore defective work expeditiously and not later than one week after notification.
- .6 It shall be the exclusive and sole responsibility of the Sign Contractor to provide compatible attachment and adhesive materials. Any de-lamination, warping, discolouring or disfiguring of graphics caused by mounting adhesives shall require repair and replacement of sign products at no expense to the Departmental Representative.

#### 1.10 PROJECT COMPLETION

- .1 Signage Contractor shall arrange a meeting with the Departmental Representative for a final on-site demonstration and review of all electrical and mechanical sign components to ensure signs are in full functioning working order prior to Substantial Performance of the Work.
- .2 Following installation, clean all signs ensuring removal of all fingerprints, dirt, shavings, adhesive, dust particles, etc. Prior to leaving the installation location, clean the work area, walls, floor, etc., that may be soiled during the installation process.
- .3 Manufacturer is to provide a complete set of as-built drawings prior to Substantial Performance of the work.

#### 2.0 PRODUCTS

##### 2.1 MATERIALS

- .1 Aluminum
  - .1 Sheet and Plate: ASTM B209
  - .2 Aluminum extrusions, tubes, bars, plates and reinforcements: ASTM B221-96 and ANSI H35.1 AA6063-T5 alloy or as otherwise specified. Sizes, profiles, and shapes as indicated, or as further developed for specified requirements.

Custom extrusion designs provided, enhanced, and/or developed within the scope of this Contract are and will remain the property of the Owner.

- .2. Stainless Steel: ASTM A167, Type 304 to ASTM A 167-96, Type 304 alloy in sandblasted finish, mirror polished finish, as specified. Brushed applications to be XL-Blend S finish to allow for on-site repair and touch-ups as required. All dimensional letters and characters to have sandblasted finish on face and returns.
- .3. Glass: All glass to be low iron tempered and laminated using optically clear interlayer unless specified otherwise. Minimum thickness of 4mm for each layer with approximately 2mm thick interlayer, for a total of 10mm thickness.
- .4. Polycarbonate: MIL-P-46144C; Type I, class 1.
- .5. Vinyl: 0.1 mm thick machine cut, with pressure sensitive adhesive and integral colors.
- .6. Exterior Banners
  - .1. 10 oz. opaque marine fabric with a white inkjet receptive topcoat. Suitable for indoor and long-term outdoor applications.
  - .2. Refer to 2.1.2 Aluminum
  - .3. All tensile cables to be made out of stainless steel
  - .4. Lighting – Illumination to achieve 2,929 delivered lumens, 16,765 candelas at nadir, min. 1 fc (10.7 lux) at 129 ft (39m) (4', 4000K, 10° x 60° optic, HO).
- .7. Substitutions – Materials & Products:
  - .1. The Contractor shall carefully study the detailed drawings for the various signs and make specific recommendations for changes if he/she considers these changes will improve the quality of any sign. These recommendations for changes shall be submitted in writing to the Departmental Representative & The Consultant before the preparation of shop drawings or fabrication of any samples or signs. No substitutions will be considered without samples.
  - .2. Substitutions shall be proposed under the following conditions:  
Substitutions shall satisfy all design conditions and other specified requirements.  
Substitutions should be equal or superior to materials specified.  
Properties included but not limited to the following as applicable will be considered:  
Physical dimension requirements to satisfy the space limitations, static and dynamic weight limitations, structural properties, interchange ability of parts or components, accessibility for maintenance, possible removal or replacement, colour, texture and compatibility with other materials, products, assemblies and components.
  - .3. Substitutions due to delivery or availability not to be grounds for additional claims to contract price.
- .8. Electrical Signs:
  - .1. General: Furnish and install all lighting, electrical components, fixtures and lamps ready for use in accordance with the sign type drawings, details and specifications.
  - .2. Verify line voltages for sign locations that require electrical signs.
  - .3. Quality Control: Installed electrical components and sign installations are to comply with National Electrical Code as well as applicable federal, province and local codes for installation techniques, fabrication methods and general product safety.
  - .4. LED illumination to be free of shadows and hot spots using 6,500 K temperature lighting.

- .5 Edge-lit acrylic panels to be free of hotspots. Use graduated etching as required to achieve optimal illumination. Testing and mockups are required where illumination is behind graphics for even light distribution.
- .9 Colour as noted on the drawings.
- .10 All structural components including, but not limited to, plate thickness, wall thickness, bolt sizing, spacing, and embedment to be reviewed by P.Eng in the province of installation prior to any construction or shop drawings. Only shop drawings stamped by P.Eng. will be considered.
- .11 **Standard Sign Systems:**  
 An interior sign system consisting of dovetailed aluminum extrusion profiles, which slide together to form a completed sign. The flexibility of the system provides for single-sided as well as double-sided suspended signage. The frameless design provides expansion capabilities which can accommodate the addition or removal of modular profiles after the sign has been installed. The system is simple to update. The removal of a concealed, vertical locking pin allows for changes to be made to a sign quickly.
- .12 **Graphic Film**
  - .1 Graphic film to be tough, scuff-resistant, flexible and with consistent printability.
  - .2 Vinyl film on storefront glazing to have removable adhesive performance.
  - .3 Vinyl film on drywall hoarding board to have permanent adhesive performance.
  - .4 **Physical Characteristics:**

PROPERTY	VALUE
Caliper, face	3.4 mil (97 µm)
Caliper, adhesive	1.0 mil (25 µm)
Dimensional Stability	<0.065" (1.651mm)
Tensile at Yield	
Elongation	
Gloss Hunter Gloss @60	55 +/-10
Adhesion: 15 min Permanent	3.2 lbs/in (560N/m)
15 min Removable	1.0 lbs/in (175N/m)
Flammability	Self-extinguishing
Shelf Life	1 year
Durability Vertical Exposure	Unprinted-5year, Printed-up to 4 years
Min. Application Temperature	50°F (10°C)
Service Temperature	-40°- 180°F (-4°- 82°C) (Reasonable range of temp which would be expected under normal environmental conditions)
Chemical Resistance	Resistant to most mild acids, alkalis, and salt solutions

- .5 Apply a layer of luster laminate on top of the vinyl graphic film for protection.
- .13 **Alternate Products:**
  - .1 Conditions for Consideration: The Departmental Representative will consider the Contractor's request for comparable product/s when the following conditions are satisfied.

If the following conditions are not satisfied, the Departmental Representative may return requests without action, except to record noncompliance with these requirements:

- .2 Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
- .3 Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
- .4 Evidence that proposed product provides specified warranty or equivalent to specified product.
- .5 List of similar installations for completed projects with project names and addresses and names and addresses of designers and the Owner's representative, if requested.
- .6 Samples, if requested.

## 2.2 GENERAL

- .1 The designs contained within the Contract are the property of the Owner and The Consultant and may not be used for any other purpose without express written permission of the Owner.
- .2 Sign components presented in this document are for design intent purposes only. Shop drawings shall be provided by the Sign Contractor to be used as the final construction documents, and shall include complete construction, engineering and installation details required for implementing the designs described herein.
- .3 Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- .4 Do not scale drawings for dimensions. Sign Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. The Consultant to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- .5 The Signage Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Sign Contractor shall further warrant that all components, specified or required to satisfactorily complete the installation, are compatible with each other and with conditions of installations.
- .6 The Signage Contractor shall obtain and pay for all necessary permits and variances
- .7 Sign Contractor shall furnish all labor, materials, equipment, tools, supplies and services necessary and reasonably incidental to complete fabrication, installation and delivery of sign(s) as specified. Sign Contractor shall provide all materials, equipment, services, labor tools, and supplies to fulfill completion of this contract. Sign Contractor shall be responsible for a complete and thorough job. Materials not specifically described but required for a complete and proper installation shall be identified and provided for by the Sign Contractor. Sign Contractor shall be responsible for the quality of all materials and workmanship of any firms or individuals who act as his subcontractors. Sign Contractor shall be responsible for providing subcontractors with complete and up-to-date drawings, specifications, sign schedules and other information issued for this project. Sign Contractor shall be responsible for coordinating final review and approval of all copy wording with the Consultant prior to submittal of shop drawings.

- .8 Provide complete and comprehensive fabrication/installation liaison with all other trades. Where the Signage Contractor is providing graphics only, it shall be the Signage Contractor's responsibility to schedule his work to coincide with other trades' fabrication, finishing and installation schedules.
- .9 The Work shall be done in accordance with the highest standards of workmanship and good practice using top grade materials and all work will be done to the approval of the Owner. The Contractor will employ only appropriately qualified, skilled and experienced workers. The Contractor will be responsible for checking all dimensions of existing arrangements before putting the work in hand and in verifying the full scope of the work needed. The Contractor at no extra cost to the Owner will replace unsatisfactory work.
- .10 "Provide" means supply all labor, materials, equipment etc. necessary to complete the work. Unless otherwise noted the Contractor shall provide all materials, equipment, tools etc. to complete the work and all materials, fittings, equipment etc. provided by the Contractor and intended to remain as part of the work shall be new, in perfect condition, appropriate to the intended use, in good operating condition and otherwise able to contribute to a first class result. The contractor shall be responsible for the receiving, storing and security of all materials, equipment, tools etc. needed for the work and for bringing such to and away from the site of the work. The Contractor may benefit from the existing building services such as lighting, water and power supply, drainage, elevators, heating and cooling but only to the extent these are readily available without having adverse impact on the hospital's activities. If necessary the Contractor shall provide such additional amenities or services needed to implement the work such as temporary power or lighting as part of the work and at no extra cost.

## 2.3 SIGN STANDARDS

- .1 Graphics & Typography:
  - .1 All typographic layouts shall utilize typeface specified in each sign type drawing. The fonts are available as "OpenType" (OT), for Macintosh and/or DOS/Windows platforms from fontshop.com. The Contractor shall provide all variations of the fonts used for the project. No substitute fonts are to be used. Samples or mock-ups produced using a substitute font will be rejected.
  - .2 All sign messages must be submitted by the Sign Contractor to the Departmental Representative and Sign Consultant as a printed sign message schedule for verification prior to manufacturing of the signs.
  - .3 Letterforms and symbols shall be photographically or digitally rendered in precise, crisp, clean forms. All letterforms shall be free of hickies, nicks, discontinuous curves, line waves, cut or ragged edges, edge build-up, bleeding, surface pinholes, and other imperfections. Letterforms shall conform to the prescribed proportions of the typographic font(s) specified by the Consultant.
  - .4 All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings is for layout purposes only; final text for signs is listed in the Message Schedule or as shown in the Graphic Detail Package or Directional Content Plans.
  - .5 The letterform and messages to be used for all signs are identified by an example within the contract documents.
  - .6 All letter sizes specified are based on the height of the capital letter of the letterform except otherwise specified.
  - .7 Artwork for the symbol and pictograms identified in this document are available in electronic format from the Consultant and shall be requested and used by the Contractor.
- .2 Color

- .1 All inks and paints required for screened or imprinted surfaces shall be a type made for the surface material on which it is to be applied and recommended by the manufacturer of the ink or paint. Exact identification of all ink and paint shall be noted on the shop drawings, together with data describing the method of application, and, if other than "air" dried, drying.
- .2 Digital printing using AGFA Anapurna M2050 printer or approved equal – high speed UV curable inkjet system using UV inks in CMYK + LcLm + White, with pre and post-white capability on dark surfaces; good ink adhesion for high image longevity and outdoor resistance; direct printing to rigid and painted substrates up to 45 mm thick and 2050 mm wide borderless; direct printing to variety of roll media including film, vinyl, paper, canvas and banners; top quality printing at quality as high as 720 x 1440 dpi, capable of rendering crisp text as small as 4 and 6 point negative.
- .3 All screened inks shall be made by a manufacturer with experience in production and consistency of such inks for the purpose and surfaces involved.
- .4 No paint, ink, or lacquer that will fade, discolor or de-laminate as a result of proximity to UV light source shall be used.
- .5 All inks, paints and lacquers shall be evenly applied and without pinholes, scratches, peeling, application marks, etc.
- .6 Prime condition or other surface pre-treatments where recommended by the manufacturer shall be included in the work and noted on the shop drawings.
- .7 All sign surfaces shall be free of buckles, warping, oil canning effect and shall have faces of such flatness that when measured from corner to corner along the diagonal, the maximum deviation from the nominal plane of the surface shall not exceed 1/16" for measured distances of up to 6' - 0", and 1/8" for measured distances 6' - 0" and greater.

#### 2.4 FABRICATION

- .1 Design components to allow for expansion and contraction for a minimum material temperature range of 140 degree F, without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- .2 Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible unless otherwise indicated on the Contract Documents.
- .3 Shop fabricates all products so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- .4 Contact surfaces of connected members to be true. Assemble so joints will be tight and practically unnoticeable, without use of filling compound.
- .5 Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces to be smooth, flat and without oil-canning, free of rack and twist.
- .7 Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- .8 Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- .9 Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.



- .10 Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- .11 All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- .12 Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.
- .13 Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- .14 A suitable bond-break to be provided between all dissimilar materials to prevent galvanic reaction.
- .15 Product must be made accessible for quality control inspection at any time.
- .16 In so far as practicable, fabrication, assembly and fitting of the work shall be executed in the shop with the various parts or assemblies ready for installation on site; keeping work done on site to a minimal. Work that cannot be shop assembled shall be given a trial fit at the shop to insure a proper and expeditious field assembly
- .17 Illuminated sign boxes – Sign Casings
  - .1 Design, construct and reinforce sign casing to provide strong, rigid, self-supporting, weather-tight, light-tight housing to accommodate sign faces and electrical components. Weld or mechanically fasten all intersecting members.
  - .2 Provide access for installation, maintenance, and re-lamping through hinged sign face or removable panels.
  - .3 Provide for thermal movement, heat and moisture dissipation by approved non-staining, concealed methods.
  - .4 Fabricate overhead hangers, wall brackets, wall fasteners for installation. Exposed materials to match sign casing: concealed material to be aluminum or steel with rust inhibitive finish.
  - .5 Contractor is to ensure that there are no light leaks.
  - .6 Illumination to be tested prior to installation.

### 3.0 EXECUTION

- .1 The Signage Contractor will schedule the Work, as required to suit the operation of the Facility. All costs for overtime, initially scheduled or not, are deemed to be included in the Signage Contractor's price.

### 3.1 INSTALLATION

- .1 Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- .2 Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned,

- signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact the Project Manager for clarification.
- .3 Contractor shall own and be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
  - .4 Remove or correct signs or installation work the Departmental Representative determines as unsafe or as an unsafe condition.
  - .5 At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
  - .6 Locate signs as shown on the Location Plans.
  - .7 Certain signs may be installed on glass. A blank vinyl back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank vinyl back up is to be the same size as sign being installed.
  - .8 Contractor will be responsible for verifying that at each sign location there are no utility lines that will be affected by installation of signs. Any damage to utilities during installation of signs will be the sole responsibility of the Contractor to correct and repair.
  - .9 Furnish inserts and anchoring devices that must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.
  - .10 Sign Contractor to be responsible for signage internal wiring and electrical and data cable hook-up. Coordinate with General Contractor for all source power which will be supplied.
  - .11 The Sign Contractor is to protect goods supplied by him from damage during installation with appropriate insurance against fire, theft, or other damage. He shall also protect from injury the property of the Departmental Representative, which may be adjacent, or with which he may come in contact, and he shall make good any such damage occurring through his fault.
  - .12 The Sign Contractor shall not use any hazardous substances in the manufacture of the signs, nor bring on site any hazardous substances, regulated under any environmental laws, without the express written consent of the Departmental Representative.
  - .13 All exterior structure to support signage is the responsibility of the signage contractor. Coordinate with General Contractor for necessary blocking, plates or supports within the walls.
  - .14 When installing signs in the vicinity of building expansion joints, consideration to be given to the movement created by the joints.
  - .15 The Contractor shall comply with all building rules of the Departmental Representative including any specific requirements of scheduling or concerning health, safety and construction, including the wearing of appropriate personal protection such as safety shoes, hard hats, eye protection and gloves in the work area. The Contractor shall be responsible for knowing all of these rules prior to the commencement of work. The Contractor shall arrange the delivery and removal of equipment and material with the Departmental Representative so as to minimize interference with the building's normal operation.

- .16 Any interaction with any existing building condition that is deemed necessary for the proper construction, fabrication or installation of the work under this contract must be brought to the attention of the Departmental Representative immediately and prior to the commencement of any work. This includes, but is not limited to, any demolition, patching of existing conditions and any disruption or modification of any building mechanical, electrical or other system.
- .17 The Contractor will control and confine odors, dust and debris to the work area at all times. Daily clean up on a continual basis is required. The Contractor must protect the facility including people and equipment, surrounding finishes etc. from odors, dust, damage or injury etc. Any claims for damages to such areas shall be charged back to signage contractor.
- .18 The Contractor will take all necessary precautions including scanning for buried services to avoid any unintended consequences and make good the affected materials and assemblies.
- .19 The successful Contractor is to protect goods supplied by him from damage during installation and shall also protect from injury the property of the Departmental Representative or others which may be adjacent or with which may come in contact and shall make good any such damage occurring through the contractor fault. It shall remain their property until such time as the installation is completed and accepted by the Departmental Representative and the vendor shall protect his goods with appropriate insurance against fire, theft, or other damage.
- .20 Sign locations as shown on location drawings are for general information only. Sign Contractor is to co-ordinate with the Consultant for the final onsite locations. All signs are to be located with the use of numbered tags corresponding to the sign numbers.
- .21 At no time must a sign be placed so that it can interfere with sight lines of Security cameras in place or obstruct access to control boxes or equipment.

### 3.2 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
  - .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
  - .2 Leave signs clean.
  - .3 Remove debris from interior of sign boxes.
  - .4 Touch up damaged finishes.
- .2 Waste Management: separate waste materials for reuse] and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION 10 14 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Rough Carpentry Section 06 20 00
- .2 Toilet & Bath Accessories Section 10 28 10

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A 167-2004, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA-B651-04, Accessible Design for the Built Environment.
- .5 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 Certification Bodies.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature for toilet partitions or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate fabrication details, plans, elevations, hardware, and installation details.
- .4 Samples:
  - .1 Submit duplicate 300 x 300mm samples of panel showing finish on sides, two finished edges and core construction.
  - .2 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.
- .5 Sustainable Design Submittals:
  - .1 LEED Canada-CI Version 1.0-2007 submittals: in accordance with Section 01 35 21 -

LEED Requirements.

- .6 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
  - .2 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
- .7 Closeout Submittals:
  - .1 Provide maintenance data for plastic laminate for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Departmental Representative in accordance with 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.
- .2 Installers: Factory-trained personnel having a minimum of five (5) years proven experience in the installation of toilet partitions for projects of similar size and complexity.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Protect finished laminated plastic surfaces during shipment and before and during installation. Store flat and blocked off the floor in a protected area. Do not remove protective wrappings until immediately prior to final inspection.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 35 21 – LEED Requirements.

2.2 MATERIALS

- .1 Overhead Braced type laminated plastic toilet partitions.
- .2 Laminated plastic sheets: GP grade, colour and pattern to match Octolam #180 Misty Dreams, White.
- .3 Core material:
  - .1 FSC Certified.
  - .2 Urea-formaldehyde free.

- .4 Laminated plastic adhesive: as recommended by toilet partition manufacturer. to CAN/CGSB-71.20.
  - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.
  - .2 Urea-formaldehyde free.
    - .1 Recycled content: In accordance with Section 01 35 21 - LEED Requirements.
- .5 Sealer: water resistant sealer or glue as recommended by laminate manufacturer.
  - .1 Sealer: maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .6 Headrails: not less than 24 mm x 40 mm, clear anodized, extruded aluminum, anti-grip, anti-swing design fasten to plasters from both sides.
- .7 Pilaster shoe/ceiling trim: 0.8 mm stainless steel, 150 mm high.
- .8 Attachment: stainless steel tamper proof type screws and bolts.

## 2.3 COMPONENTS

- .1 Hinges:
  - .1 Heavy duty, commercial duty.
  - .2 Material/finish: stainless steel casting.
  - .3 Swing: As shown on drawing.
  - .4 Adjustable to hold door open at any angle up to 90 degrees.
  - .5 Emergency access feature.
- .2 Latch set: surface mounted, heavy duty slide latch, door-stop, keeper and bumper, stainless steel, emergency access feature.
- .3 Wall and connecting brackets: stainless steel extrusion or casting.
- .4 Coat hook: rubber tipped hook and rubber door bumper, stainless steel.
- .5 Door pull: Barrier-free type suited for out swinging doors, stainless steel.
- .6 All stainless steel components to be Satin finish.

## 2.4 FABRICATION

- .1 Doors, panels and screens: 19 mm thick, composite plastic laminate panels, to sizes indicated.
- .2 Pilasters: 32 mm thick, constructed same as door, to sizes indicated.
- .3 Laminate plastic to core material ensuring core and laminate profiles coincide to provide continuous support and bond over entire surface.
- .4 Finish edges of composite laminated plastic panels with same laminated plastic strip channel edging and mitre corners.
  - .1 Chamfer exposed edges uniformly at approximately 20 degrees.
- .5 Provide formed and closed edges for doors, panels and pilasters.
  - .1 Mitre and weld corners and grind smooth.
- .6 Provide internal reinforcement at areas of attached hardware and fittings.
  - .1 Temporarily mark location of reinforcement for grab bars.

### 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 INSTALLATION

- .1 Ensure supplementary anchorage, if required, is in place.
- .2 Do work in accordance with CSA-B651.

#### 3.3 ERECTION

- .1 Partition erection:
  - .1 Install partitions secure, plumb and square.
  - .2 Leave 12 mm space between wall and panel or end pilaster.
  - .3 Anchor mounting brackets to masonry or concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes.
  - .4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.
  - .5 Provide for adjustment of floor variations with screw jack through steel saddles made integral with pilaster. Conceal floor fixings with stainless steel shoes.
  - .6 Equip outswinging doors with door pulls on of door in accordance with CSA-B651.
  - .7 Install hardware, grab bars.
- .2 Floor supported and overhead braced partition erection:
  - .1 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device.
  - .2 Secure pilaster shoes in position.
  - .3 Secure headrail to pilaster face with not less than two fasteners per face.
  - .4 Set tops of doors parallel with overhead brace when doors are in closed position.
- .3 Screen erection:
  - .1 Provide urinal screens consisting of panel as indicated.
  - .2 Anchor screen panels to walls with 2 panel brackets.

#### 3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

#### 3.5 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.

**1.0 GENERAL****1.1 RELATED REQUIREMENTS**

- |    |                                     |                   |
|----|-------------------------------------|-------------------|
| .1 | Door Hardware                       | Section 08 71 00. |
| .2 | Gypsum Board Assemblies             | Section 09 21 16. |
| .3 | Acoustical Ceilings for Minor Works | Section 09 51 99. |
| .4 | Resilient Flooring for Minor Works  | Section 09 65 99. |
| .5 | Electronic Safety & Security        | Division 28.      |

**1.2 REFERENCES**

- |    |  |
|----|--|
| .1 | Aluminum Association Designation System for Aluminum Finishes - 2008.  |
| .2 | ASTM International   |
| .1 | ASTM A 653/A 653M- 09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.   |
| .2 | ASTM E 90- 09, Standard Test Method for Laboratory Measurement of Airborne - Sound Transmission Loss of Building Partitions, and Elements.   |
| .3 | Canada Green Building Council (CaGBC)  |
| .1 | LEED Canada-NC Version 1.0- 2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007). |
| .2 | LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.   |
| .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 Certification Bodies.   |
| .5 | Health Canada / Workplace Hazardous Materials Information System (WHMIS)   |
| .1 | Material Safety Data Sheets (MSDS).  |
| .6 | Underwriters Laboratories of Canada (ULC)  |
| .1 | CAN/ULC-S102- 07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.  |

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- |    |   |
|----|---|
| .1 | Submit in accordance with Section 01 33 00 - Submittal Procedures.  |
| .2 | Shop Drawing  |
| .1 | Submit engineered shop drawings. All shop drawings to be signed sealed by Professional Engineer Licensed in B.C. Designs and fabricate work in accordance with NBC 2010. VBBL 2007. The said professional engineer to submit schedule B & C-B according to VBBL 2007. |
| .3 | Product Data:   |
| .1 | Submit manufacturer's printed product literature and data sheets for post and panel   |



demountable partitions and include product characteristics, performance criteria, physical size, finish and limitations.

- .4 Samples:
  - .1 Submit one representative model of partition.
    - .1 Indicate basic construction, glazed sections, door frames, trim, and finishes.
  - .2 Submit duplicate 200 x 300 mm samples of panel colours, textures and finishes and 300 mm long samples of trim options for colour selection by Departmental Representative.
  - .3 Submit sample of ceiling fixing device.
- .5 Test Reports:
  - .1 Submit test reports in accordance with Section 01 45 00 - Quality Control, from approved independent testing laboratory, certifying partition system complies with sound transmission rating, fire hazard classification as specified.
- .6 Sustainable Design Submittals:
  - .1 LEED Canada- NC Version 1.0 CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 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 amount of construction wastes that are recycled or salvaged.
  - .3 Recycled Content: submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
  - .4 Wood Certification: submit Chain-of-Custody Certificate number for FSC certified wood.

#### 1.4 QUALITY ASSURANCE

- .1 Sustainable Standards Certification:
  - .1 Certified Wood: submit listing of wood products and materials used in accordance with FSC-STD-01-001.
- .2 Partition System: GREENGUARD.  
Indoor Air Quality Certified.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect post and panel demountable partitions from nicks, scratches, and blemishes.

- .3 Replace defective damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## 2.0 PRODUCTS

### 2.1 DESIGN REQUIREMENTS

- .1 Partition System:
  - .1 Fully demountable and relocatable, with interchangeable standardized fascia units which can be rearranged in any desired combination within a given wall space. Partition system is capable of accommodating dissimilar fascia types (including finishes) and elevations on each on each separate side of a partition and partition (panel) section.
  - .2 Non-progressive, allowing for removal and reinstallation of panels from either side of partition and at any given point on an individual panel in a given panel run without disturbing adjacent panels.
- .2 Components: non-combustible, distortion free, uniform in dimension, construction and appearance, made to suit specific function and to have been proven in use.
- .3 Partition heights:
  - .1 Ceiling height: 3200 mm.
  - .2 Partition system shall accommodate floor and ceiling height variances of up to 95mm, including 80mm expansion and 12mm compression. Frame must permit on-site height modifications for reconfiguration to location with alternate ceiling height in a seismic zone.
- .4 Partition module: core widths range from 305mm-1220mm with 25mm increments.
- .5 Minimum sound transmission rating of installed panel partition: tested to ASTM E 90, STC 40 for solid full panel and STC 38 for glazed full panel, without the aid of acoustical batting.
- .6 Vertical load capacity: Comply with ANSI/BIFMA X5.6, maximum load capacity of 750 lbs per panel to a maximum of 1440 lbs per 4875mm partition run length.
- .7 Flame spread rating: Able to achieve up to Class A rating when tested in accordance with ASTM E 84.
- .8 Partition system shall be erected and disassembled in a manner to prevent damage to finished surfaces, including floors, walls, ceilings, columns, windows mullions, bulkheads, and exterior curtain wall profiles including convection units.
- .9 Partition system to accommodate field-installed vertical and horizontal power and communications wiring without restriction to locations and power and communications junction boxes within panel faces on either one or both sides without damage to walls, ceilings, or any other base building surface.
- .10 Partition system shall interface between the floor, ceiling and base building construction in a non-destructive way providing a tight fit.
- .11 Partition system shall be nominally 102mm thick and provide 63.5mm of clear and accessible

interior cavity to facilitate dating and electrical.

- .12 Partition system shall provide non-visible methods of panel attachment and connection.
- .13 Partition system must be capable of dismantling into component parts for ease of distribution, installation, inventory and storage.

## 2.2 MATERIALS

- .1 Aluminum extrusions: Aluminum Association alloy AA 6063-T5.
- .2 Galvanized steel sheet: furniture grade to ASTM A 653/A 653M with Z275 zinc coating.
- .3 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, FSC Certified.
  - .1 Particleboard resin to contain no added urea-formaldehyde.
    - .1 Minimum 10 % by weight of recycled material in core of finished product.
- .4 Sound and light seal: self-adhesive, closed cell, inorganic, permanently elastic, sponge type stripping, 12 x 12 mm size.
- .5 Glass and glazing materials: to Section 08 80 50 - Glazing.
- .6 Acoustical sealant : type recommended by partition manufacturer to achieve STC rating specified.
- .7 Laminated Plastic: to NEMA LD3, Grade VGS.

## 2.3 COMPONENTS

- .1 General framing and retaining components: steel. Metal thickness and configuration to provide rigidity, safe support and fixing of partition system.
- .2 Vertical posts and horizontal rails:
  - .1 Steel, 28mm x 58mm face width, concealed type, pre-punched for vertical and horizontal wire management.
  - .2 All posts shall provide concealed integrated slotting to partition structure for furniture, mounted storage and accessory integration.
  - .3 Universal posts used to create all door and product elevations in glass, solid or combination panel finishes and to create 2, 3 and 4-way connections. Posts shall allow for reconfiguration of finishes, elevations and configuration on site.
- .3 Solid fascia with low-pressure laminated plastic faced particle board.
- .4 Floor channels: Modular steel channels, with integrated non-damaging floor gripper. Can be removed without removing adjacent panels.
- .5 Ceiling channels: Minimum 3050mm continuous steel channels, pre-punched to accept multiple ceiling attachment methods in a non-damaging manner and for ease of wire management distribution.
- .6 Partition, base and ceiling trim: Recessed, black PVC, approximately 3" (75mm) high, continuous, snapped onto flange of floor and/or ceiling track.
- .7 Glazed Fascia
  - .1 Frame to be extruded aluminum for double-glazed unit.

- .2 Glazing to be nominal 6mm thick tempered clear glass.
- .3 Glazed fascia to be full-height glazed panel, factory-assembled and be delivered to site complete and ready for installation.
- .8 Door frames: extruded aluminum for doors 45 mm thick, 890 mm wide.
  - .1 Prepare for hardware specified in Section 08 71 00 - Door Hardware.
  - .2 Include 3 resilient buttons on strike side.
- .9 Door units shall be interchangeable with like-sized panels using the same frame components as panels. Pivot doors shall be designed with non-handed, reconfigurable door leaf, reversible in the field without additional modifications or materials.
- .10 Solid doors shall be architectural quality, industry standard, solid particle board tube core.
- .11 External corners: polyester wrapped MDF to match panels.
- .12 Accessories: plastic extrusions, miscellaneous trim, battens, fasteners, clips, runners or tracks, levelling devices, and other accessories required for installation as recommended by partition manufacturer.

## 2.4 FINISHES

- .1 Aluminum:
  - .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
    - .1 Clear anodic finish: designation AA- M10 A31.
  - .2 Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 2, and Protective and Decorative.
- .2 Steel:
  - .1 Concealed steel components: apply 1 coat CAN/CGSB-1.81 baked primer.
- .3 Particle board (panel & door):
  - .1 Low-pressure laminated plastic, stainless steel look as selected by Departmental Representative.

## 3.0 EXECUTION

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive post and panel demountable partitions previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's 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 from Departmental Representative.

### 3.2 ERECTION

- .1 Install system after floor finishes and in accordance with manufacturer's instructions.
- .2 Fasten runners to floors, ceiling and abutting vertical surfaces.
  - .1 At ceilings use fasteners that rigidly support partition without damaging or defacing ceiling

panels or grid system members.

- .3 Erect partitions plumb, square and level.
  - .1 Accurately fit and fasten to abutting surfaces.
  - .2 Shim under partitions at uneven floors to ensure level installation.
- .4 Install continuous light/sound seal at junction of ceiling height partitions with floors, ceilings and abutting walls and vertical surfaces.
- .5 Seal partitions in accordance with Section 07 92 00 - Joint Sealants and Section 01 35 21 - LEED Requirements.

### 3.3 ADJUSTING

- .1 Adjust post and panel demountable partitions fit accurately in accordance with manufacturer's written recommendations.

### 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 21 - Construction/Demolition Waste Management and Disposal and 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by post and panel demountable partitions installation.

END OF SECTION 10 22 19

## 1.0 GENERAL

### 1.1 RELATED REQUIREMENTS

- |    |                             |                     |
|----|-----------------------------|---------------------|
| .1 | Rough Carpentry Minor Work  | Section 06 08 99    |
| .2 | Finish Carpentry            | Section 06 20 00    |
| .3 | Glazing                     | Section 08 80 50    |
| .4 | Plastic Toilet Compartments | Section 10 21 13.19 |

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM A 167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM B 456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .3 ASTM A 653/A 653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 ASTM A 924/A 924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
  - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
  - .3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .4 CSA International
  - .1 CAN/CSA-B651-04, Accessible Design for the Built Environment.
  - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

### 1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.
- .5 Sustainable Standards Certification:
  - .1 Low-Emitting Materials: submit listing of laminate adhesives used in building, verifying that they contain no urea-formaldehyde.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Tools:
  - .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
  - .2 Deliver special tools to Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Sheet steel: to ASTM A 653/A 653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A 167, Type 304, with satin finish.
- .3 Sustainability Characteristics:
  - .1 Laminate Adhesives.
    - .1 Urea Formaldehyde Free.
- .4 Stainless steel tubing: Type 304, commercial grade, seamless welded 1.2 mm wall thickness.
- .5 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 INTERIOR FINISH MATERIAL & COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and my list specific manufacturers related to style and quality upon which the scheme for the project is based.
- .2 The following component specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

### 2.3 COMPONENTS

- .1 Toilet tissue dispenser (TTD) side by side double roll type, surface mounted, brushed stainless steel frame, capacity of 3000 double ply sheets, transfer paddle, locking dispenser for coreless roll use.
- .2 Paper towel Dispenser & Disposal (PTDD): Hands-free type for jumbo roll towels max 200mm diameter . Stainless steel type 304 #4 brushed finish. Safety guarded stainless steel saw tooth cutting bar. Full length SS piano hinges for door c/w two tumbler keyed locks. Include removable galvanized steel liner (26 ga). Operates with plug in AC adaptor.
- .1 PTDD-1: Fully recessed, extra-large capacity (47 litre).
- .2 PTDD-2: Semi-recessed, extra-large capacity (47 litre).
- .3 PTDD-3 Fully recessed, large capacity (18 litre).
- .3 Soap Dispenser (SD): Sensor-operated soap dispenser spout assembly in chrome-plated plastic with LED indicators for low soap and low battery. Complete with soap bottle of 765 gram capacity. Dispenser shall be able to dispense minimum 0.7 grams of lotion soap with moisturizer each shot. Battery infrared metering activation with 51/2" spout.
- .4 Grab Bars (GB): 30/32 mm dia x 1.6 mm wall tubing of stainless steel, 38 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2kN. Configurations and sizes as indicated.
- .1 GB1 (Toilet Side Wall Grab Bar): 915mm L.
- .2 GB2 (Toilet Back Wall Grab Bar): 610 mm L, horizontal installation.
- .3 GB3 (Urinal Side Grab Bars, 2 nos.): 610 mm L, vertical installation.
- .5 Sanitary Napkin Disposal (ND): Stainless Steel Type 304 recessed Type with coverall door, removable leak proof plastic waste bin. Self-closing counter balanced door secured to recessed body. Recessed body to be corrosion resistant galvanized steel.
- .6 Mirror (MR)
- .1 For Unit Washrooms: One-piece channel frame is 13 x 13 x 9.5 mm with bright polished finish and mitred corners. No.1 quality, 6mm glass mirror electrolytically copper plated; guaranteed against silver spoilage for 10 years. Mirror corners and back protected by shock absorbing material. Back is galvanized steel, secured to concealed wall hanger with two theft-resistant locking screws.
- .2 For all other washrooms: to CAN/CGSB-12.5, float glass, 6mm thick unless indicated otherwise, edges ground and polished.
- .7 Shelf (SH): 11 gauge, Type 304, 18-10 stainless steel with surface treatment to minimize finger marks. Size to be 120 x 600mm, complete with mounting hardware.
- .8 Baby Changing Station (BCS): Surface-mounted wall unit brushed 20 gauge stainless steel exterior with bacterial-resistant polyethylene body. To support static load of 250 lbs minimum. To ASTM F2285. Liner dispenser, cam-buckle safety belt, pneumatic gas shock mechanism for smooth, safe



open and close motion. Safety instructions in both official languages, graphic illustration, labeled with universally accepted symbol.

#### 2.4 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

#### 2.5 FINISHES

- .1 Chrome and nickel plating: to ASTM B 456, satin finish, U.O.N.
- .2 Manufacturer's or brand names on face of units not acceptable.

#### 3.0 EXECUTION

##### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.
- .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 from Departmental Representative.

##### 3.2 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
  - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
  - .2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.
  - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
  - .4 Toilet and shower compartments: use male to female through bolts.

- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.
- .5 Install mirrors in accordance with Section 08 80 50 - Glazing.

### 3.3 ADJUSTING

- .1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

### 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 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.5 PROTECTION

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

### 3.6 SCHEDULE

- .1 Locate accessories where indicated on drawings. Exact locations to be confirmed by Departmental Representative.

## 1.0 GENERAL

### 1.1 DOCUMENTS

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

### 1.2 SECTION INCLUDES

- .1 Motorized rolled-cloth solar shades at Passport Office storefront.

### 1.3 RELATED REQUIREMENTS

- .1 Rough Carpentry for Minor Works                      Section 06 08 99
- .2 Aluminum Doors and Frame                                  Section 08 11 16

### 1.4 PERFORMANCE REQUIREMENTS

- .1 Shade cloth: Comply with CAN/ULC S102-M; Flame Spread, 25; Smoke Developed, 50 and pass NFPA-701 criteria for small or large scale test as required by the Fire Marshall.

### 1.5 SUBMITTALS

- .1 Product Data: required for shade mechanism and shade cloth.
- .2 Shade cloth Samples: Two of type and pattern, each 300 mm square.
- .3 Shop drawings including details for required installations.
- .4 Filed Sample: Install full size shade cloth sample in opening as directed for final verification of fabric color, weave and density.

### 1.6 QUALITY ASSURANCE

- .1 Prior to fabrication, verify actual opening dimension; adjust shade dimensions for required fit.
- .2 Provide complete assemblies produced by one manufacturer for each type required including hardware, accessories items, and mountings.
- .3 Pre-installation Conference: Coordination of trades and installation requirements.

### 1.7 WARRANTY

- .1 Provide manufacturer's 1 year warranty from date of Substantial Completion.

## 2.0 PRODUCTS

### 2.1 INTERIOR FINISH MATERIAL & COLOUR SCHEDULE

- .1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental

Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in Finish schedule or an approved alternative.

## 2.2 MOTORIZED SHADING SYSTEM

- .1 Motorized Shade: Provide motorized shading system utilizing linear motor, fabloc tube and all necessary electrical accessories for switch or automatic operation in accordance with the control specifications. Electrical equipment shall be installed by the electrical contractor and all control and power wiring by him as indicated in section 16 of the specifications.
- .2 Internal Limit Switches: to be adjusted by two hex key limit switches to allow exact setting of stop position in both the raise (top) and lower (bottom) positions. Micro switches provide circuit breaking at the end of the run. Limit switch setting cannot be distributed by the action of the roller tube.
- .3 Brake: Solenoid activated disc brake mechanism stops and holds in any position. Brake automatically disengages when motor is operating.
- .4 Motor- Asynchronous: with built in reversible capacitor start and run, made to be operated with 95-125V-AC at 60Hz. Single Phase. D.C. motor not acceptable. Temperature Class A (maximum temperature rating 140 degrees C). Thermally protected, totally enclosed. Motor operator shall be concealed inside tube. Maintenance free. CSA and UL APPROVED.
- .5 Gear Box: 3 levels of satellite gears for load distribution, planetary type gears machined to close tolerance of tempered steel. Speed varies according to model from 12 RPM to 30 RPM.
- .6 Installation: Two screws lock the drive end wheel of the motor to the tube. A notched section in the tube turns the ring which activates the shade assembly. Upper and lower stop positions are adjusted with hex key limit switches located on motor end.
- .7 Controls:
  - .1 Maximum two motors shall be operated by a white three position rocker switch, located remotely as directed by the Departmental Representative. Where required, motors shall be hooked up to a "Motor Group Control" (M.G.C.) located as shown on the Manufacturers wiring diagrams. Shade manufacturer shall supply the switch and "M.G.C." for installation and hook-up by the electrical contractor, CSA and UL approved. Brushed stainless steel switch cover plates (1, 2, 3, or 4 gang).
  - .2 Control type to be timer-operated, control located at Front Storage (#1018-B) next to door.

## 2.3 HARDWARE & ACCESSORIES REQUIRED FOR TOTAL INTEGRATED SYSTEM

- .1 Fabloc Tube: Extruded aluminum tube, 6063-T5 alloy, 65 mm O.D. tube with internal keyway to receive tubular motor. Tube shall be extruded with two fabric mounting channels. Channels shall be designed to accept fabloc spline. Long span fabloc tube where needed.
- .2 Fabloc Spline: Extruded vinyl with asymmetrical locking channels and embossed fabric guide, for use with 65 mm O.D. tube. Spline shall be snapped and locked into fabloc tube and have sufficient capacity to support fabric shade. Spline shall be readily removable without dismounting fabloc tube from end brackets.
- .3 End Brackets (Drive and Idler): Shall consist of 3 mm thick sheet steel. Wall jamb or ceiling

mounted as required. Shall be permanently installed and accept fascias.

- .4 Fabloc Tube End Plug: Delrin end cap shall have steel pin which permits up to 8 mm lateral adjustment in tube width.
- .5 Fascia: Provide extruded 6063-T5 aluminum fascia with clear anodized finish. Fascia shall bang on to extrude aluminum mounting clips and brackets without any exposed fastening devices. Fascia will not cover the top of the bracket when banged in place so as to ensure airflow over the top of the shade and bracket assembly.
- .6 Closure: Provide extruded 6063-T5 aluminum closure hanger and closure cover with clear anodized finish, fastened inside the pocket. Pocket and blocking shall be supplied by others.
- .7 Hembar: Extruded 6063-T5 aluminum, clear anodized with plastic end finials. Exposed type.
- .8 Finishes: All exposed aluminum parts have clear anodized finish. Steel parts are either zinc plated, satin coat finish, or have been bonderized prior to painting with baked, enamel finish.

#### 2.4 SHADING FABRIC

- .1 Shade cloths shall be woven of .018 opaque, vinyl coated polyester yarn consisting of approximately 79% vinyl and 21% 500 denier polyester core yarn. The fabric shall be tensioned in the finishing range prior to heat setting to keep the warp ends straight and minimize or eliminate weave distortion to keep the fabric flat. The fabric shall be dimensionally stable. Colour to be as selected from standard range.

Openness Factor		6% + 0%
		-1%
Weight per/sq./yd		19 oz.
Warp ends per inch		36
Fill ends per inch		30
Stretch % (271 lb.wt.):	WARP	2 %
	FILL	3%
Set %	WARP	1.5%
	FILL	1.5%
Abrasion Resistance	YARN	NONE
(500 Tarber Cycles)	RUPTURE	NONE
	WEAR	TRACE
U.V. Deterioration:	FADE	NONE
(200 Sun Fade Hours)	TENSILE	
	RETENTION	96%

- .2 Performance: As a "shade cloth" the fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than + 3 mm in either direction due to warp distortion, or weave design.
- .3 Flame Retardance: Fabric shall be certified by an independent Laboratory to pass the Small Scale Vertical Burn Requirement test CAN and ULC-S109-M98, and NFPA 701 small scale.

2.5 FABRICATION

- .1 Prior to fabrication, verify actual opening dimensions by on-site measurement. Calculate blind dimensions to fit within specified tolerances.
- .2 Fabricate blinds to fill openings from head to sill and jamb to jamb. Measure in several places. The clearance blind-to-blind shall be 3 mm minimum. Locate blind divisions at mullions.

3.0 EXECUTION

3.1 EXAMINATION

- .1 Install units to comply with manufacturer's instruction to type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories.
- .2 Tolerance: Deviation from vertical not more than 6 mm in 2440 mm. Maximum offset from level 1.5 mm in 1525 mm. Alignment of adjacent shades, maximum offset of 3 mm.
- .3 Verify that the work in which the blinds will be installed is free of conditions that interfere with blinds installations and operations. Begin blind installation only when unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Install blinds in accordance with manufacturer's instruction.
- .2 Secure with non-corrosive fasteners, concealed in final assembly.
- .3 Install blinds square, plumb, true to line with operable parts adjusted for correct function.
- .4 Include centre brackets where necessary to prevent deflection of headrail.
- .5 Adjust to provide for operation without binding.
- .6 Demonstrate blinds to be in smooth, working order.

3.3 COORDINATION

- .1 Coordinate the motor power characteristics, wiring, connections and operating control system requirements in accordance with manufacturer's installation specifications and a power source connection point by others in accordance with Division 26-Electrical.
- .2 Coordinate where the motorized shading systems' operating control device station are to be located and mounted. Refer to the Drawings and Owner's building automation system requirements.

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX A**

**PRE-RENOVATIONS HAZARDOUS BUILDING  
MATERIAL AND SURVEY REPORT**

Public Works and Government Services Canada  
Suite 641 – 800 Burrard Street  
Vancouver, B.C.  
V6Z 2V8

December 4, 2012

Attention: Mrs. Amy Moizumi, B.Sc, (Agr)  
Environmental Specialist, Environmental Services

Subject: Final Hazardous Building Materials Assessment – Sinclair Center 757  
West Hastings Street, Vancouver, British Columbia

DST File No.: BE-VC-015575

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## **1.0 INTRODUCTION**

DST Consulting Engineers Inc. (DST) is pleased to provide the results of our Hazardous Building Materials Assessment that was completed in select areas of the Sinclair Center located in Vancouver, British Columbia (to be referred to hereafter as “the Subject Building”). The scope of our hazardous materials assessment is detailed on drawings, presented in **Appendix II**.

The assessment was completed to identify the presence or absence of Asbestos-Containing Materials (ACMs), Lead-Based Coatings (LBCs), Polychlorinated Biphenyls (PCBs), Ozone-Depleting Substances (ODS), Mould Amplification, Animal Waste, Crystalline Silica and Elemental Mercury in preparation for renovation activities, and to provide appropriate recommendations based on the findings of our assessment.

The assessment was completed on November 5 and November 6, 2012 by David Kernel, CLI, CLRA, Environmental Technologist of DST.

This report provides an outline of applicable regulations and guidelines, our methodology, the results of the assessment, and conclusions with appropriate recommendations.



## **2.0 REGULATIONS AND GUIDELINES**

### **2.1 Federal Regulations**

#### **2.1.1 Canada Labour Code**

In federal jurisdictions, hazardous building materials are regulated under the *Canada Labour Code, Part II, Part X, Hazardous Substances*.

#### **2.1.2 Asbestos-Containing Materials (ACMs)**

ACMs are regulated under the *Canada Occupational Health and Safety Regulations, (SOR/86-304)*.

In addition, PWGSC Departmental Policy 057 provides specific requirements for the management and abatement of ACMs in PWGSC owned and leased facilities.

#### **2.1.3 Lead-Based Coatings (LBCs)**

The *Hazardous Products Act (HPA), Surface Coating Materials Regulation (SOR/2005-109)* provides regulatory requirements for the sale and labeling of surface coatings.

The Surface Coating Materials Regulation reduced the threshold for lead in paint from 5,000 mg/kg to 600 mg/kg, and in 2010, to 90 mg/kg. However, Provincial regulations do not require lead controls for surface coatings containing <600 mg/kg, as such, DST identifies a lead-based coating as a coating containing >600 mg/kg or >0.05 mg/cm<sup>2</sup> (by XRF analyzer).

#### **2.1.4 Halocarbon and Ozone Depleting Substances (ODS)**

Halocarbon and Ozone Depleting substances are regulated under the Canadian Environmental Protection Act (CEPA), "*Federal Halocarbon Regulations, 2003, (SOR/2003-289)*".

#### **2.1.5 Polychlorinated Biphenyl's (PCBs)**

PCBs are regulated under the Canadian Environmental Protection Act (CEPA), specifically under the "*PCB Regulations*" (SOR/2008-273), including amendments to December 8, 2011.

#### **2.1.6 Transportation of Dangerous Goods Act**

The Transportation of Dangerous Goods Act provides detailed requirements for the transportation of hazardous materials, including lead-containing wastes.

## **2.2 Provincial Regulations**

In British Columbia, the management of hazardous building materials in the work place is regulated by WorkSafeBC under the Workers' Compensation Act (effective April 15, 1998), as amended by the Workers' Compensation (Occupational Health and Safety) Amendment Act (effective October 1, 1999). Specific requirements of the Occupational Health and Safety Amendment Act are prescribed in the British Columbia Occupational Health and Safety (BC OH&S) Regulation.

### **2.2.1 Mould Amplification**

Mould-impacted building materials are regulated under Part 4, section 4.79 of the BC OH&S Regulation.

### **2.2.2 Elemental Mercury**

Mercury-containing equipment is regulated under Part 5, section 5.49 of the BC OH&S Regulation.

### **2.2.3 Crystalline Silica**

Section 6.111(1) of the OHS Regulation describes specific requirements for workplace exposure to crystalline silica (rock dust).

There is no specific exposure limit for "rock dust". Rather, there are exposure limits for the constituents of rock dust that pose a hazard to a worker's health, for example, crystalline silica. Crystalline silica is a designated substance and, therefore, the requirements of section 5.57 of the Regulation apply.

### **2.2.4 Hazardous Wastes**

In British Columbia, environmental matters pertaining to waste generally fall under the jurisdiction of the British Columbia Ministry of Environment (MoE), pursuant to the Environmental Management Act. The key waste regulation under the Environmental Management Act relating to hazardous building materials is the Hazardous Waste Regulation (HWR), as amended from time to time. The HWR provides the requirements for the proper handling, storage, transportation, treatment, recycling and disposal of hazardous wastes in the province. The regulation also outlines the materials and criteria to be used to characterize waste as hazardous.

### 3.0 METHODOLOGY

The site review and sampling was completed by DST on November 5 and November 6, 2012.

Suspect hazardous building materials were visually identified, based on the surveyor's knowledge of the historic composition of building products. Visual identification of materials suspected to contain hazardous materials were supported by the analysis of representative samples.

Suspect ACM samples were analyzed for asbestos content at Asbestos Analytical Services Ltd. (AASL) following the National Institute for Occupational Safety and Health (NIOSH) Method 9002.

Suspect LBCs samples were tested for lead content using a Niton X-Ray Fluorescence (XRF) spectroscopy detector. The Niton XRF is designed to detect and quantify the amount of lead present in painted surfaces. Measurements were made following Niton XRF standard operating procedures for lead in surface coating measurements.

Suspected ozone-depleting substances (ODSs), elemental mercury, sources of polychlorinated biphenyls (PCBs), mould amplification, animal droppings and crystalline silica were visually identified based on appearance, age, and knowledge of historic applications/locations.

### 4.0 FINDINGS

#### 4.1 Asbestos-Containing Materials (ACMs)

Forty eight (48) samples of suspect ACMs were collected and analyzed for asbestos content. Asbestos analytical reports are included in **Appendix I**. The sample descriptions and analytical results are summarized in **Table 1**, below. Drawings indicating sample point locations are presented in **Appendix II**.

Table 1: Analysis of Suspect ACMs Sinclair Center – 757 West Hastings Street, Vancouver, BC			
Sample I.D.	Sample Description	Sample Location	Asbestos Content & Type
SC-01	Blue Vinyl Sheet Flooring	Lower Mall / Food court corridor	None-Detected
SC-02	Red hard fire stop mastic around conduits	Lower Mall / Food court corridor	None-Detected
SC-03	Leveling compound near conduits	Lower Mall / Food court corridor	None-Detected
SC-04	Drywall Joint Compound	Lower Mall / Food court / "Fortune Wok"	None-Detected

<b>Table 1: Analysis of Suspect ACMs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>			
<b>Sample I.D.</b>	<b>Sample Description</b>	<b>Sample Location</b>	<b>Asbestos Content &amp; Type</b>
SC-05	Drywall Joint Compound	Front till walls / Lower Mall / Food court / “Fortune Wok”	None-Detected
SC-06	Drywall Joint Compound	Kitchen walls / Lower Mall / Food court / “Pita Fresh”	None-Detected
SC-07	Brown vinyl sheet flooring on walls	Wall / Lower Mall / Food court / “Pita Fresh”	None-Detected
SC-08	Teal 12x12 vinyl floor tile with mastic	Vacant unit beside Pita Fresh / Lower Mall / Food court lobby	None-Detected
SC-09	Drywall Joint Compound	Vacant unit beside Pita Fresh / Lower Mall / Food court lobby	None-Detected
SC-10	Double layer 12x12 vinyl floor tile	Change rooms / Lower Mall / Food court corridor	None-Detected
<b>SC-11</b>	<b>Red duct mastic</b>	<b>Ceiling space / Lower Mall / Food court lobby</b>	<b>1-10% Chrysotile</b>
SC-12	Drywall Joint Compound coating on concrete slab	Ceiling space / Lower Mall / Food court lobby	None-Detected
SC-13	Fire spray insulation	Ceiling space / Lower Mall / Food court lobby	None-Detected
SC-14	Drywall Joint Compound bulkhead	Ceiling space / Lower Mall / Food court lobby	None-Detected
SC-15	Drywall Joint Compound	North East wall / Lower Mall / Food court corridor	None-Detected
SC-16	Drywall Joint Compound	North East corner perimeter / Lower Mall / Food court lobby	None-Detected
SC-17	Drywall Joint Compound	Grey column / Lower Mall / Food court lobby	None-Detected
SC-18	Drywall Joint Compound	Kitchen wall / Lower Mall / Food court / “Miriams”	None-Detected
SC-19	12x12 vinyl floor tile Brown stripes	Lunch room / Lower Mall / Food court lobby	None-Detected
SC-20	Ceiling tile	Lunch room / Lower Mall / Food court lobby	None-Detected
SC-21	Drywall Joint Compound	Ceiling / Lower Mall / Retail unit 147	None-Detected
SC-22	Drywall Joint Compound	Ceiling / Lower Mall / North East men's washroom	None-Detected
SC-23	Drywall Joint Compound	Ceiling / Lower Mall / Retail unit 143	None-Detected
SC-24	Leveling compound	Floor doorway / Lower Mall / Retail Unit 146	None-Detected

<b>Table 1: Analysis of Suspect ACMs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>			
<b>Sample I.D.</b>	<b>Sample Description</b>	<b>Sample Location</b>	<b>Asbestos Content &amp; Type</b>
SC-25	Drywall Joint Compound	Walls / Lower Mall / Retail unit 146	None-Detected
SC-26	Grey 12x12 vinyl floor tile with mastic	Floor / Lower Mall / Retail unit 146	None-Detected
SC-27	Drywall Joint Compound	Ceiling / Lower Mall / Retail unit 146	None-Detected
SC-28	Drywall Joint Compound	Perimeter wall / Lower Mall / Retail unit 148	None-Detected
SC-29	Beige with brown 12x12 vinyl floor tile	Floor / Lower Mall / Food court corridor stairway	None-Detected
SC-30	Drywall Joint Compound	Column / Lower Mall / Retail unit 143	None-Detected
SC-31	Red mastic fire stop	Pipe penetrations / Wall / Lower Mall / Food court corridor	None-Detected
SC-32	Ceiling tile	Passport office / Upper Mall / Retail unit 241	None-Detected
SC-33	Drywall Joint Compound	East wall / Upper Mall / Retail unit 241	None-Detected
SC-34	Drywall Joint Compound	Column / Upper Mall / Retail unit 241	None-Detected
SC-35	Drywall Joint Compound	West wall / Upper Mall / Retail unit 241	None-Detected
SC-36	Drywall Joint Compound	Ceiling / Upper Mall / Retail unit 241	None-Detected
SC-37	Drywall Joint Compound	Demising wall / Offices / Upper Mall / Retail unit 250	None-Detected
SC-38	Drywall Joint Compound	North wall / Upper Mall / Retail unit 250	None-Detected
SC-39	Drywall Joint Compound	Bulkhead ceiling / Upper Mall / Retail unit 250	None-Detected
SC-40	Drywall Joint Compound	Ceiling / Upper Mall / Retail unit 250	None-Detected
SC-41	Drywall Joint Compound	North wall / Upper Mall / Retail unit 248	None-Detected
SC-42	Drywall Joint Compound	West wall / Upper Mall / Retail unit 248	None-Detected
SC-43	Drywall Joint Compound	East wall / Upper Mall / Retail unit 244	None-Detected
SC-44	Drywall Joint Compound	East wall / Upper Mall / Retail unit 244	None-Detected

<b>Table 1: Analysis of Suspect ACMs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>			
<b>Sample I.D.</b>	<b>Sample Description</b>	<b>Sample Location</b>	<b>Asbestos Content &amp; Type</b>
SC-45	Drywall Joint Compound	Hot water tank storage / Upper Mall / Hair Salon	None-Detected
SC-46	Drywall Joint Compound	Under stairs / Upper Mall / Hair Salon	None-Detected
SC-47	Drywall Joint Compound	Bulkhead above ceiling / Lower Mall / Food court	None-Detected
SC-48	Drywall Joint Compound	Walls / B2 – Federal Bldg / Room 6	None-Detected

Note: **Bold** print indicates asbestos-containing materials.

Based on the analytical results, the red HVAC duct mastic located in the ceiling space of the Lower Mall Food Court lobby was found to be asbestos-containing.

**NOTE: Cinder block walls were tested for visible signs of vermiculite insulation. Based on our findings, no asbestos-containing vermiculite insulation was identified in the cinder block walls of the Subject Building.**

## 4.2 Lead-Based Coatings

Suspect LBC samples that were determined to contain a concentration of lead equal to or > 0.05 mg/cm<sup>2</sup> were classified as LBCs, i.e., paints with hazardous levels of lead.

In total, DST identified eighty-nine (89) suspected LBCs in the Subject Building. A description of the coatings tested, sample point locations and analytical results are summarized in **Table 2 - Lead-Based Coatings Sample Analytical Results**, below.

<b>Table 2: Analysis of Suspect LBCs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>				
<b>Sample Number</b>	<b>Location / Description</b>	<b>Color</b>	<b>Result (mg/cm<sup>2</sup>)</b>	<b>Lead-Based Coating</b>
LS-01	Food court corridor / Cinder block walls	Green	0.02	No
LS-02	Food court corridor / Ceramic wall tiles	White	0.03	No
<b>LS-03</b>	<b>Food court corridor / Freight elevator door frame</b>	<b>Green</b>	<b>2.2</b>	<b>Yes</b>
LS-04	Food court corridor / Storage room wall	Beige	0.02	No
<b>LS-05</b>	<b>Food court corridor / South west entrance concrete wall</b>	<b>Green</b>	<b>0.06</b>	<b>Yes</b>
<b>LS-06</b>	<b>Fortune Wok / Ceramic floor tiles</b>	<b>Grey with Blue</b>	<b>3.0</b>	<b>Yes</b>

<b>Table 2: Analysis of Suspect LBCs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>				
<b>Sample Number</b>	<b>Location / Description</b>	<b>Color</b>	<b>Result (mg/cm<sup>2</sup>)</b>	<b>Lead-Based Coating</b>
LS-07	Fortune Wok / Ceramic wall tiles	Grey	0.03	No
LS-08	Fortune Wok / Drywall	White	0.03	No
<b>LS-09</b>	<b>Fortune Wok / 3x3 ceramic wall tiles</b>	<b>Beige with spots</b>	<b>0.28</b>	<b>Yes</b>
<b>LS-10</b>	<b>Fortune Wok / 3x3 ceramic wall tiles</b>	<b>Purple</b>	<b>0.14</b>	<b>Yes</b>
<b>LS-11</b>	<b>Fortune Wok / 3x3 ceramic wall tiles</b>	<b>Off white</b>	<b>1.1</b>	<b>Yes</b>
LS-12	Fortune Wok / Vertical support beam	Black	0.03	No
<b>LS-13</b>	<b>Pita Fresh / 12x12 ceramic floor tiles</b>	<b>Blue</b>	<b>14.1</b>	<b>Yes</b>
LS-14	Pita Fresh / Drywall	Teal	0.02	No
LS-15	Pita Fresh / Door and frame	Green	0.02	No
LS-16	Pita Fresh / 6x6 ceramic tiles	White	0.04	No
<b>LS-17</b>	<b>Pita Fresh / Ceramic wall tiles (front)</b>	<b>Brown</b>	<b>0.07</b>	<b>Yes</b>
<b>LS-18</b>	<b>Pita Fresh / Ceramic wall tiles (front)</b>	<b>Light brown</b>	<b>0.05</b>	<b>Yes</b>
LS-19	Pita Fresh / Front awning	Brown	0.02	No
<b>LS-20</b>	<b>Pita Fresh / 3x3 ceramic wall tiles (kitchen)</b>	<b>Light blue</b>	<b>1.4</b>	<b>Yes</b>
<b>LS-21</b>	<b>Pita Fresh / 3x3 ceramic wall tiles (kitchen)</b>	<b>Dark blue</b>	<b>22.7</b>	<b>Yes</b>
<b>LS-22</b>	<b>Vacant Restaurant / 3x3 ceramic wall tiles (front) (Gridline 19.5 – 21 / R.5 – X.5)</b>	<b>Peach</b>	<b>1.0</b>	<b>Yes</b>
<b>LS-23</b>	<b>Vacant Restaurant / 1x3 ceramic wall tiles (front) (Gridline 19.5 – 21 / R.5 – X.5)</b>	<b>Black</b>	<b>3.2</b>	<b>Yes</b>
<b>LS-24</b>	<b>Vacant Restaurant / 2x3 ceramic wall tiles (front) (Gridline 19.5 – 21 / R.5 – X.5)</b>	<b>Blue</b>	<b>1.1</b>	<b>Yes</b>
LS-25	Vacant Restaurant / Drywall walls (Gridline 19.5 – 21 / R.5 – X.5)	Peach	0.02	No
LS-26	Vacant Restaurant / Drywall walls (Gridline 19.5 – 21 / R.5 – X.5)	Dark blue	0.02	No
<b>LS-27</b>	<b>Food court change room / Men's and women's washroom ceramic tiles</b>	<b>Black</b>	<b>9.8</b>	<b>Yes</b>

<b>Table 2: Analysis of Suspect LBCs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>				
<b>Sample Number</b>	<b>Location / Description</b>	<b>Color</b>	<b>Result (mg/cm<sup>2</sup>)</b>	<b>Lead-Based Coating</b>
<b>LS-28</b>	<b>Food court change room / Men's and women's washroom ceramic tiles</b>	<b>White</b>	<b>0.6</b>	<b>Yes</b>
<b>LS-29</b>	<b>Charlie's / 6x6 ceramic tiles</b>	<b>Grey</b>	<b>0.09</b>	<b>Yes</b>
<b>LS-30</b>	<b>Charlie's / 3x3 ceramic tiles</b>	<b>White</b>	<b>0.08</b>	<b>Yes</b>
LS-31	Charlie's / Walls	Yellow	0.02	No
LS-32	A&W / 4x4 ceramic floor tiles	Grey	0.03	No
<b>LS-33</b>	<b>A&amp;W / 4x4 ceramic wall tiles</b>	<b>White</b>	<b>0.08</b>	<b>Yes</b>
LS-34	Food court lobby / Concrete walls	White	0.03	No
LS-35	Food court lobby / Drywall (south side)	Red	0.02	No
LS-36	Food court lobby / Drywall	Tan	0.02	No
LS-37	Food court lobby / Drywall	Grey	0.02	No
<b>LS-38</b>	<b>Food court lobby / Back column (Gridline 17 / V)</b>	<b>Grey</b>	<b>0.9</b>	<b>Yes</b>
<b>LS-39</b>	<b>Janitors closet / Ceramic floor tiles (Gridline 15 – 15.5 / O.5 – R)</b>	<b>Grey</b>	<b>0.07</b>	<b>Yes</b>
<b>LS-40</b>	<b>Miriam's / Ceramic floor tiles</b>	<b>Grey</b>	<b>0.09</b>	<b>Yes</b>
<b>LS-41</b>	<b>Miriam's / Drywall (west side)</b>	<b>Red</b>	<b>0.06</b>	<b>Yes</b>
LS-42	Miriam's / Drywall (kitchen)	Green	0.04	No
<b>LS-43</b>	<b>Miriam's / 3x3 ceramic wall tiles</b>	<b>White</b>	<b>0.12</b>	<b>Yes</b>
<b>LS-44</b>	<b>Food court lobby / Lunch room / Fire door (Gridline 17.5 – 19 / R)</b>	<b>Tan</b>	<b>0.19</b>	<b>Yes</b>
LS-45	Men's north west washroom / 3x3 ceramic wall tiles	White	0.03	No
LS-46	Men's north west washroom / 3x3 ceramic wall tiles	Green	0.03	No
<b>LS-47</b>	<b>Men's north west washroom / 2x2 ceramic floor tiles</b>	<b>Grey</b>	<b>0.05</b>	<b>Yes</b>
AS-48	Men's north west washroom / Fire door	Green	0.02	No
<b>LS-49</b>	<b>Corridor outside men's north west washroom / Concrete walls</b>	<b>Green</b>	<b>0.05</b>	<b>Yes</b>



<b>Table 2: Analysis of Suspect LBCs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>				
<b>Sample Number</b>	<b>Location / Description</b>	<b>Color</b>	<b>Result (mg/cm<sup>2</sup>)</b>	<b>Lead-Based Coating</b>
<b>LS-50</b>	<b>Men's north east washroom / 3x3 ceramic floor tiles</b>	<b>Grey</b>	<b>0.05</b>	<b>Yes</b>
LS-51	Men's north east washroom / 3x3 ceramic wall tiles	White	0.03	No
LS-52	Men's north east washroom / 3x3 ceramic wall tiles	Green	0.03	No
LS-53	Men's north east washroom / Drywall	White	0.02	No
<b>LS-54</b>	<b>Retail unit 143 / Windows and frames (Gridline 16 – 18 / A – C)</b>	<b>White</b>	<b>4.5</b>	<b>Yes</b>
LS-55	Retail unit 143 / Drywall (Gridline 16 – 18 / A – C)	White	0.04	No
LS-56	Retail unit 143 / Wainscoting (Gridline 16 – 18 / A – C)	Purple	0.03	No
LS-57	Retail unit 146 / Drywall (Gridline 22 – 24 / G1 – H)	White	0.02	No
LS-58	Retail unit 146 / Drywall (Gridline 22 – 24 / G1 – H)	Grey	0.04	No
LS-59	Retail unit 148 / Drywall (Gridline 22 – 24 / I1.5 – K1)	Beige	0.04	No
<b>LS-60</b>	<b>Staff women's washroom / 3x3 ceramic tiles</b>	<b>White</b>	<b>0.08</b>	<b>Yes</b>
<b>LS-61</b>	<b>Staff women's washroom / 3x3 ceramic tiles</b>	<b>Red</b>	<b>0.09</b>	<b>Yes</b>
<b>LS-62</b>	<b>Retail unit 241 (passport) / Concrete perimeter walls around windows</b>	<b>White</b>	<b>1.6</b>	<b>Yes</b>
LS-63	Retail unit 241 (passport) / Drywall	White	0.02	No
LS-64	Retail unit 250 / Drywall (Gridline 20.5 – 24 / H – K1)	Orange	0.02	No
LS-65	Retail unit 250 / Drywall (Gridline 20.5 – 24 / H – K1)	Black	0.02	No
LS-66	Retail unit 250 / Drywall (Gridline 20.5 – 24 / H – K1)	White	0.02	No
LS-67	Retail unit 250 / Drywall (Gridline 20.5 – 24 / H – K1)	Grey	0.02	No
<b>LS-68</b>	<b>Retail unit 250 / Concrete perimeter walls around windows (Gridline 20.5 – 24 / H – K1)</b>	<b>Orange</b>	<b>2.1</b>	<b>Yes</b>
<b>LS-69</b>	<b>Retail unit 248 / Plywood panels (Gridline 20.5 – 24 / F – H)</b>	<b>Beige</b>	<b>0.08</b>	<b>Yes</b>
<b>LS-70</b>	<b>Retail unit 248 / Drywall (Gridline 20.5 – 24 / F – H)</b>	<b>Tan</b>	<b>0.06</b>	<b>Yes</b>

<b>Table 2: Analysis of Suspect LBCs</b> <b>Sinclair Center – 757 West Hastings Street, Vancouver, BC</b>				
<b>Sample Number</b>	<b>Location / Description</b>	<b>Color</b>	<b>Result (mg/cm<sup>2</sup>)</b>	<b>Lead-Based Coating</b>
<b>LS-71</b>	<b>Retail unit 244 / Lobby / Ceramic floor tiles (Gridline 20.5 – 24 / F – H)</b>	<b>Light brown</b>	<b>0.08</b>	<b>Yes</b>
<b>LS-72</b>	<b>Retail unit 244 / Back office / Ceramic floor tiles (Gridline 20 – 22 / A – B2)</b>	<b>Dark brown</b>	<b>0.3</b>	<b>Yes</b>
<b>LS-73</b>	<b>Retail unit 244 / Front office / Ceramic floor tiles (Gridline 20 – 22 / A – B2)</b>	<b>Peach with brown</b>	<b>0.2</b>	<b>Yes</b>
<b>LS-74</b>	<b>Retail unit 244 / Lobby / Ceramic floor tiles (Gridline 20 – 22 / A – B2)</b>	<b>White</b>	<b>0.3</b>	<b>Yes</b>
LS-75	Retail unit 244 / Drywall (Gridline 20 – 22 / A – B2)	Blue	0.02	No
<b>LS-76</b>	<b>Retail unit 244 / Window sills (Gridline 20 – 22 / A – B2)</b>	<b>White</b>	<b>2.1</b>	<b>Yes</b>
LS-77	Retail unit 244 / Drywall (Gridline 20 – 22 / A – B2)	Tan	0.02	No
<b>LS-78</b>	<b>Retail unit 246 (hair salon) / 16x16 ceramic floor tiles</b>	<b>White spotted</b>	<b>0.05</b>	<b>Yes</b>
LS-79	Retail unit 246 (hair salon) / 12x12 ceramic floor tiles	White	0.03	No
LS-80	Retail unit 246 / (hair salon) Drywall under stairs in closet	White	0.02	No
<b>LS-81</b>	<b>Retail unit 246 (hair salon) / 9x9 ceramic floor tiles</b>	<b>Grey</b>	<b>1.9</b>	<b>Yes</b>
<b>LS-82</b>	<b>Retail unit 246 (hair salon) / 12x12 ceramic floor tiles / Mezzanine</b>	<b>White</b>	<b>0.13</b>	<b>Yes</b>
LS-83	Retail unit 246 (hair salon) / Ceiling	White	0.02	No
<b>LS-84</b>	<b>B2 main corridor / Cinder block walls</b>	<b>White</b>	<b>0.09</b>	<b>Yes</b>
<b>LS-85</b>	<b>B2 main corridor / Mail room / Door frame</b>	<b>Off white</b>	<b>0.07</b>	<b>Yes</b>
LS-86	B2 main corridor / Mail room / Door	Off white	0.02	No
<b>LS-87</b>	<b>B2 main corridor / Room 6 / Fire door</b>	<b>Grey</b>	<b>0.11</b>	<b>Yes</b>
LS-88	B2 main corridor / Room 6 / Drywall	White	0.02	No
<b>LS-89</b>	<b>B2 main corridor / Room 6 / Door frame</b>	<b>White</b>	<b>0.13</b>	<b>Yes</b>

Notes: **Bold Print** – Indicates a positive result, i.e., hazardous levels of lead in the surface coating.

Copies of the analytical results for the LBCs assessment are presented in **Appendix I**.

Based on the results of DST's assessment and the analytical results, forty-seven (47) of the eighty-nine (89) suspected LBCs were found to contain hazardous levels of lead.

#### **4.3 Ozone Depleting Substances (ODSs)**

Equipment suspected to contain ozone-depleting substances was observed on-site based on visible manufacturer labels, where accessible. Observed equipment containing ODSs include:

- Domestic fridges within the food court units of the Subject Building; and,
- One (1) large walk in freezer which was identified in the food court service corridor.

#### **4.4 Elemental Mercury**

Fluorescent light fixtures identified throughout the Subject Building are presumed to contain mercury vapor.

Mercury containing thermostats were not identified within the Subject Building.

#### **4.5 Polychlorinated Biphenyls (PCBs)**

Fluorescent light ballasts identified throughout the Subject Building were found to be non PCB-containing.

#### **4.6 Mould Amplification**

DST identified one (1) area of suspected mould amplification (10' x 6") on the North wall kitchen of "Charlie's" located in the food court of the Subject Building.

#### **4.7 Animal Waste**

Animal droppings were visually identified within food court and food court service corridor of the Subject Building.

#### **4.8 Crystalline Silica**

Crystalline silica is expected to be present in concrete, cement mortar, ceramic tiles, and stucco finishes that were identified in various quantities and at various locations throughout the Subject Building.

## **5.0 CONCLUSIONS**

### **5.1 Asbestos-Containing Materials (ACMs)**

Based on the findings of the assessment, the following ACMs were identified within the Subject Building:

- The red mastic applied to the HVAC ducting in the ceiling space of the food court.

### **5.2 Lead-Based Coatings (LBCs)**

Based on the findings of DST's assessment and analytical results, forty-seven (47) of the eighty-nine (89) suspect lead-based coatings samples were found to have hazardous levels of lead i.e., equal to or  $>0.05 \text{ mg/cm}^2$ .

All forty-seven samples were found to be in good condition, where observed, of the time of DST's assessment.

### **5.3 Ozone Depleting Substances (ODS)**

Based on the results of DST's assessment, the following equipment was found to contain ODS;

- Domestic fridges within the food court units of the Subject Building; and,
- One (1) large walk in freezer which was identified in the food court service corridor.

### **5.4 Mercury**

Mercury containing thermostats were not identified within the Subject Building.

Fluorescent light fixtures identified throughout the Subject Building are presumed to contain mercury vapor.

### **5.5 Polychlorinated Biphenyl's (PCBs)**

Fluorescent light ballasts identified throughout the Subject Building were found to be non PCB-containing.

### **5.6 Mould Amplification**

DST identified one (1) area of suspected mould amplification (10' x 6") on the North wall kitchen of "Charlie's" located in the food court of the Subject Building.

## **5.7     *Animal Waste***

Animal droppings were visually identified within food court and food court service corridor of the Subject Building.

## **5.8     *Crystalline Silica***

Silicate is expected to be present in concrete, cement mortar, and stucco finishes that were identified in various quantities and at various locations of throughout the Subject Building.

## **6.0     RECOMMENDATIONS**

### **6.1     Asbestos-Containing Materials**

Prior to any renovation and/or demolition activities, identified ACMs should be removed in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed through Parts 5.48-5.59 – Controlling Exposure, and Parts 6.1 - 6.32 – Asbestos.

DST recommends reference to WorkSafeBC publication “*Safe Handling of Asbestos, A Manual of Standard Practices*”. This document provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on asbestos and asbestos products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of ACMs.

Asbestos-containing wastes should be managed in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

### **6.2     Lead-Based Coatings**

Control the preparation of painted surfaces in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed in Parts 5.48-5.59 – Controlling Exposure and Parts 6.59-6.69 – Lead of the BC OH&S Regulation.

DST recommends reference to WorkSafeBC publication “*Lead-Containing Paints and Coatings – Preventing Exposure in the Construction Industry*”, 2011. This manual provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on lead and lead products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of LBCs.

Lead-containing wastes should be disposed of in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

### **6.3 Ozone Depleting Substances (ODSs)**

When taken out of service, ODS-containing equipment should be managed in accordance with the requirements prescribed in British Columbia's Ozone-Depleting Substances and Other Halocarbons Regulation, including amendments up to B.C. Reg. 4/2010, January 14, 2010 and transport ODS-containing wastes in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

DST recommends reference to Federal regulations entitled, "Federal Halocarbon Regulations, 2003 SOR/2003-289". This guideline provides information on the appropriate management, handling and disposal of ODS-containing equipment.

### **6.4 Elemental Mercury**

When taken out of service, mercury-containing wastes should be managed in accordance with the requirements of the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

### **6.5 Mould Amplification**

Retain a qualified contractor to remove and dispose of the visible mould that was identified on the North kitchen wall of "Charlie's". The abatement of the mould-contaminated materials should be completed in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed under Part 5 (sections 5.48-5.59 – Controlling Exposure) of the BC OH&S Regulation.

DST recommends reference to WorkSafeBC guideline entitled, "G4.79 – Moulds and Indoor Air Quality", 2007. The guideline provides information on possible health effects and basic principles, including precautionary measures that should to be considered in order to minimize the potential for worker exposure during the removal of mould-contaminated materials.

### **6.6 Animal Waste**

Retain a qualified contractor to remove and dispose of the droppings identified throughout the food court service corridor of the Subject Building. The abatement of the droppings should be completed in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed under Part 5 (sections 5.48-5.59 – Controlling Exposure) of the BC OH&S Regulation.

Otherwise, control the hazard through implementing a site-specific exposure control program in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed under Part 5 (sections 5.48-5.59 – Controlling Exposure) of the BC OH&S Regulation..

DST recommends reference to WorkSafeBC guideline entitled, "A Hantavirus Exposure Control Program for Employers and Workers", 2006. This guideline was developed to assist employers and employees who may come into contact with rodents and/or rodent droppings in the workplace. The guideline presents information for employers to prevent hantavirus infections and to implement an exposure control program that will minimize potential worker exposure to rodents and/or rodent droppings contaminated with hantavirus. The guideline also provides worker procedures that can be used in the workplace to remove and clean up contaminated rodent carcasses and/or contaminated rodent droppings.

## **6.7 Crystalline Silica**

Silicate is expected to be present in concrete, cement mortar, and stucco finishes that were identified in various quantities and at various locations of throughout the Subject Building.

When disturbing these materials through renovations, or otherwise, ensure workers and persons adjacent to the work are not exposed to airborne silica levels in excess of permissible levels as set out by WorkSafeBC (i.e.  $<0.005 \text{ mg/m}^3$ ).

## **7.0 LIMITATIONS**

The conclusions and recommendations contained in this assessment report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted environmental assessment standards and practices applicable to these locations and are subject to the following inherent limitations:

1. The data and findings presented in this report are valid as of the dates of the investigations. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration at the property, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.
2. No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, and conclusions, which are based solely upon site conditions in existence through the period of assessment.
3. DST's assessment reports present professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to

applicable environmental laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental laws, rules, regulations or policies of federal, provincial, or local governmental agencies. Any use of the assessment report constitutes acceptance of the limits of DST's liability. DST's liability extends only to its client and not to other parties who may obtain this assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.

## 8.0 CLOSING

We hope the information presented in this document meets your current requirements. If you have any questions, or require additional information please contact us at your convenience.

Yours truly,

**DST Consulting Engineers Inc.**



David Kernel, CLI, CLRA  
*Environmental Technologist*



Christian Injates, CEC, CEM  
*Sector Head, Building Environments*

FILE PATH: L:\BE\PROJECTS\PUBLIC WORKS AND GOVERNMENT SERVICES CANADA\BE-VC-015575 - PWGSC - HAZMAT ASSESSMENT - SINCLAIR CENTRE FOOD COURT\REPORTS & DELIVERABLES\BE-VC-015575 - FINAL PRE-RENOVATION HAZARDOUS MATERIALS ASSESSMENT - SINCLAIR CENTRE - PWGSC.DOC



## **APPENDIX I**

### **LABORATORY CERTIFICATES OF ANALYSIS (ASBESTOS AND LEAD)**



# Asbestos Analytical Services Ltd.

7 - 2883 East Kent Avenue N., Vancouver, BC, V5S 3T9

## ASBESTOS ANALYSIS REPORT

AASL Report #: **B00152**

Analyst: Gabrielle Sutton

Report Date: 13NOV2012

Method: NIOSH Method 9002

Project Location: Sinclair Center, 757 Hastings Street, Vancouver, BC

Reference #s: BE-VC-015575

Number of Samples: 48

# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
1. 1 **	SC-01	Layer 1 - blue, pliable	Blue Vinyl Sheet Flooring, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 1 - 5 % Fibrous Glass > 95 % Non-Fibrous	---
1. 2	SC-01	Layer 2 - yellow glue	Blue Vinyl Sheet Flooring, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
1. 3 **	SC-01	Layer 3 - black, spongy	Blue Vinyl Sheet Flooring, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
1. 4	SC-01	Layer 4 - orange-yellow glue	Blue Vinyl Sheet Flooring, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
2 * **	SC-02	Single Phase - red, hard	Red Hard Firestop Mastic Around Conduits, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
3. 1	SC-03	Layer 1 - thin light green (paint)	Leveling Compound Near Conduits, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
3. 2 *	SC-03	Layer 2 - off-white, thick	Leveling Compound Near Conduits, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
3. 3 * **	SC-03	Layer 3 - red, hard	Leveling Compound Near Conduits, Floor, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
4	SC-04	Single Phase - creamy-white	Drywall Joint Compound, Walls, Lower Mall, Food Court, "Fortune Wok"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
5. 1	SC-05	Layer 1 - creamy-white mastic	Drywall Joint Compound, Front Till Walls, Lower Mall, Food Court, "Fortune Wok"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
5. 2	SC-05	Layer 2 - cream fibrous	Drywall Joint Compound, Front Till Walls, Lower Mall, Food Court, "Fortune Wok"	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
5. 3	SC-05	Layer 3 - white residue	Drywall Joint Compound, Front Till Walls, Lower Mall, Food Court, "Fortune Wok"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
6. 1	SC-06	Layer 1 - thin aqua-blue / off-white (paint)	Drywall Joint Compound, Kitchen Walls, Lower Mall, Food Court, "Pita Fresh"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
6. 2 *	SC-06	Layer 2 - creamy-white, lumpy	Drywall Joint Compound, Kitchen Walls, Lower Mall, Food Court, "Pita Fresh"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
6. 3	SC-06	Layer 3 - creamy-white	Drywall Joint Compound, Kitchen Walls, Lower Mall, Food Court, "Pita Fresh"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---



# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
7. 1	SC-07	Layer 1 - clear, pliable & pattern / white spongy	Brown Vinyl Sheet Flooring on Walls, Wall, Lower Mall, Food Court, "Pita Fresh"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
7. 2	SC-07	Layer 2 - cream fibrous	Brown Vinyl Sheet Flooring on Walls, Wall, Lower Mall, Food Court, "Pita Fresh"	Asbestos Fibres Not Detected 20 - 40 % Cellulose Fibres 10 - 20 % Fibrous Glass > 45 % Non-Fibrous	---
8. 1 **	SC-08	Layer 1 - aqua tile	Teal 12x12 Vinyl Floor Tile with Mastic, Vacant Unit Beside "Pita Fresh", Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
8. 2	SC-08	Layer 2 - black mastic	Teal 12x12 Vinyl Floor Tile with Mastic, Vacant Unit Beside "Pita Fresh", Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
9. 1	SC-09	Layer 1 - thin light brown (paint)	Drywall Joint Compound, Vacant Unit Beside "Pita Fresh, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
9. 2	SC-09	Layer 2 - white	Drywall Joint Compound, Vacant Unit Beside "Pita Fresh, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
10. 1 **	SC-10	Layer 1 - grey tile, pliable	Double Layer 12x12 Vinyl Floor Tile, Change Rooms, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
10. 2	SC-10	Layer 2 - brown mastic	Double Layer 12x12 Vinyl Floor Tile, Change Rooms, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
10. 3	SC-10	Layer 3 - white	Double Layer 12x12 Vinyl Floor Tile, Change Rooms, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
10. 4 **	SC-10	Layer 4 - grey tile, pliable	Double Layer 12x12 Vinyl Floor Tile, Change Rooms, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
11 **	SC-11	Single Phase - red mastic	Red Duct Mastic, Ceiling Space, Lower Mall, Food Court Lobby	1 - 10 % Chrysotile Asbestos > 90 % Non-Fibrous	T
12. 1	SC-12	Layer 1 - thin grey / beige / cream / orange (paint)	Drywall Joint Compound Coating on Concrete Slab, Ceiling Space, Lower Mall , Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
12. 2 *	SC-12	Layer 2 - white, hard	Drywall Joint Compound Coating on Concrete Slab, Ceiling Space, Lower Mall , Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
13	SC-13	Single Phase - grey fibrous	Fire Spray Insulation, Ceiling Space, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 20 - 40 % Fibrous Glass 10 - 30 % Cellulose Fibres > 45 % Non-Fibrous	---
14. 1	SC-14	Layer 1 - white	Drywall Joint Compound Bulkhead, Ceiling Space, Lower Mall, Food Court	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
14. 2	SC-14	Layer 2 - cream fibrous	Drywall Joint Compound Bulkhead, Ceiling Space, Lower Mall, Food Court	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
14. 3	SC-14	Layer 3 - white	Drywall Joint Compound Bulkhead, Ceiling Space, Lower Mall, Food Court	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---



# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
15. 1	SC-15	Layer 1 - thin light green (paint)	Drywall Joint Compound, North East Wall, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
15. 2	SC-15	Layer 2 - white	Drywall Joint Compound, North East Wall, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
16. 1	SC-16	Layer 1 - thin dark grey / orange (paint)	Drywall Wall Joint Compound, North East Corner Perimeter, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
16. 2	SC-16	Layer 2 - white	Drywall Wall Joint Compound, North East Corner Perimeter, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
16. 3	SC-16	Layer 3 - cream & pale green fibrous	Drywall Wall Joint Compound, North East Corner Perimeter, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
17. 1	SC-17	Layer 1 - thin dark grey / orange (paint)	Drywall Joint Compound, Grey Column, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
17. 2	SC-17	Layer 2 - white	Drywall Joint Compound, Grey Column, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
18. 1	SC-18	Layer 1 - thin olive (paint)	Drywall Joint Compound, Kitchen Wall, Lower Mall, Food Court, "Miriams"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
18. 2	SC-18	Layer 2 - white	Drywall Joint Compound, Kitchen Wall, Lower Mall, Food Court, "Miriams"	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
19 **	SC-19	Single Phase - light beige tile	12x12 Vinyl Floor Tile Brown Stripes, Lunch Room, Lower Mall, Food Court	Asbestos Fibres Not Detected 1 - 10 % Synthetic Fibres 1 - 5 % Wollastonite Fibres > 85 % Non-Fibrous	---
20 **	SC-20	Single Phase - grey fibrous	Ceiling Tile, Lunch Room, Lower Mall, Food Court Lobby	Asbestos Fibres Not Detected 30 - 50 % Fibrous Glass 10 - 30 % Cellulose Fibres > 30 % Non-Fibrous	---
21. 1	SC-21	Layer 1 - thin off-white / cream (paint)	Drywall Joint Compound, Ceiling, Lower Mall, Retail Unit 147	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
21. 2	SC-21	Layer 2 - white	Drywall Joint Compound, Ceiling, Lower Mall, Retail Unit 147	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
22. 1	SC-22	Layer 1 - thin off-white (paint)	Drywall Joint Compound, Ceiling, Lower Mall, North East Men's Washroom	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
22. 2	SC-22	Layer 2 - white	Drywall Joint Compound, Ceiling, Lower Mall, North East Men's Washroom	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
23. 1	SC-23	Layer 1 - thin off-white / green / grey (paint)	Drywall Joint Compound, Ceiling, Lower Mall, Retail Unit 143	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
23. 2	SC-23	Layer 2 - creamy-white	Drywall Joint Compound, Ceiling, Lower Mall, Retail Unit 143	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---



## Asbestos Analytical Services Ltd.

# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
24. 1	SC-24	Layer 1 - weave	Leveling Compound, Floor Doorway, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 50 - 70 % Synthetic Fibres 10 - 30 % Cellulose Fibres > 5 % Non-Fibrous	---
24. 2	SC-24	Layer 2 - yellow glue	Leveling Compound, Floor Doorway, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
24. 3 *	SC-24	Layer 3 - off-white, hard	Leveling Compound, Floor Doorway, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 1 - 5 % Cellulose Fibres > 95 % Non-Fibrous	---
25. 1	SC-25	Layer 1 - thin light grey / orange (paint)	Drywall Joint Compound, Walls, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
25. 2	SC-25	Layer 2 - white	Drywall Joint Compound, Walls, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
26. 1 **	SC-26	Layer 1 - creamy-white tile	Grey 12x12 Vinyl Floor Tile with Mastic, Floor, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
26. 2	SC-26	Layer 2 - black mastic	Grey 12x12 Vinyl Floor Tile with Mastic, Floor, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
27. 1	SC-27	Layer 1 - thin white / light blue (paint)	Drywall Joint Compound, Ceiling, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
27. 2	SC-27	Layer 2 - creamy-white	Drywall Joint Compound, Ceiling, Lower Mall, Retail Unit 146	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
28. 1	SC-28	Layer 1 - thin light beige / beige / pink (paint)	Drywall Joint Compound, Perimeter Wall, Lower Mall, Retail Unit 148	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
28. 2	SC-28	Layer 2 - creamy-white	Drywall Joint Compound, Perimeter Wall, Lower Mall, Retail Unit 148	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
28. 3	SC-28	Layer 3 - white	Drywall Joint Compound, Perimeter Wall, Lower Mall, Retail Unit 148	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
29. 1 **	SC-29	Layer 1 - creamy-white tile	Beige with Brown 12x12 Vinyl Floor Tile, Floor, Lower Mall Food Court Corridor Stairway	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
29. 2	SC-29	Layer 2 - yellow mastic	Beige with Brown 12x12 Vinyl Floor Tile, Floor, Lower Mall Food Court Corridor Stairway	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
30. 1	SC-30	Layer 1 - thin white / red (paint)	Drywall Joint Compound, Column, Lower Mall, Retail Unit 143	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
30. 2	SC-30	Layer 2 - white	Drywall Joint Compound, Column, Lower Mall, Retail Unit 143	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
30. 3	SC-30	Layer 3 - beige fibrous	Drywall Joint Compound, Column, Lower Mall, Retail Unit 143	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---



## Asbestos Analytical Services Ltd.

# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
31. 1	SC-31	Layer 1 - thin light green (paint)	Red Mastic Firestop, Pipe Penetrations, Wall, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
31. 2 * **	SC-31	Layer 2 - red, hard	Red Mastic Firestop, Pipe Penetrations, Wall, Lower Mall, Food Court Corridor	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
32 **	SC-32	Single Phase - grey fibrous	Ceiling Tile, Passport Office, Upper Mall, Retail Unit 241	Asbestos Fibres Not Detected 30 - 50 % Fibrous Glass 10 - 30 % Cellulose Fibres > 30 % Non-Fibrous	---
33. 1	SC-33	Layer 1 - thin off-white (paint)	Drywall Joint Compound , East Wall, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
33. 2	SC-33	Layer 2 - white	Drywall Joint Compound , East Wall, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
33. 3	SC-33	Layer 3 - cream & pale green fibrous	Drywall Joint Compound , East Wall, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 5 % Non-Fibrous	---
34. 1	SC-34	Layer 1 - thin off-white (paint)	Drywall Joint Compound, Column, Upper Mall, Passport, Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
34. 2	SC-34	Layer 2 - white	Drywall Joint Compound, Column, Upper Mall, Passport, Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
35. 1	SC-35	Layer 1 - thin off-white / grey (paint)	Drywall Joint Compound, West Wall, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
35. 2	SC-35	Layer 2 - white	Drywall Joint Compound, West Wall, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
36. 1	SC-36	Layer 1 - thin white (paint)	Drywall Joint Compound, Ceiling, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
36. 2	SC-36	Layer 2 - white & pale yellow	Drywall Joint Compound, Ceiling, Upper Mall, Passport Office, Retail 241	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
37. 1	SC-37	Layer 1 - thin grey / dark orange / grey (paint)	Drywall Joint Compound, Demising Wall, Offices, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
37. 2	SC-37	Layer 2 - white	Drywall Joint Compound, Demising Wall, Offices, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
38. 1	SC-38	Layer 1 - thin dark orange / grey (paint)	Drywall Joint Compound, North Wall, Upper Mall, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
38. 2	SC-38	Layer 2 - white	Drywall Joint Compound, North Wall, Upper Mall, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
39. 1	SC-39	Layer 1 - thin dark orange / grey (paint)	Drywall Joint Compound, Bulkhead Ceiling, Upper Mall, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
39. 2	SC-39	Layer 2 - white	Drywall Joint Compound, Bulkhead Ceiling, Upper Mall, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---



# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
40. 1	SC-40	Layer 1 - thin grey (paint)	Drywall Joint Compound, Ceiling, Upper Mall, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
40. 2	SC-40	Layer 2 - white	Drywall Joint Compound, Ceiling, Upper Mall, Retail Unit 250	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
41. 1	SC-41	Layer 1 - white	Drywall Joint Compound, North Wall, Upper Mall, Retail Unit 248	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
41. 2	SC-41	Layer 2 - beige fibrous	Drywall Joint Compound, North Wall, Upper Mall, Retail Unit 248	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
41. 3	SC-41	Layer 3 - pale grey	Drywall Joint Compound, North Wall, Upper Mall, Retail Unit 248	Asbestos Fibres Not Detected 1 - 5 % Cellulose Fibres 1 - 5 % Fibrous Glass > 95 % Non-Fibrous	---
42. 1	SC-42	Layer 1 - thin orange / light blue / white (paint)	Drywall Joint Compound, West Wall, Upper Mall, Retail Unit 248	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
42. 2	SC-42	Layer 2 - white	Drywall Joint Compound, West Wall, Upper Mall, Retail Unit 248	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
43. 1	SC-43	Layer 1 - thin creamy-white (paint)	Drywall Joint Compound, East Wall, Upper Mall, Retail Unit 244	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
43. 2	SC-43	Layer 2 - white	Drywall Joint Compound, East Wall, Upper Mall, Retail Unit 244	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
43. 3	SC-43	Layer 3 - beige fibrous	Drywall Joint Compound, East Wall, Upper Mall, Retail Unit 244	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
44. 1	SC-44	Layer 1 - white, thick	Drywall Joint Compound, East Wall, Upper Mall, Retail Unit 244	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
44. 2	SC-44	Layer 2 - thin white (paint)	Drywall Joint Compound, East Wall, Upper Mall, Retail Unit 244	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
44. 3	SC-44	Layer 3 - white, thin	Drywall Joint Compound, East Wall, Upper Mall, Retail Unit 244	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
45. 1	SC-45	Layer 1 - thin pale orange, lumpy (paint)	Drywall Joint Compound, Hot Water Tank Storage, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
45. 2	SC-45	Layer 2 - white	Drywall Joint Compound, Hot Water Tank Storage, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
45. 3	SC-45	Layer 3 - cream fibrous	Drywall Joint Compound, Hot Water Tank Storage, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
45. 4	SC-45	Layer 4 - white	Drywall Joint Compound, Hot Water Tank Storage, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---



## Asbestos Analytical Services Ltd.

# B00152	Sample	Sub-Sample	Sample Description / Location	Results	ASB
46. 1	SC-46	Layer 1 - thin off-white (paint)	Drywall Joint Compound, Under Stairs, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
46. 2	SC-46	Layer 2 - white	Drywall Joint Compound, Under Stairs, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
46. 3	SC-46	Layer 3 - cream fibrous	Drywall Joint Compound, Under Stairs, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
46. 4	SC-46	Layer 4 - white	Drywall Joint Compound, Under Stairs, Upper Mall, Hair Salon	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
47. 1	SC-47	Layer 1 - creamy-white, thin	Drywall Wall Joint Compound, Bulkhead Above Ceiling, Lower Mall, Food Court	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
47. 2	SC-47	Layer 2 - beige fibrous	Drywall Wall Joint Compound, Bulkhead Above Ceiling, Lower Mall, Food Court	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---
47. 3	SC-47	Layer 3 - pale grey	Drywall Wall Joint Compound, Bulkhead Above Ceiling, Lower Mall, Food Court	Asbestos Fibres Not Detected 1 - 5 % Cellulose Fibres 1 - 5 % Fibrous Glass > 95 % Non-Fibrous	---
48. 1	SC-48	Layer 1 - thin light grey (paint)	Drywall Joint Compound, Walls, B2 - Federal Building, Room 6	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
48. 2	SC-48	Layer 2 - white	Drywall Joint Compound, Walls, B2 - Federal Building, Room 6	Asbestos Fibres Not Detected 90 - 100 % Non-Fibrous	---
48. 3	SC-48	Layer 3 - beige fibrous	Drywall Joint Compound, Walls, B2 - Federal Building, Room 6	Asbestos Fibres Not Detected 90 - 100 % Cellulose Fibres > 1 % Non-Fibrous	---

### Comments

Samples analyzed in accordance with NIOSH Laboratory Method 9002

American Industrial Hygiene Association (AIHA) BAPAT Program Laboratory Number 204301

Estimated Limit of Detection is <0.5 %

ASB = Asbestos present/absent in material

T = Asbestos Present

AASL Asbestos Analytical Services Ltd. will not accept any responsibility as to the manner of interpretation or application of these results.

\* Sample preparation included grinding process.

\*\* Sample preparation included ashing process.

Analyst: Original Signed By

Gabrielle Sutton, B.A.

Date: November 13, 2012

Original Signed By

Reviewed By: Gabrielle Sutton, B.A.



**APPENDIX II**

**FACILITY DRAWINGS**





—  = 2 DECKLISH EIGHTH WALL

- HAZMAT SURVEY AREA REQUIRED**



DA02

CHERNOFF THOMPSON  
ARCHITECTS  
300 N. 1st St., Suite 200  
Chicago, IL 60610  
Tel: 312.427.1234

**SINCLAIR CENTRE  
SINCLAIR CENTRE  
REVITALIZATION  
PROJECT**

LOWER MALL FLOOR PLAN (NE)

32017





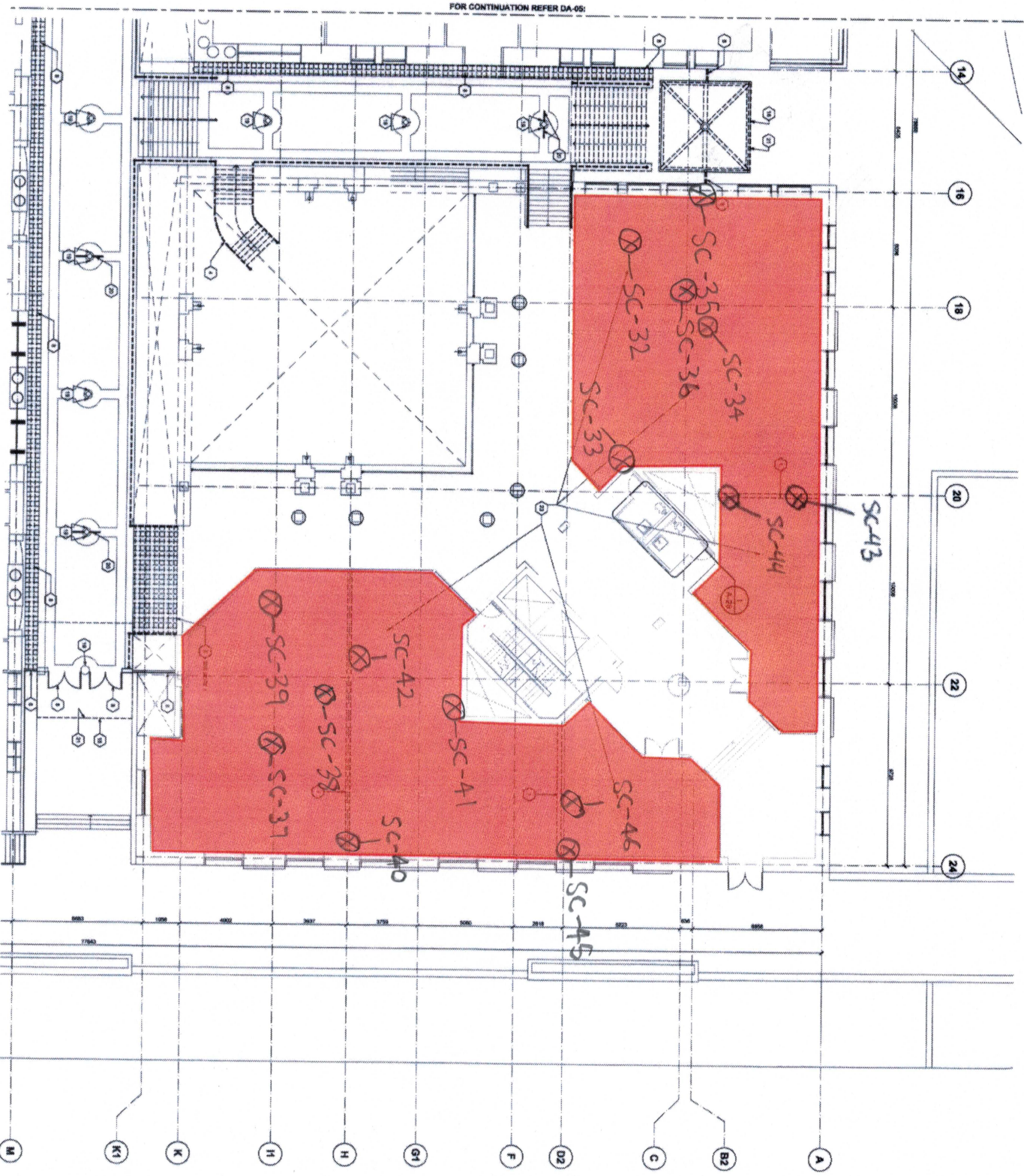


DEMOLITION NOTES:

- 1 - DEMOLISH EXISTING WALL
- 2 - DEMOLISH EXISTING DOOR
- 3 - DEMOLISH EXISTING WINDOW
- 4 - DEMOLISH EXISTING ROOF
- 5 - DEMOLISH EXISTING FLOOR
- 6 - DEMOLISH EXISTING CEILING
- 7 - DEMOLISH EXISTING CONCRETE SLAB
- 8 - DEMOLISH EXISTING STAIRS
- 9 - DEMOLISH EXISTING ELEVATOR
- 10 - DEMOLISH EXISTING MECHANICAL
- 11 - DEMOLISH EXISTING ELECTRICAL
- 12 - DEMOLISH EXISTING PLUMBING
- 13 - DEMOLISH EXISTING GAS
- 14 - DEMOLISH EXISTING HVAC
- 15 - DEMOLISH EXISTING LIGHTING
- 16 - DEMOLISH EXISTING PAINT
- 17 - DEMOLISH EXISTING GLASS
- 18 - DEMOLISH EXISTING METAL
- 19 - DEMOLISH EXISTING WOOD
- 20 - DEMOLISH EXISTING BRICK
- 21 - DEMOLISH EXISTING TILE
- 22 - DEMOLISH EXISTING CARPET
- 23 - DEMOLISH EXISTING LINOLEUM
- 24 - DEMOLISH EXISTING MARBLE
- 25 - DEMOLISH EXISTING GRANITE
- 26 - DEMOLISH EXISTING QUARTZ
- 27 - DEMOLISH EXISTING LAMINATE
- 28 - DEMOLISH EXISTING VENEER
- 29 - DEMOLISH EXISTING STAIN
- 30 - DEMOLISH EXISTING FINISH
- 31 - DEMOLISH EXISTING TRIM
- 32 - DEMOLISH EXISTING MOLDING
- 33 - DEMOLISH EXISTING BASE
- 34 - DEMOLISH EXISTING CASE
- 35 - DEMOLISH EXISTING CABINETS
- 36 - DEMOLISH EXISTING ISLAND
- 37 - DEMOLISH EXISTING SINK
- 38 - DEMOLISH EXISTING STOVE
- 39 - DEMOLISH EXISTING REFRIG
- 40 - DEMOLISH EXISTING DISHWASHER
- 41 - DEMOLISH EXISTING RANGE
- 42 - DEMOLISH EXISTING OVEN
- 43 - DEMOLISH EXISTING FREEZER
- 44 - DEMOLISH EXISTING COOLER
- 45 - DEMOLISH EXISTING WALK-IN
- 46 - DEMOLISH EXISTING REFRIG
- 47 - DEMOLISH EXISTING FREEZER
- 48 - DEMOLISH EXISTING COOLER
- 49 - DEMOLISH EXISTING WALK-IN
- 50 - DEMOLISH EXISTING REFRIG
- 51 - DEMOLISH EXISTING FREEZER
- 52 - DEMOLISH EXISTING COOLER
- 53 - DEMOLISH EXISTING WALK-IN
- 54 - DEMOLISH EXISTING REFRIG
- 55 - DEMOLISH EXISTING FREEZER
- 56 - DEMOLISH EXISTING COOLER
- 57 - DEMOLISH EXISTING WALK-IN
- 58 - DEMOLISH EXISTING REFRIG
- 59 - DEMOLISH EXISTING FREEZER
- 60 - DEMOLISH EXISTING COOLER
- 61 - DEMOLISH EXISTING WALK-IN
- 62 - DEMOLISH EXISTING REFRIG
- 63 - DEMOLISH EXISTING FREEZER
- 64 - DEMOLISH EXISTING COOLER
- 65 - DEMOLISH EXISTING WALK-IN
- 66 - DEMOLISH EXISTING REFRIG
- 67 - DEMOLISH EXISTING FREEZER
- 68 - DEMOLISH EXISTING COOLER
- 69 - DEMOLISH EXISTING WALK-IN
- 70 - DEMOLISH EXISTING REFRIG
- 71 - DEMOLISH EXISTING FREEZER
- 72 - DEMOLISH EXISTING COOLER
- 73 - DEMOLISH EXISTING WALK-IN
- 74 - DEMOLISH EXISTING REFRIG
- 75 - DEMOLISH EXISTING FREEZER
- 76 - DEMOLISH EXISTING COOLER
- 77 - DEMOLISH EXISTING WALK-IN
- 78 - DEMOLISH EXISTING REFRIG
- 79 - DEMOLISH EXISTING FREEZER
- 80 - DEMOLISH EXISTING COOLER
- 81 - DEMOLISH EXISTING WALK-IN
- 82 - DEMOLISH EXISTING REFRIG
- 83 - DEMOLISH EXISTING FREEZER
- 84 - DEMOLISH EXISTING COOLER
- 85 - DEMOLISH EXISTING WALK-IN
- 86 - DEMOLISH EXISTING REFRIG
- 87 - DEMOLISH EXISTING FREEZER
- 88 - DEMOLISH EXISTING COOLER
- 89 - DEMOLISH EXISTING WALK-IN
- 90 - DEMOLISH EXISTING REFRIG
- 91 - DEMOLISH EXISTING FREEZER
- 92 - DEMOLISH EXISTING COOLER
- 93 - DEMOLISH EXISTING WALK-IN
- 94 - DEMOLISH EXISTING REFRIG
- 95 - DEMOLISH EXISTING FREEZER
- 96 - DEMOLISH EXISTING COOLER
- 97 - DEMOLISH EXISTING WALK-IN
- 98 - DEMOLISH EXISTING REFRIG
- 99 - DEMOLISH EXISTING FREEZER
- 100 - DEMOLISH EXISTING COOLER

AREA REQUIRED  
HAZMAT SURVEY

FOR CONTINUATION REFER DA-05:



1 LEVEL L1 PLAN - FEDERAL BUILDING

**CHENOFF THOMPSON**  
ARCHITECTS  
3000 BAYVIEW AVE. SUITE 100  
SCARBOROUGH, ONTARIO M1H 3B7  
TEL: (416) 291-1111  
FAX: (416) 291-1112  
WWW.CHENOFFTHOMPSON.COM

**PROJECT NORTH**

Legend:  
- Contour  
- Wall  
- Door  
- Stair

NO.	DESCRIPTION	DATE
1	3000 BAYVIEW AVE. SUITE 100	2011-01-01
2	3000 BAYVIEW AVE. SUITE 100	2011-01-01
3	3000 BAYVIEW AVE. SUITE 100	2011-01-01

**SINCLAIR CENTRE  
REVITALIZATION  
PROJECT**

Contractor Signature: [Signature]  
Date: [Date]  
Project Manager: [Name]  
Client: [Name]  
Project Address: 787 W. HASTINGS ST., VANCOUVER  
Project Phone: [Phone]  
Project Fax: [Fax]  
Project Email: [Email]  
Project Website: [Website]

Project No./Rev. No.: 32017  
Drawing No.: DA04  
Sheet No.: 0

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX B**

**GEOTECHNICAL REPORT**

# GEOTECHNICAL ASSESSMENT

Sinclair Centre Seismic Upgrade

***FINAL REPORT***



***Prepared for:***

Public Works and Government Services Canada  
641 – 800 Burrard Street  
Vancouver, BC, V6Z 2V8

***Prepared by:***

Stantec Consulting Ltd.  
4370 Dominion Street, Suite 500  
Burnaby, BC V5G 4L7  
Tel: (604) 436-3014 Fax: (604) 436-3752

***Project No.:***

1233-10882

***Date:***

December 7, 2012



**Stantec**



---

**Stantec**



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[File Name and Path: V:\1233\active\geotech\1233-10000 to 1233-10999\1233-10800 to 1233-10899\123310882\_sinclair\_centre\_seismic\_upgrade\report\rpt\_geotechnical\_assessment\_sinclair\_centre\_final.docx]

## 1 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has completed a geotechnical assessment for the proposed seismic upgrades to the Sinclair Centre, located at 757 West Hastings Street in Vancouver, BC.

The purposes of the assessment were to identify the subsurface soil and groundwater conditions, identify geotechnical issues and provide detailed geotechnical recommendations for the proposed seismic upgrades of the existing Sinclair Centre facility. The scope of work for the assessment involved a geotechnical site investigation and drilling program, engineering analysis and preparation of this geotechnical report.

## 2 PROJECT AND SITE DESCRIPTION

As part of the currently planned seismic retrofitting of the Sinclair Centre, Stantec has previously completed a limited subsurface investigation consisting of non-intrusive testing of the underlying soil and rock deposits in order to develop a shear wave profile within these deposits. Based on the shear wave profiles developed, Stantec completed an engineering review to determine the appropriate Site Class to use for the site in accordance with the 2010 National Building Code for Canada and the 2006 British Columbia Building Code. This supplementary geotechnical investigation and report addresses conventional geotechnical design issues such that the City of Vancouver permit requirements have been adhered to.

The existing Sinclair Centre development is located at 757 West Hastings Street in Vancouver, BC. The Sinclair Centre site is roughly square in shape, has an approximate total area of 6,800 m<sup>2</sup> (1.7 acres), and is bound by West Cordova Street to the north, Granville Street to the east, West Hastings Street to the south, and Howe Street to the west. The site generally slopes down from the south towards the north property line. The Sinclair Centre is comprised of four separate buildings (the 1936 Federal Building, the Post Office Building, the Winch Building, and the Customs Examining Warehouse) which are joined together with a glass atrium roof, and currently houses several retail stores as well as Government of Canada service agencies.

## 3 GEOTECHNICAL SITE INVESTIGATION

Stantec completed a geotechnical subsurface investigation for the proposed seismic retrofit on September 4<sup>th</sup> and 5<sup>th</sup>, 2012. The investigation consisted of two (2) air-rotary (ODEX) boreholes (TH12-1 and TH12-2), which were completed utilizing a track-mounted drill rig operated by Mud Bay Drilling Co. Ltd. of Surrey, BC. The boreholes were advanced to depths of 12.2 m (40 ft.) and 15.5 m (51 ft.) below current site grades. Each of the boreholes was completed to its target depth.

The field work was continuously monitored by a Stantec representative, who identified the sample locations, classified the soils, kept a detailed log of each borehole, and observed and recorded pertinent site features. Representative soil samples were collected from the boreholes and brought to the Stantec soils laboratory in Burnaby, BC for further visual identification and classification, as well as natural water content measurements. The boreholes were carried out at the locations shown on Drawing No. 1 (**Appendix B**).

## **4 SUBSURFACE CONDITIONS**

The subsurface soil strata and groundwater conditions encountered in the boreholes are described in detail on the Borehole Records, with additional and supplementary information provided in this section. All soil descriptions and identifications were made in accordance with ASTM Standard D2488 (Visual Manual Procedure). The detailed borehole records, along with an explanation of the symbols and terms used in their description, are provided in **Appendix C**.

In general, the soil conditions encountered during our subsurface investigation consisted of surficial fills overlying a native deposit of silty sand. The silty sand was underlain by deposits of sandstone and shale that extended beyond the termination depth of the boreholes. Further information regarding the subsurface conditions encountered during our investigation is presented below.

### ***Fill***

A brownish grey sand and gravel fill was encountered in both of the boreholes below the surficial cover of asphalt/concrete. The sand and gravel fill was generally compact to dense and contained some cobbles and boulders. The layer varied in thickness from 0.3 to 1.1 m (1 to 3.5 ft.).

### ***Silty Sand***

A native deposit of glaciated grey or light brown silty sand was encountered beneath the fill in both of the boreholes. The silty sand deposit varied in thickness from 0.45 to 1.2 m (1.5 to 4 ft.), and included variable amounts of fine gravel. SPT blow counts and drilling observations indicated that the silty sand deposit is generally dense to very dense.

### ***Sandstone***

A native deposit of grey fine sandstone was encountered beneath the silty sand within each of the Stantec boreholes. This sandstone deposit contained trace to some lignite seams, and was observed to be soft to medium hard based on results of SPT blow counts and drilling observations.

### ***Shale***

A deposit of grey shale was encountered beneath the sandstone within one of the boreholes, and interbedded with the sandstone in the other borehole. The shale deposit was generally observed to be soft to medium hard based on results of SPT blow counts and drilling observations.

### **Groundwater**

A groundwater table was not encountered within either of the Stantec boreholes; however, seepage was noted at depths of 6 to 10 m (20 to 33 ft.) below current grades. Based on the encountered soil and rock conditions, it is envisaged that the groundwater level will not fluctuate significantly following extended periods of heavy precipitation or based on seasonal changes.

## **5 DISCUSSION AND RECOMMENDATIONS**

### **5.1 General**

Based on the results of the Stantec field work, review of existing information, laboratory testing and engineering analyses, the main geotechnical findings are as follows:

1. Existing soil conditions at the time of our subsurface investigation generally consisted of a surficial cover of concrete/asphalt over fills underlain by dense to very dense silty sand. The silty sand deposit was further underlain by bedrock consisting of soft to medium hard sandstone and shale that extended beyond the termination depths of the boreholes.
2. Excavated existing granular fill will likely be suitable for reuse as structural fill provided that the soils are free of organics and oversize material (i.e. cobbles/boulders) and can be compacted to the required specification.
3. Conventional pad and strip footings constructed on a bearing surface consisting of existing fills or underlying native glaciated soils over bedrock are suitable for the Sinclair Centre
4. Based on the results of the Stantec subsurface investigation, it is considered appropriate to classify the seismic site response as Site Class B (in accordance with the 2006 BCBC).

The following sections of this report present our geotechnical recommendations in greater detail. Recommendations for various geotechnical aspects of the project are based on the information obtained during the field investigation, and on detailed engineering analysis.

Terminology and specifications for aggregates, granular materials and asphalt pavement used in subsequent sections of this report are in accordance with the Master Municipal Construction Document (MMCD) Volume II, 2000 edition, developed jointly by the Consulting Engineers of BC, the BC Road Builders and Heavy Construction Association, and the Municipal Engineers Division of the Association of Professional Engineers and Geoscientists of BC.

### **5.2 Backfill Requirements**

Backfill should consist of pre-approved, clean, well-graded, non-friable, granular soil with less than 5% fines (passing the #200 sieve), for the portion of a sample passing the #10 sieve. Backfill should be placed in maximum 300 mm thick lifts and compacted to at least 98% Standard Proctor Maximum Dry Density (SPMDD). Inspection and testing by Stantec will be required during the placement and compaction of backfills.

Excavated existing granular fill will likely be suitable for reuse as backfill provided that the soils are free of organics and oversize material (i.e. cobbles/boulders) and can be compacted to the required specification. If the existing granular fills are excavated to be used as backfill, they should be stockpiled and reviewed by Stantec to confirm suitability.

All stockpiled fill should be covered with polyethylene sheeting to prevent runoff from entering the municipal storm sewer system (following periods of precipitation).

### **5.3 Foundation Design**

We consider that for new foundations for the Sinclair Centre conventional pad and strip footings founded on either the native glaciated soils and/or compacted structural fill over these native soils, or directly on the underlying sandstone bedrock.

New pad and strip footings founded on granular soils should be designed for a Serviceability Limit State (SLS) bearing resistance of 150 kPa, which corresponds to an estimated total post-construction settlement of less than 25 mm. We recommend using a factored ULS bearing resistance of 225 kPa for pad and strip footings founded on the soils listed above. The factored ULS bearing resistance includes a geotechnical resistance factor of 0.5.

Similarly, new pad and strip footings founded directly on the sandstone bedrock should be designed for a Serviceability Limit State (SLS) bearing resistance of 750 kPa. We recommend using a factored ULS bearing resistance of 1000 kPa for pad and strip footings founded on the soils listed above. The factored ULS bearing resistance includes a geotechnical resistance factor of 0.5.

Based on correspondence with the structural engineering consultant (CWMM Consulting Engineers Ltd.) regarding the proposed structural upgrades to the existing foundation, Stantec recommends a factored Ultimate Limit States (ULS) design bearing resistance of 2000 kPa for the approximately 34.5 m x 11.5 m existing interior core foundation. The factored ULS bearing resistance is based on a geotechnical resistance factor of 0.9.

New strip and pad footings should have minimum widths of 450 mm and 900 mm, respectively. All exterior footings in permanently heated buildings should be founded at least 450 mm below finished exterior grade for protection against frost action. All bearing surfaces for footings shall be dry and free of loose or deleterious material prior to placement of concrete.

### **5.4 Exterior and Interior Slabs-on-Grade**

Exterior and interior slabs should be placed on a bedding layer consisting of at least 150 mm of clean, free-draining 19 mm minus clear crushed gravel compacted to 100% Standard Proctor Maximum Dry Density (SPMDD), placed on the structural fill. Where the slab is near or below exterior grades, the underslab drainage layer should be connected to a perimeter drainage system. This may be done by providing 100 mm diameter weep holes through the foundation wall at (typically) 3 m on-centres at an elevation above the level of the perimeter drains.

We recommend that a vapour barrier, consisting of 10-mil polyethylene sheeting, be placed between interior slabs-on-grade and the bedding material to limit the migration of moisture due to capillary rise. Adjacent sheets of the vapour barrier should overlap a minimum of 600 mm.

## 5.5 Building and Site Drainage

Permanent drainage measures should include perimeter drainage at foundation base elevation around all portions of buildings constructed below final grade, and underslab drainage for all proposed slabs below or near final site grades.

It is recommended that a perimeter drainage system, consisting of at least 100 mm diameter slotted or perforated rigid wall pipe, be placed around all portions of the building with slabs below a level 150 mm above average final site grades. The drainage pipes should be surrounded by a minimum of 150 mm of 19 mm drain rock or 19 mm clear crush gravel. The invert elevation of the drain pipes should be at least 150 mm below the underside of the slabs.

The perimeter drainage system should be designed to direct water by gravity flow into a permanent storm water drain or collector sump. The roof and surface runoff should be collected and directed to a storm sewer in a solid wall pipe, separate from the perimeter drainage. Final ground surfaces should be graded to direct surface runoff away from building areas.

## 5.6 Lateral Loads and Backfill Adjacent to Subgrade Walls

Any proposed subgrade walls (i.e., foundation walls, retaining walls etc.) must be designed to resist static lateral soil pressures and dynamic lateral pressures induced by seismic activity. For subgrade walls up to 3 m in height, lateral earth loads should be calculated on the basis of a uniform pressure of 20 kPa. This pressure includes both static and seismic loading.

Subgrade walls exceeding 3 m in height must be designed to resist the static and seismic soil pressure distributions as shown on Drawing No. 2 (**Appendix B**).

If positive drainage is not provided in the backfill behind the subgrade walls, full hydrostatic pressures should be included in the calculation for lateral loads. In order to reduce hydrostatic pressures that may build up in the backfill, subgrade walls should be backfilled with at least a 450 mm wide zone of free-draining backfill. The free-draining backfill should extend to within 600 mm of final grade.

## 5.7 Excavations, Utility Trenches and Dewatering

Excavations within soil deposits greater than 1.2 m in depth must have side slopes no steeper than 1H:1V (horizontal to vertical). If steeper excavation cuts are required within the granular soil deposits, Stantec will need to provide design recommendation for a suitable shoring system for these slopes. Excavations within the sandstone or shale bedrock greater than 1.2 m in depth must have side slopes no steeper than 1H:3V (horizontal to vertical) provided the excavation face(s) are free of potentially unstable rock fragments. Excavations should be inspected regularly for signs of instability and slopes flattened, if required. All excavations should be carried out in accordance with Workers' Compensation Board (WCB) regulations applicable in BC.

Bedding fill for pipes and utilities should conform to Master Municipal Construction Document or the pipe supplier's specifications. Bedding fill should be compacted to a minimum 98% SPMD. In general, a minimum of 150 mm of bedding fill should be placed below all pipes. If wet conditions are

encountered in the utility trench, pea-gravel can be used as bedding below pipes. Trench backfill above the bedding fill should consist of backfill as defined in Section 5.2.

It is not likely that groundwater will be encountered in shallow excavations. However, all excavations must be kept dry during construction, and we consider that dewatering can likely be handled with conventional sump and pump techniques.

## **5.8 Seismic Considerations**

Seismic design for “normal structures”, such as warehouses, low-rise commercial buildings, and high-rise office towers, is based on the 2010 National Building Code of Canada (NBCC), which will be adopted in the 2012 British Columbia Building Code (BCBC) later this year. The primary objective of the NBCC earthquake resistant design requirements for “normal structures” is to protect the life and safety of the building occupants as the building responds to strong ground shaking. Structures designed in conformance with the NBCC provisions may undergo extensive structural damage during strong ground shaking but should not collapse. Collapse is defined to be a state where occupants can no longer exit the building because of structural failure. This implies that key structural components of a building and supporting foundations necessary to ensure the building’s post-earthquake stability must be protected against collapse under design levels of shaking.

The 2010 NBCC seismic design procedures are based on ground motion parameters (e.g., peak ground acceleration (PGA) and spectral acceleration (Sa) values) having a 2% probability of exceedence in 50 years, which corresponds to a 0.04% probability of exceedence (i.e., the 2,475 year return period earthquake event). The design PGA for firm ground for this site in the City of Vancouver is 0.46g (g = acceleration due to gravity).

Based on the results of the Stantec field investigation and the subsurface conditions encountered at the subject site, it is considered appropriate to classify the seismic site response as Site Class B.

While some damage to the building would be expected under the influence of 2010 NBCC design earthquake event, it is not anticipated that collapse of the building would occur due to foundation failure, and the intent of the building code would be achieved.

## **5.9 Tie-Down Anchor Requirements**

As part of the seismic retrofit, Stantec understands that foundations for select shear walls within the Sinclair Centre may require the use of tie-down anchors as a result of seismically induced uplift forces.

CWMM Consulting Engineers Ltd. have indicated that the preferred anchor for foundations designed with tie-down anchors is a 63 mm diameter double corrosion protected (DCP) DYWIDAG *GEWI*® Bar ASTM A615 (Grade 75) CAN/CSA(G3018-M1982). It should be noted that the 63 mm *GEWI*® bars and associated hardware are only available in Grade 80 steel from DYWIDAG. The tie-down anchors are to be installed in a minimum 150 mm diameter grout hole. Stantec understands that the passive tie-down anchor system being proposed for use on the Sinclair Centre Seismic Upgrade Project can be installed without the use of an anchor sleeve to provide a free-bond length. It should be noted that a free bond length facilitated by two-stage grouting will be required for each tie-down anchor that is to be tensioned as part of the proof testing procedure. Stantec recommends that a minimum of 10% of the tie down anchors are proof tested such that their ultimate design capacity is verified. Based on the free



bond length requirements, tie-down anchors to be proof tested must be determined prior to installation. Once selected anchors are successfully proof tested and subsequently de-tensioned, second stage grouting is completed such that there is no free-bond length.

For anchors embedded in the sandstone bedrock, the Ultimate Limit States (ULS) capacity can be taken as 330 kN/m in both tension and compression. For Seismic loads the geotechnical resistance factor would be 0.9. A summary of tie-down anchor design capacities is presented in Table 1, below. It should be noted that the free bond length presented for the proposed passive anchor system will only be required for those anchors scheduled for proof testing. Additionally, it should be noted that the anchor lengths include the temporary free bond length for proof testing and is measured from the rock surface, not the top of the approximately 1.5 m thick existing foundations.

**Table 1: Tie-Down Anchor Design Capacities**

Anchor Diameter (mm)	Anchor Length (m)	Free Bond Length (m)	Minimum Anchor Spacing (m)	Ultimate Capacity of Tie-Down Anchor Grout Column (kN)	Factored Ultimate Design Capacity (kN)
63	6	1.5	1.5	1485	1335
	7	1.5	1.5	1815	1485*
	7.5	1.8	1.2	1881	1485*
	10	2.25	0.750	1734	1485*
	12	3.0	0.600	1811	1485*

**Note:** Design capacities marked with an asterisk (\*) are governed by 85% of the yield strength of the steel anchor.

## 5.10 Concrete Considerations

Laboratory tests were conducted on two (2) selected soil samples to measure the water soluble sulphate content, conductivity, and pH of the native silty clay subgrade. The results of the chemical tests are summarized in Table 2, below.

**Table 2: Summary of Chemical Testing**

Borehole	Sample Depth	Soluble Sulphate, SO <sub>4</sub> (mg/L)	Soluble Conductivity (μS/cm)	Soluble pH
BH10-1	1.0 m	36	269	7.78
BH10-2	0.5 m	294	835	8.16

Based on the above-noted soluble sulphate values, the degree of sulphate exposure is low to moderate (per CSA A23.1-04, Table 3). Consequently, Type MS or MSb cement, or equivalent, may be used for concrete in contact with the fill and native site soils.

Air entrainment to meet the requirements outlined in CSA A23.1-04 should be specified for all concrete in contact with freezing temperatures. Stricter specifications may be required for structural requirements, other exposure conditions, or other considerations.

The pH and specific conductance values of the soil indicate a moderate level of corrosivity; therefore, the potential for attack on exposed steel is moderate.

The results of the laboratory chemical testing are included in **Appendix D**.



## 6 CLOSURE

This report was prepared for the exclusive use of Public Works and Government Services Canada (PWGSC) and their agents. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Stantec.

The recommendations contained in this report are based on assumed continuity of soils with those of our boreholes, and preliminary design grades. Stantec should be provided with final architectural and structural drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of PWGSC, who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

This report was prepared by Tyler Trudel, M.Eng., P.Eng. and reviewed by Nigel Denby, M.Eng., P.Eng.

Respectfully submitted,

**Stantec Consulting Ltd.**



The image shows a blue ink signature of Tyler Trudel over a circular professional engineer stamp. The stamp contains the text: "PROFESSIONAL ENGINEER", "PROVINCE OF BRITISH COLUMBIA", "T. J. TRUDEL", and "# 35094". A handwritten date "12/07/12" is written below the stamp.

Tyler Trudel, M.Eng., P.Eng.  
Geotechnical Engineer



The image shows a blue ink signature of Nigel Denby over a circular professional engineer stamp. The stamp contains the text: "PROFESSIONAL ENGINEER", "PROVINCE OF BRITISH COLUMBIA", and "NIGEL DENBY". A handwritten date "12/7/12" is written below the stamp.

Nigel Denby, M.Eng., P.Eng.  
Senior Principal

TT/ND



# **APPENDIX A**

## **Statement of General Conditions**

## Statement of General Conditions

**USE OF THIS REPORT:** This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. (Stantec) and the Client. Any use which a third party makes of this report is the responsibility of such third party.

**BASIS OF THE REPORT:** The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

**STANDARD OF CARE:** Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

**INTERPRETATION OF SITE CONDITIONS:** Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

**VARYING OR UNEXPECTED CONDITIONS:** Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

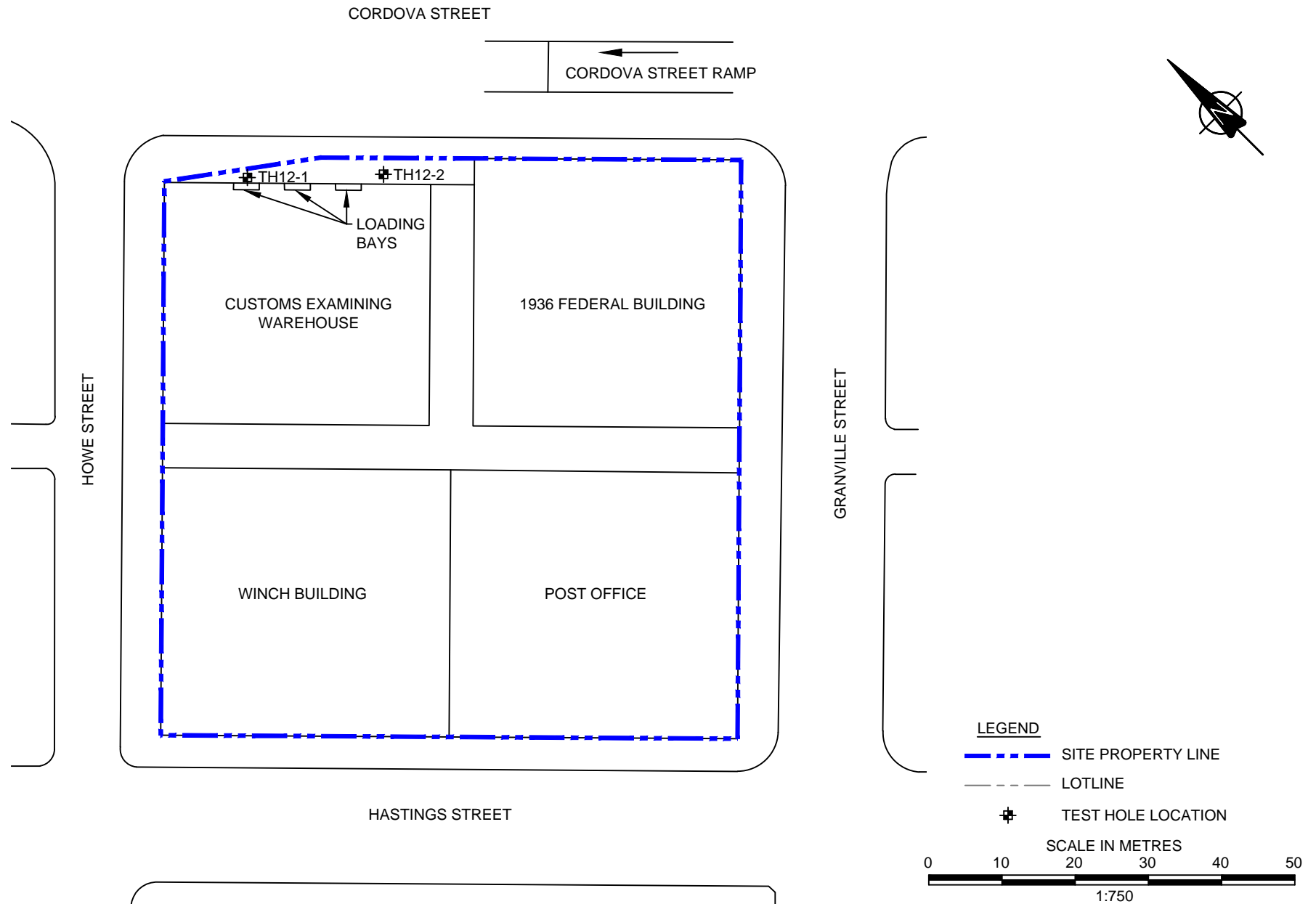
**PLANNING, DESIGN, OR CONSTRUCTION:** Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.





# APPENDIX B

## Drawings



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

## BOREHOLE LOCATION PLAN

SINCLAIR CENTRE SEISMIC UPGRADES  
757 WEST HASTINGS STREET, VANCOUVER, BC

Client: PUBLIC WORKS & GOVERNMENT SERVICES CANADA

Job No.: 123310882

Scale: 1:750

Date: 01-Oct-12

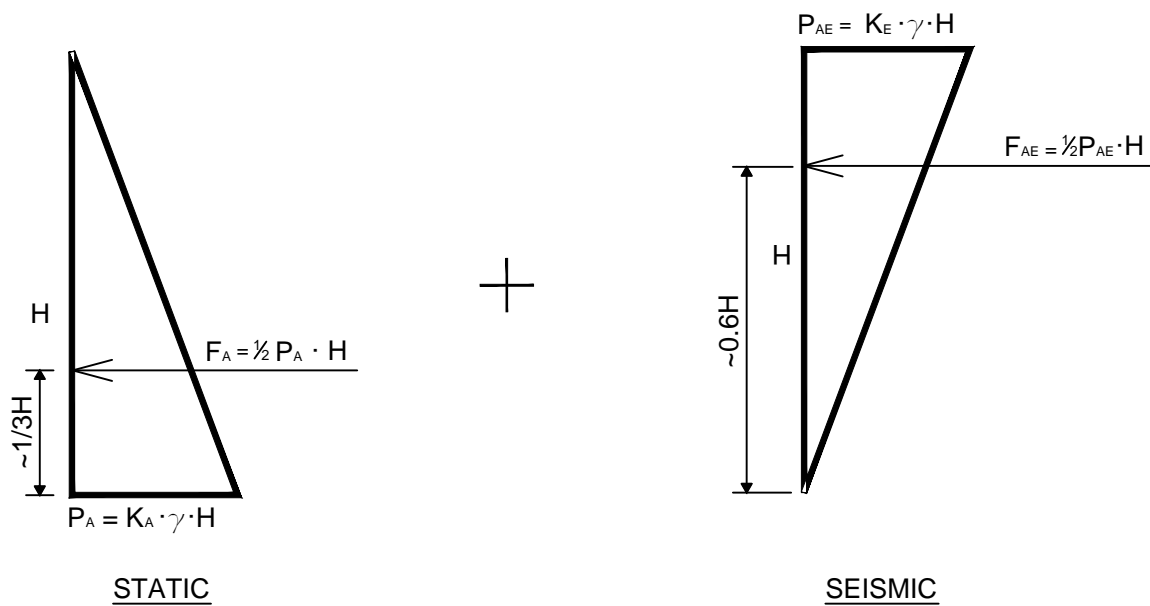
Dwn. By: GH

App'd By: TT

Dwg. No.:

1





#### DESIGN PARAMETERS :

$\gamma_{\text{SAND AND GRAVEL}} = 21 \text{ kN/m}^3$

$\Phi = 35^\circ$

$K_A = 0.27$

$K_E = 0.18$

ASSUMPTIONS: - NO HYDROSTATIC PRESSURE (ADEQUATE PERIMETER DRAINAGE PROVIDED)  
- SAND AND GRAVEL BACKFILL

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

## LATERAL EARTH PRESSURE ON SUBGRADE WALLS

SINCLAIR CENTRE SEISMIC UPGRADES  
757 WEST HASTINGS STREET, VANCOUVER, BC

Job No.: 123310882

Scale: N.T.S

Date: 01-Oct-12

Dwn. By: GH

App'd By: TT

Dwg. No.:

2



Stantec

Client: PUBLIC WORKS & GOVERNMENT SERVICES CANADA



# APPENDIX C

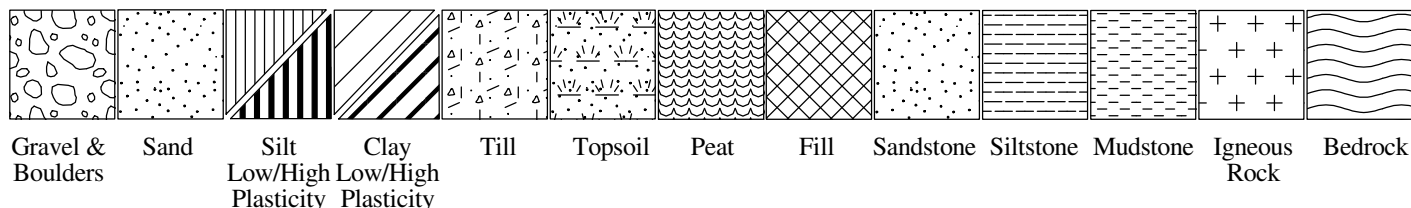
## Borehole Records



# Stantec

## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

### STRATA PLOT



Initial water level reading

Long term water level reading  
(date)

### SOIL DESCRIPTION

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

less than 10%	Trace	20-35%	Adjective (e.g. silty or sandy)
10-20%	Some	35-50%	And (e.g. silt and sand)

The standard terminology to describe cohesionless soils includes the state of packing, as determined by laboratory test or by the Standard Penetration Test 'N' -value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler one foot (305 mm) into the soil. The state of packing approximately relates to the SPT 'N' value as follows:

State of Packing	'N' Value	Relative Density %	State of Packing	'N' Value	Relative Density %
Very Loose	<4	<15	Dense	30-50	65-85
Loose	4-10	15-35	Very Dense	>50	>85
Medium Dense	10-30	35-65			

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer test, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength kips/sq.ft.	kPa	'N' Value	Consistency	Undrained Shear Strength kips/sq.ft.	kPa	'N' Value
Very Soft	<0.25	<12.5	<2	Stiff	1.0-2.0	50-100	8-15
Soft	0.25-0.5	12.5-25	2-4	Very Stiff	2.0-4.0	100-200	15-30
Firm	0.5-1.0	25-50	4-8	Hard	>4.0	>200	>30

### SAMPLES



GS... Grab Sample



RC... Rock Core



NR... No Recovery



AS... Auger Sample



ST... Shelby tube or thin wall tube



UNDIST .. Undisturbed Sample



SS... Split spoon sample  
(Obtained by performing the  
Standard Penetration Test)



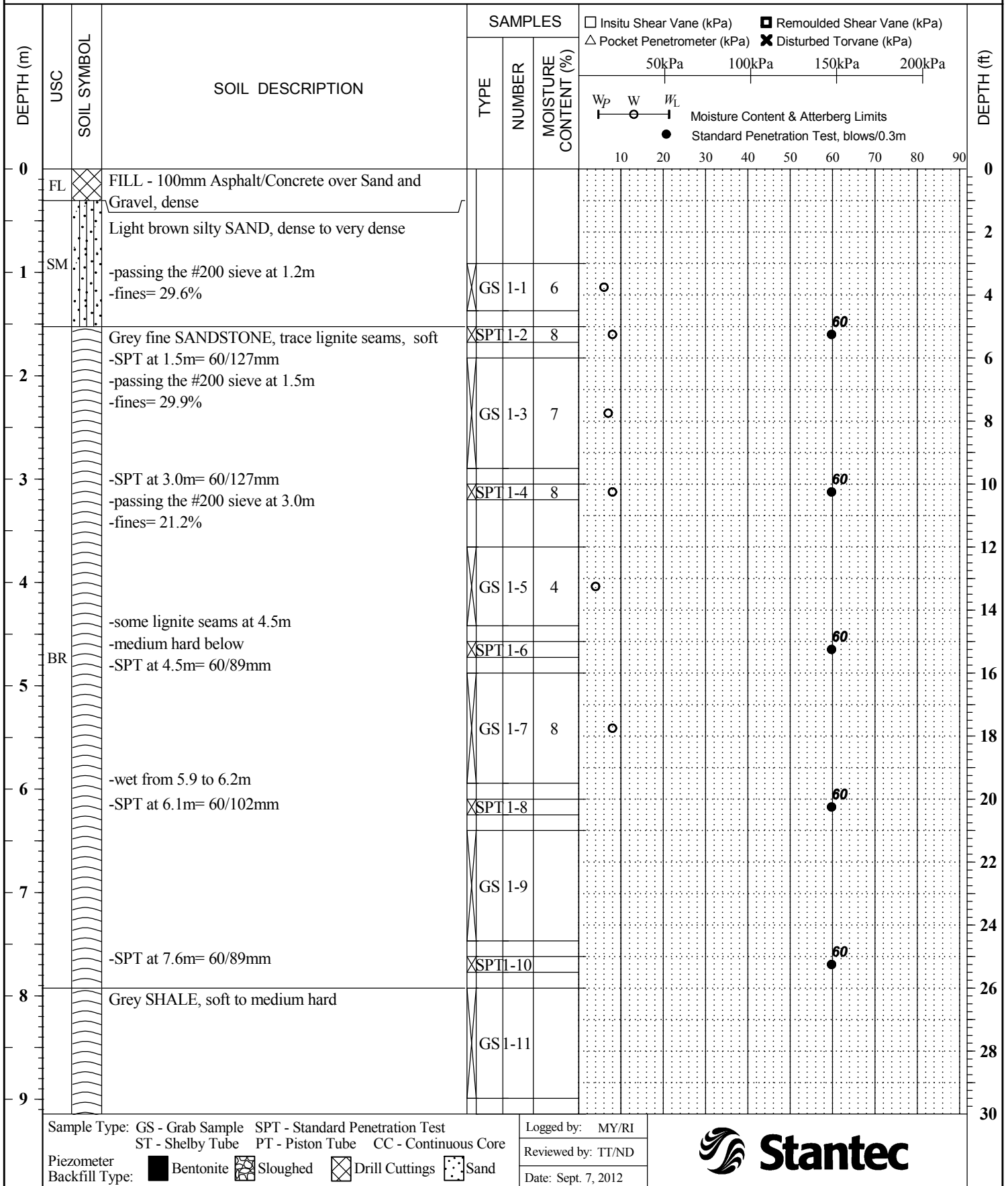
Ps... Piston Sample



# BOREHOLE RECORD

TH12-1

CLIENT PUBLIC WORKS AND GOVERNMENT SERVICES CANADA PROJECT No. 123310882  
 PROJECT Seismic Upgrading DATUM  NORTHING   
 LOCATION 757 West Hasting Street, Vancouver, BC ELEVATION  EASTING   
 DRILLING DATE Sept 4, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD ODEX / SPT



## TH12-1 cont'd

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			Moisture Content & Atterberg Limits		DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	$w_p$	$w_L$	
9.1	BR		Grey SHALE, medium hard -SPT at 9.1m= 60/50mm	X SPT	I-12				30
10.7			-hard below -SPT at 10.7m= 60/25mm (bouncing)	X SPT	I-14				35
			GS	I-13					
			GS	I-15					
12.2									
12.2 - 18.0			End of Test Hole at 12.2m Hole sealed with Bentonite from 0.1 to 1.5m and from 11.6 to 12.2m						

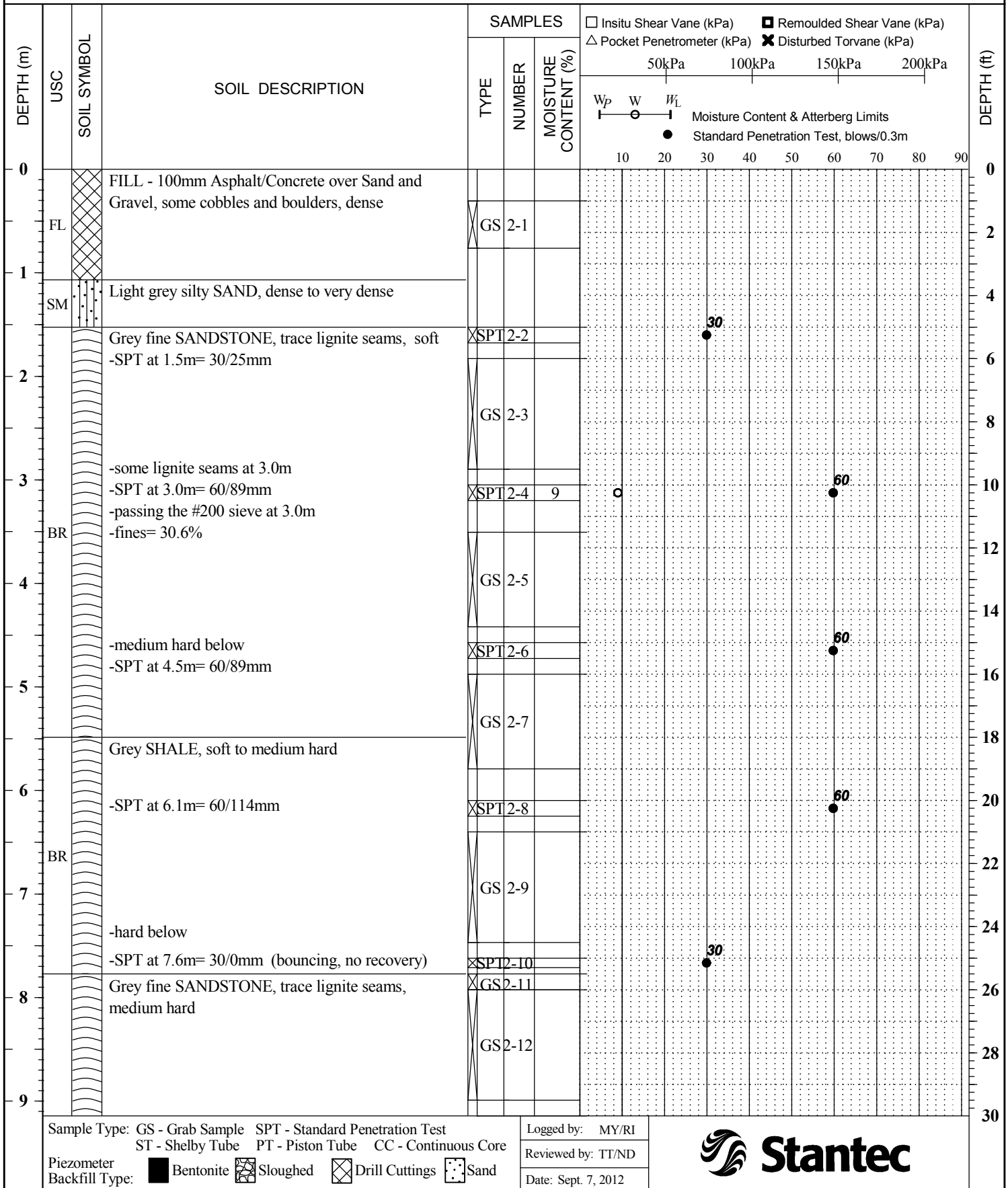
Sample Type: GS - Grab Sample    SPT - Standard Penetration Test  
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: MY/RI  
 Reviewed by: TT/ND  
 Date: Sept. 7, 2012

# BOREHOLE RECORD

TH12-2

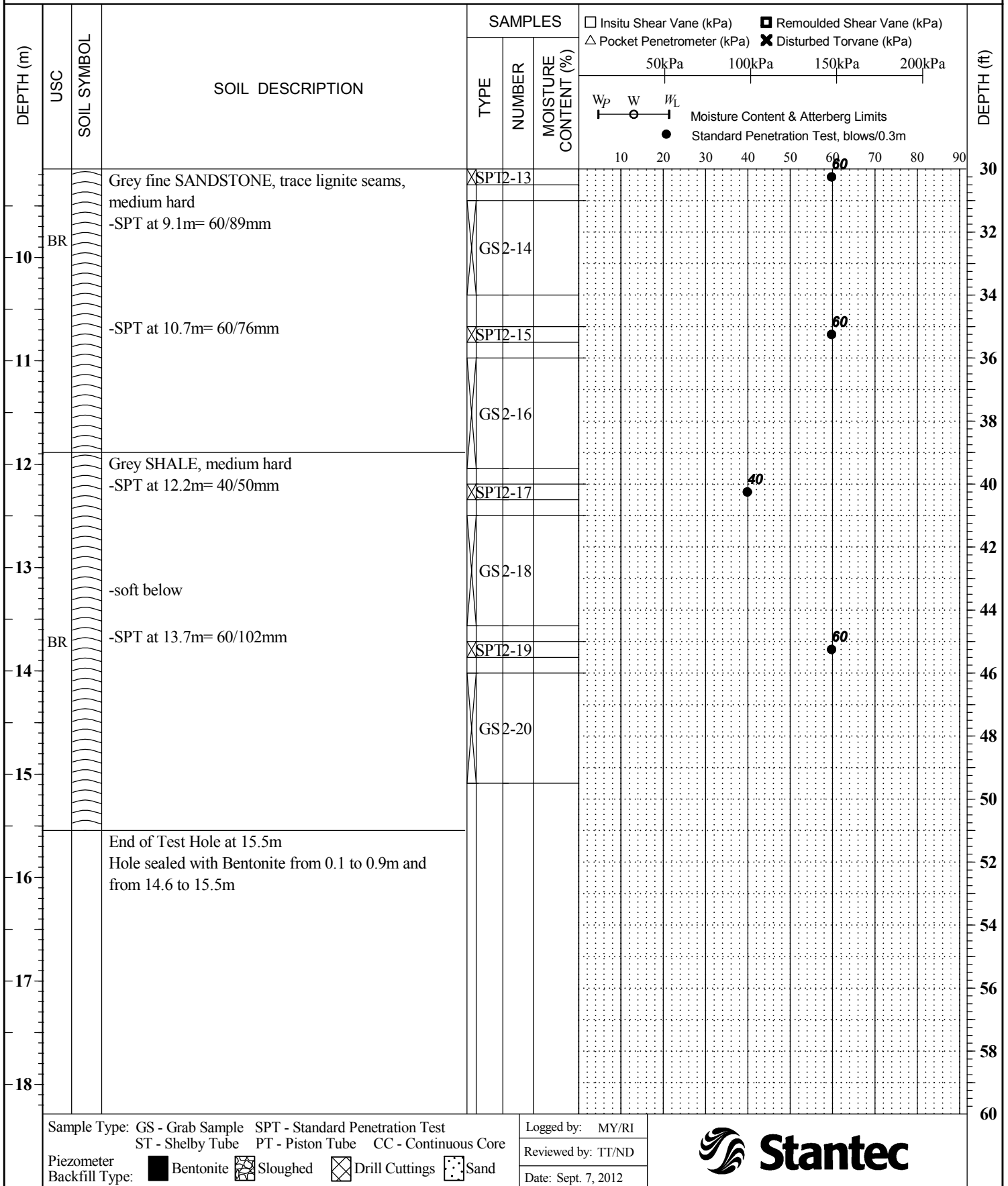
CLIENT PUBLIC WORKS AND GOVERNMENT SERVICES CANADA PROJECT No. 123310882  
 PROJECT Seismic Upgrading DATUM  NORTHING   
 LOCATION 757 West Hasting Street, Vancouver, BC ELEVATION  EASTING   
 DRILLING DATE Sept 5, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD ODEX / SPT



# BOREHOLE RECORD

TH12-2 cont'd

CLIENT PUBLIC WORKS AND GOVERNMENT SERVICES CANADA PROJECT No. 123310882  
 PROJECT Seismic Upgrading DATUM  NORTHING   
 LOCATION 757 West Hasting Street, Vancouver, BC ELEVATION  EASTING   
 DRILLING DATE Sept 5, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD ODEX / SPT





# **APPENDIX D**

## **Laboratory Testing**

Your P.O. #: 16300R-20  
 Your Project #: 123310882  
 Your C.O.C. #: G034769

**Attention: Tyler Trudel**  
 STANTEC CONSULTING LTD  
 BURNABY - NATIONAL CONTRACT  
 4370 DOMINION ST. 5TH FLOOR  
 BURNABY, BC  
 Canada V5G4L7

**Report Date: 2012/10/02**

## CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B286090**  
**Received: 2012/09/25, 14:50**

Sample Matrix: Soil  
 # Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity (Soluble)	2	2012/09/30	2012/10/01	BBY6SOP-00029	SM-2510 B
pH (Soluble)	2	2012/09/30	2012/09/30	BBY6SOP-00025	SM-4500H+B
Saturated Paste	2	2012/09/30	2012/09/30	BBY6SOP-00030	Carter SSMA 18.2.2
Sulphate (soluble) (soil)	2	2012/09/30	2012/10/01	BBY6SOP-00017	SM 4500-SO42- E

\* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Tabitha Rudkin, Burnaby Project Manager  
 Email: TRudkin@maxxam.ca  
 Phone# (604) 638-2639

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B286090  
Report Date: 2012/10/02

STANTEC CONSULTING LTD  
Client Project #: 123310882

Your P.O. #: 16300R-20  
Sampler Initials: MY

### RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		EO2159	EO2159	EO2160		
Sampling Date		2012/09/04	2012/09/04	2012/09/05		
	<b>UNITS</b>	<b>TH12-01</b>	<b>TH12-01 Lab-Dup</b>	<b>TH12-02</b>	<b>RDL</b>	<b>QC Batch</b>
<b>ANIONS</b>						
Soluble Sulphate (SO4)	mg/L	36	35	294	10	6216604
<b>Soluble Parameters</b>						
Soluble Conductivity	uS/cm	269	267	835	1.0	6213767
Soluble pH	pH Units	7.78	7.84	8.16	N/A	6213766
Saturation %	%	40.2	41.1	39.1	1.0	6213756

N/A = Not Applicable

RDL = Reportable Detection Limit

Maxxam Job #: B286090  
Report Date: 2012/10/02

STANTEC CONSULTING LTD  
Client Project #: 123310882

Your P.O. #: 16300R-20  
Sampler Initials: MY

### QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6213756	Saturation %	2012/09/30	106	80 - 120	<1.0	%	2.1	30
6213766	Soluble pH	2012/09/30	102	96 - 104			0.8	20
6213767	Soluble Conductivity	2012/10/01	94	70 - 130	<1.0	uS/cm	0.8	35
6216604	Soluble Sulphate (SO4)	2012/10/01			<10	mg/L	NC	30

N/A = Not Applicable

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.



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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX C**

**SITE PHOTOS**

## APPENDIX C – SITE PHOTOS

Page 1 of 4

DRAWING REFERENCE :  
**DA200 – EXTERIOR DEMOLITION**



P1.  
REMOVE EXISTING SIGN



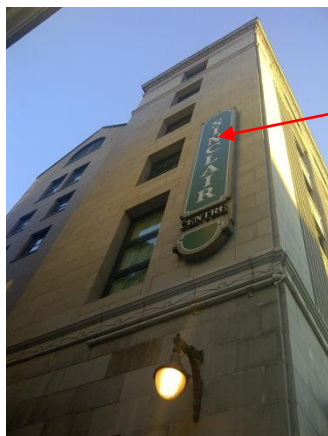
P2.  
DEMOLISH EXISTING CANOPY  
REMOVE EX. LIGHT FIXTURE (REFER TO ELEC.)



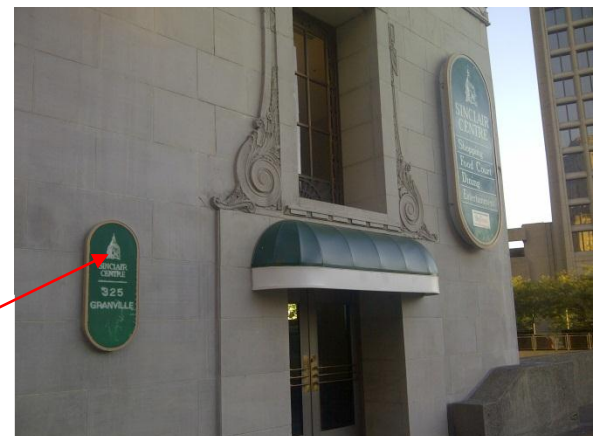
P3.  
DEMOLISH EXISTING CANOPY  
DEMOLISH EXISTING RWL, CAP PIPES FOR REUSE



P4.  
DEMOLISH EXISTING SIGN



P5  
DEMOLISH EXISTING SIGN



P6  
DEMOLISH EXISTING SIGN

## APPENDIX C – SITE PHOTOS

Page 2 of 4

DRAWING REFERENCE :  
DA203 – DEMOLITIONS (LOWER MALL FLOOR PLAN (NE) )



P1.



P2.



P3.



P4.



P5.



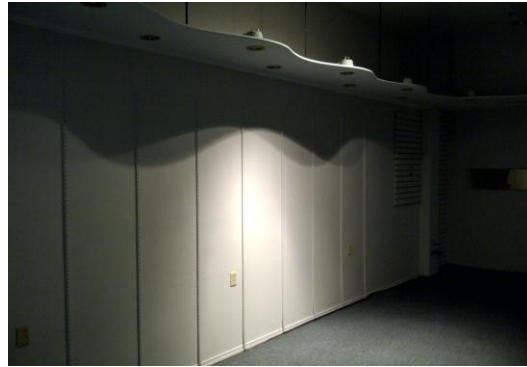
P6.

## APPENDIX C — SITE PHOTOS

Page 3 of 4



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P10.



P11.



P12.

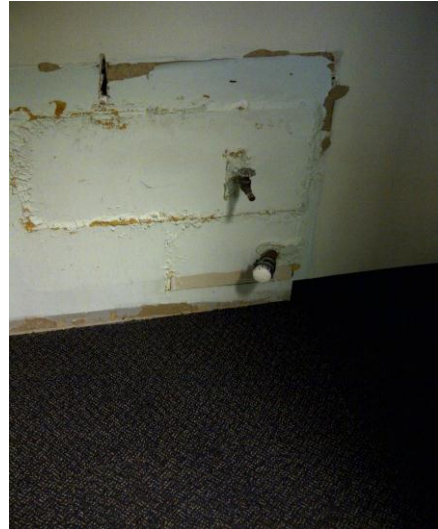


## APPENDIX C – SITE PHOTOS

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P13.



P14.

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

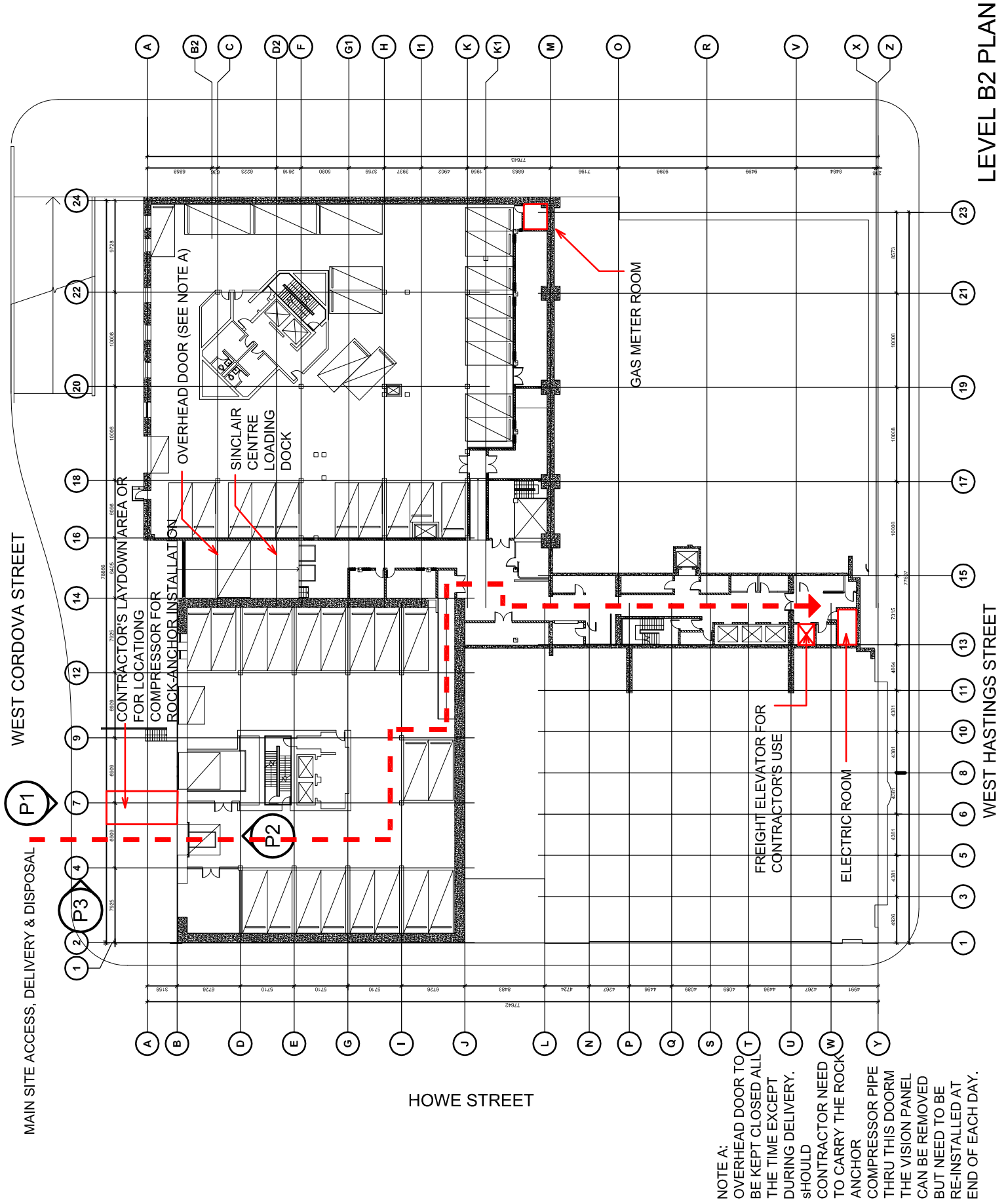
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**APPENDIX D**

**SITE ACCESS AND SITE OFFICE DRAWINGS**

APPENDIX D -  
SITE ACCESS & SITE  
OFFICE DIAGRAM

GRANVILLE STREET



LEVEL B2 PLAN

NOTE A:  
OVERHEAD DOOR TO  
BE KEPT CLOSED ALL  
THE TIME EXCEPT  
DURING DELIVERY.  
SHOULD  
CONTRACTOR NEED  
TO CARRY THE ROCK  
ANCHOR  
COMPRESSOR PIPE  
THRU THIS DOORM  
THE VISION PANEL  
CAN BE REMOVED  
BUT NEED TO BE  
RE-INSTALLED AT  
END OF EACH DAY.

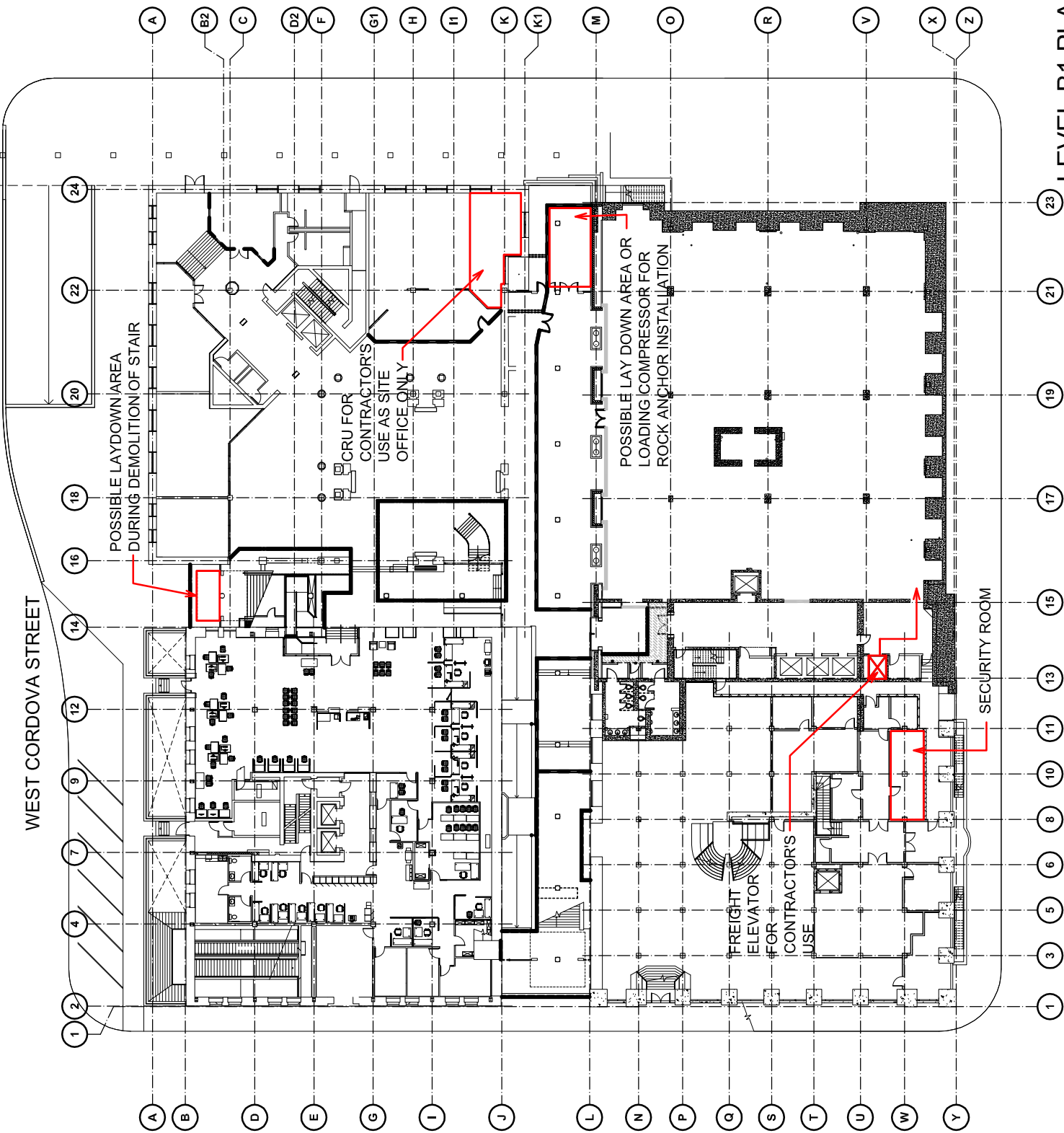
APPENDIX D -  
SITE ACCESS & SITE  
OFFICE DIAGRAM



PROJECT  
NORTH

GRANVILLE STREET

LEVEL B1 PLAN  
(LOWER MALL)



WEST CORDOVA STREET

WEST HASTINGS STREET

HOWE STREET



## APPENDIX D – SITE PHOTOS

### SITE ACCESS & SITE OFFICE DIAGRAM LEVEL B2 PLAN



P1.



P2.



P3.

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**


**VANCOUVER, BRITISH COLUMBIA**


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**APPENDIX E**


**LEED SCORECARD**

 <b>LEED SCORECARD</b>					Certified 21-26; Silver 27-31; Gold 32-41; Platinum 42-57	
		YES	MAYBE	N/A	Strategies	Action Items / Comments / Cost Notes
		29.0	16.5	11.0		
Sustainable Sites (14)		3.0	2.5	1.0		
SSc1	Site Selection OR Options A - L (Max 3 Points)				Select a LEED Certified Building	
	Option A. Brownfield Redevelopment					
	Option B. Stormwater Management, Rate and Quantity					
	Option C. Stormwater Management, Treatment					
	Option D. Heat Island Reduction, Non-Roof					
	Option E. Heat Island Reduction, Roof					
	Option F. Light Pollution Reduction					
	Option G. Water Efficient Irrigation, Reduced Potable Water Consumption					
	Option H. Water Efficient Irrigation, No Potable Water Use or No Irrigation					
	Option I. Innovative Wastewater Technologies					
	Option J. Water Use Reduction, 20% or 30% Reduction		1.0		Ultra low flow flush fixtures. Waterless urinals. Dual flush toilets. Landlord advises OK.	Mechanical Consultant to document
	Option K. Onsite Renewable Energy					
	Option L. Other Quantifiable Environmental Performance		1.5		A building that had in place at time of selection other quantifiable environmental performance, for which the requirements may be found in other LEED rating systems.	Review with Property Manager if whole complex is BOMA BEST certified.

 <b>LEED SCORECARD</b>					Certified 21-26; Silver 27-31; Gold 32-41; Platinum 42-57	
		YES	MAYBE	N/A	Strategies	Action Items / Comments / Cost Notes
		29.0	16.5	11.0		
SSc2	<b>Development Density and Community Connectivity</b>	1			Select space in building that is located in an established, walkable community with a min density of 13,800m <sup>2</sup> per hectare (60,000 square feet per acre), two-story downtown development) OR within 800m (1/2 mile) of a residential zone with avgas density 25 units per hectare.	Project is within 400m distance to about 10 of required amenities in a community.
SSc3.1	<b>Alternative Transportation</b> , Public Transportation Access	1			Within 400m of two or more public bus lines usable by occupants and/or within 800m of a commuter rail, light rail or subway	Project is within 400m to several bus routes, 2 train stations, sea bus.
SSc3.2	<b>Alternative Transportation</b> , Bicycle Storage & Changing Rooms			1		
SSc3.3	<b>Alternative Transportation</b> , Parking Availability	1			Parking spaces provided to tenant shall not exceed min number required by local zoning regulations and priority parking for carpools or vanpools will be provided for 5% or more of tenant occupants.	Review with Property Manager if parking allotted to Tenant does not exceed local zoning regulations.
<b>Water Efficiency (5)</b>		<b>2</b>				
WEc1.1	<b>Water Use Reduction</b> , 20% Reduction	1			Low flow fixtures and occupant sensors to reduce potable water demand.	Mechanical Consultant to document
WEc1.2	<b>Water Use Reduction</b> , 30% Reduction	1			Same as above.	Mechanical Consultant to document
<b>Energy &amp; Atmosphere (17)</b>		<b>5</b>	<b>6</b>	<b>1</b>		
EAp1	<b>Fundamental Commissioning</b>	✓			Determine Owner's Program of Requirements and Initial Design Intent. Develop and maintain a Commissioning Plan. Complete commissioning reports during Schematic, Tender & Construction Phases.	Commissioning Authority to document
EAp2	<b>Minimum Energy Performance</b>	✓			High efficiency building envelope, HVAC systems and mechanical systems	Mechanical Consultant to document
EAp3	<b>CFC Reduction in HVAC&amp;R Equipment</b>	✓			Conduct inventory to identify equipment that uses CFC refrigerants and replace or retrofit these systems with non-CFC refrigerants. Specify new HVAC&R equipment that uses no CFC refrigerants.	Mechanical Consultant to document
EAc1.1	<b>Optimize Energy Performance</b> , Lighting Power, 15%, 25%, 35%		3		Consider a computer simulation model to assess the performance and identify the most cost-effective energy efficiency measures.	Electrical Consultant to document
EAc1.2	<b>Optimize Energy Performance</b> , Lighting Controls	1			Install daylight responsive controls in all regularly occupied spaces within 4.5 metres (15 ft) of windows and under skylights.	Electrical Consultant to document
EAc1.3	<b>Optimize Energy Performance</b> , HVAC		2		Equipment efficiency; every solar exposure must have a separate control zone; interior spaces must be separately zoned; private offices and specialty occupancies must have active controls capable of sensing space use and modulating HVAC system in response to space demand. Add more control zones; affect base building.	Mechanical Consultant to document

 <b>LEED SCORECARD</b>					Certified 21-26; Silver 27-31; Gold 32-41; Platinum 42-57	
		YES	MAYBE	N/A	Strategies	Action Items / Comments / Cost Notes
		29.0	16.5	11.0		
EAc1.4	Optimize Energy Performance, Equipment & Appliances	2			EnergyStar eligible appliances (stove, fridge, microwaves etc), office equipment (printers, photocopiers, scanners etc), electronics (TV's, projectors, AV equipment, computers etc.), and commercial food service equipment (vending machines) installed. Including AV equipment.	Mechanical Consultant to document
EAc2	Enhanced Commissioning			1		
EAc3	Energy Use, Measurement & Payment Accountability	2			Install sub-metering equipment to measure and record energy uses within the tenant space. Negotiate a lease where energy costs are paid by the tenant and not included in the base rent.	Note: BOMA BEST Level 2 requirement
EAc4	Green Power		1		Engage in green power contract with the local utility. Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources.	PWGSC to engage in a 2-year contract with a green power supplier. Note: BOMA BEST Level 2 requirement
Materials & Resources (14)		6	2	6.0		
MRp1	Storage & Collection of Recyclables	✓			Collection area to be provided within the renovated space, Storage & pick-up area to be provided in the base building. Recycling Policy to be in place.	Confirm with Property Manager
MRc1.1	Tenant Space, Long-Term Commitment	1			Occupant commits to remain in the same location for not less than 10 years.	PWGSC to provide information
MRc1.2	Building Reuse: Maintain 40% of Interior Non-Structural Components			1	Maintain at least 40% by area of the existing non-shell, non-structure components (walls, flooring and ceilings)	
MRc1.3	Building Reuse: Maintain 60% of Interior Non-Structural Components			1	Same as above to achieve 60%	
MRc2.1	Construction Waste Management: Divert 50% from Landfill	1			Develop Construction Waste Management Plan.	
MRc2.2	Construction Waste Management: Divert 75% from Landfill	1			Develop Construction Waste Management Plan.	
MRc3.1	Resource Reuse: 5%			1		
MRc3.2	Resource Reuse: 10%			1		
MRc3.3	Resource Reuse: 30% Furniture and Furnishings			1		
MRc4.1	Recycled Content: 10% (post-consumer + ½ post-industrial)	1			Use materials with high recycled content.	

 <b>LEED SCORECARD</b>					Certified 21-26; Silver 27-31; Gold 32-41; Platinum 42-57
		YES	MAYBE	N/A	
		29.0	16.5	11.0	Strategies
					Action Items / Comments / Cost Notes
MRc4.2	<b>Recycled Content:</b> 20% (post-consumer + ½ post-industrial)		1		Same as above 20%
MRc5.1	<b>Regional Materials:</b> 20% Manufactured Regionally	1			Use min of 20% of the combined value of construction and Div 12 (Furniture) materials and products that are manufacture regionally within a radius of 800km (500 miles).
MRc5.2	<b>Regional Materials:</b> 10% Extracted and Manufactured Regionally		1		Use min of 10% if the combined value construction and Division 12 (Furniture) materials and products extracted, harvested or recovered, as well as manufactured, within 800 km (500 miles) of the project.
MRc6	<b>Rapidly Renewable Materials</b>			1	
MRc7	<b>Certified Wood</b>	1			Use 50% FSC certified wood / wood doors.
<b>Indoor Environmental Quality (15)</b>		<b>11</b>	<b>3</b>	<b>3</b>	
EQp1	<b>Minimum IAQ Performance</b>	✓			Meet the minimum requirements of Ashrae 62.1-2004
EQp2	<b>Environmental Tobacco Smoke (ETS) Control</b>	✓			Smoking area must be 7.6m from entries, operable windows or outdoor air intakes.
EQc1	<b>Outdoor Air Delivery Monitoring</b>		1		Permanent monitoring and alarm systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design min ventilation requirements.
EQc2	<b>Increased Ventilation</b>		1		Dependent on base building systems design.
EQc3.1	<b>Construction IAQ Management Plan:</b> During Construction	1			IAQ management plan during construction.
EQc3.2	<b>Construction IAQ Management Plan:</b> Before Occupancy	1			IAQ testing after construction, prior to occupancy.
EQc4.1	<b>Low-Emitting Materials:</b> Adhesives & Sealants	1			Use adhesives, sealants, sealant primers and aerosol adhesives that are VOC limit compliant
EQc4.2	<b>Low-Emitting Materials:</b> Paints and Coating	1			Use paints and coatings that are VOC limit compliant
EQc4.3	<b>Low-Emitting Materials:</b> Carpet	1			Use carpet systems that meets Green Label IAQ Test Program, & Hardfloor materials that meet FloorScore.
EQc4.4	<b>Low-Emitting Materials:</b> Composite Wood and Laminate Adhesives	1			Composite wood products and laminate adhesives with no added urea-formaldehyde.
EQc4.5	<b>Low-Emitting Materials:</b> Systems Furniture and Seating		1		System furniture to be Greenguard IAQ certified, need product certification.
EQc5	<b>Indoor Chemical &amp; Pollutant Source Control</b>	1			Permanent entryway systems at high volume entryways, Merv 13 filters in HVAC equipment prior to occupancy, drains for hazardous liquids, deck to deck partitions and exhaust in rooms with chemical use areas or copy rooms,

 <b>LEED SCORECARD</b>					Certified 21-26; Silver 27-31; Gold 32-41; Platinum 42-57	
		YES	MAYBE	N/A	Strategies	Action Items / Comments / Cost Notes
		29.0	16.5	11.0		
EQc6.1	<b>Controllability of Systems:</b> Lighting	1			Provide lighting controls for: At least 90% of occupants, enabling adjustments to suit individual task needs and preferences; shared multi-occupant spaces e.g. conference rooms, cafeterias, can share lighting controls.	
EQc6.2	<b>Controllability of Systems:</b> Temperature and Ventilation	1			Provide thermal and ventilation controls for at least 50% of the space occupants that enable adjustment to suit individual needs and preferences; shared multi-occupant spaces where transient groups meet can share controls.	
EQc7.1	<b>Thermal Comfort:</b> Compliance	1			Comply with ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy.	
EQc7.2	<b>Thermal Comfort:</b> Monitoring	1			Permanent monitoring system to ensure EQc7.1 is maintained, and corrective action to ensure performance.	
EQc8.1	<b>Daylight &amp; Views:</b> Daylight 75% of Spaces			1		
EQc8.2	<b>Daylight &amp; Views:</b> Views 90% of Spaces			1		
EQc8.3	<b>Daylight &amp; Views:</b> Views 90% of Seated Spaces			1		
<b>Innovation &amp; Design Process</b>		<b>2</b>	<b>3</b>			
IDc1.1	<b>Innovation in Design</b>	1			Public Transport accessible	
IDc1.2	<b>Innovation in Design</b>		1		Exceptional performances Ex. Green Power 70%	Owner to confirm
IDc1.3	<b>Innovation in Design</b>		1		Exceptional performances Ex. 95%Waste Diversion	Team members can contribute
IDc1.4	<b>Innovation in Design</b>		1		Other Exceptional performance	Team members can contribute
IDc2	<b>LEED® Accredited Professional</b>	1			Tony Yip - LEED AP	
<b>Project Totals</b>						
<b>Certified</b> 21-26 points <b>Silver</b> 27-31 points <b>Gold</b> 32-41 points <b>Platinum</b> 42-57 points						

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX F**

**OWNER AND CONTRACTOR  
SCOPE OF WORK**

**(Passport Office)**



**SINCLAIR CENTRE REVITALIZATION PROJECT**  
**Passport Office**  
**List of Contractor's and Owner's Scope of Work**

			<b>Included in Contract (By Contractor)</b>	<b>Not Included in Contract (By Owner)</b>
<b>A</b>	<b>Specialty Items</b>			
	<b>1</b>	Lockers	Relocate & Install	
	<b>2</b>	Shelving	Relocate & Install	
	<b>3</b>	Storage Cabinets in the Vault	Relocate & Install	
	<b>4</b>	Existing Tables & Chairs	Relocate & Install	
	<b>5</b>	Boxes of personal Belongings for Staff	Relocate & Install	
	<b>6</b>	Supplies	Relocate & Install	
	<b>7</b>	Tensile Posts	Relocate & Install	
	<b>8</b>	Misc Item in Existing Office	Relocate & Install	
	<b>9</b>	Crown Asset Items		To Be Determined with Movers
	<b>10</b>	Tackboards & Whiteboards		
<b>B</b>	<b>Furniture</b>			
		Refer to Furniture List	Install	Supply
<b>C</b>	<b>Signage</b>			
		Refer to Signage List	Install	Supply
<b>D</b>	<b>IT Equipment &amp; Structured Cabling:</b>			
	<b>1</b>	Backbone Cabling (fibre)	Supply & Install (Inside Building)	
	<b>2</b>	Backbone Cabling (copper)	Supply & Install (Inside Building)	
	<b>3</b>	Backbone Cabling Connectors	Supply & Install (Inside Building)	
	<b>4</b>	Horizontal Cabling (Cat 6 UTP)	Supply & Install	
	<b>5</b>	Modular UTP Jacks & faceplates	Supply & Install	
	<b>6</b>	Patch Cabling	Supply & Install	
	<b>7</b>	Patch Panels	Supply & Install	

**SINCLAIR CENTRE REVITALIZATION PROJECT**  
**Passport Office**  
**List of Contractor's and Owner's Scope of Work**

			<b>Included in Contract (By Contractor)</b>	<b>Not Included in Contract (By Owner)</b>
	<b>8</b>	BIX Connectors	Supply & Install	
	<b>9</b>	Racks	Supply & Install	
	<b>10</b>	Vertical Cable Management	Supply & Install	
	<b>11</b>	Velcro Cable Ties	Supply & Install	
	<b>12</b>	Inner duct (corrugated)	Supply & Install	
	<b>13</b>	Raceways (wire mesh cable trays, conduits, outlet backboxes)	Supply & Install	
	<b>14</b>	Grounding	Supply & Install	
	<b>15</b>	UPS		Supply & Install
	<b>16</b>	Switches		Supply & Install
	<b>17</b>	Servers		Supply & Install
	<b>18</b>	PDU's	Relocate	Install
	<b>19</b>	Routers		Supply & Install
	<b>20</b>	Telephones		Supply & Install
	<b>21</b>	Users Computers	Relocate	Install
	<b>22</b>	Fax Machines	Relocate	Install
	<b>23</b>	Printers	Relocate	Install
<b>E</b>	<b>Security</b>			
	<b>1</b>	Door Control Panel	Supply & Install	
	<b>2</b>	Server/Monitor/keyboard/Mouse	Supply & Install	
	<b>3</b>	Card Reader	Supply & Install	
	<b>4</b>	Equipment Rack	Supply & Install	
	<b>5</b>	Cameras	Supply & Install	
	<b>6</b>	DVR	Supply & Install	
	<b>7</b>	Camera Control	Supply & Install	

**SINCLAIR CENTRE REVITALIZATION PROJECT**  
**Passport Office**  
**List of Contractor's and Owner's Scope of Work**

			<b>Included in Contract (By Contractor)</b>	<b>Not Included in Contract (By Owner)</b>
	<b>8</b>	Wiring	Supply & Install	
	<b>9</b>	Request-To-Exit	Supply & Install	
	<b>10</b>	Local Siren	Supply & Install	
	<b>11</b>	Power Supply	Supply & Install	
	<b>12</b>	Battery Backup	Supply & Install	
	<b>13</b>	Door Contacts	Supply & Install	
	<b>14</b>	Electric Strike	Supply & Install	
	<b>15</b>	Electric Hinge	Supply & Install	
	<b>16</b>	Raceways (wire mesh cable trays, conduits, junction boxes, outlet backboxes)	Supply & Install	
	<b>17</b>	Power	Supply & Install	
	<b>18</b>	Stand-Alone PC	Supply & Install	
<b>E</b>	<b>Finish Hardware</b>			
	<b>1</b>	Heavy Duty Door Closers	Supply & Install	
	<b>2</b>	Mech and Electr-Mech Locking Hardware	Supply & Install	
<b>F</b>	<b>Lighting Control</b>			
	<b>1</b>	BMS Monitoring/Control	Supply & Install	
	<b>2</b>	Interface Wiring & Conduits between BMS & Control Panels	Supply & Install	
	<b>3</b>	Control Panels (relays, transformers, controllers, LV wiring. etc)	Supply & Install	
	<b>4</b>	LV & Line voltage local Wall Switches	Supply & Install	
	<b>5</b>	LV wiring & Conduits (between control panel and local switches)	Supply & Install	
	<b>6</b>	Line voltage wiring	Supply & Install	
<b>G</b>	<b>Safety Security Lamination for Windows</b>		Supply & Install	

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX G**

**INVENTORY OF FURNITURE AND EQUIPMENT  
(Food Court Tables & Chairs)**

## **Appendix G**

### **Inventory of Furniture (Phase 2)**

#### Tables and Chairs Inventory

Upper Mall:

37 chairs

14 tables

Lower Mall:

177 chairs

60 tables

Totals

Chairs= 214

Tables= 74

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX H**

**SNC-LAVALIN FORMS**



Building ID / Name

Project Number

Project Name

Equipment Description

This piece of equipment replaces equipment number:

Supplier

Purchase Price

Model Number

Manufacturer

Serial Number

Purchase Date

Certification Expiry

Installation Date

Estimated Service Life (in years)

Warranty Expiry Date

Is the Equipment Regulated?

Tenant Owned

☐ Yes ☐ No

☐ Yes ☐ No

Equipment Group

Equipment Category

Unique Counter

Parent equipment Number

Location ("Floor number" - "Room number" - "Section/Wing")

Location (Specific Details)

### Electrical Specifications

Volts

HP

Amps or KVA

RPM

Phases

No. of Circuit (Panels)

Fuse size

Fuse Quantity

### Mechanical Specifications

C.F.M. / G.P.M

Capacity

Belts Size

Belts Quantity

Pre-Filters Size

Pre-Filters Quantity

Main Filters Size

Main Filters Quantity

### Fire Suppression

Type

Capacity (kg/lbs)

Actuation Type (Auto/Man)

Sprinkler System/

Year of Installation

### Environmental

Refrigerant

☐ Glycol

Type

Quantity

Capacity

ton/kw

Storage Tanks

☐ 1 Ext. above ground

☐ 2 Ext. underground

☐ 3 Interior

Capacity

Fuel type

Secondary containment

☐ Double Wall

☐ Berm

Litres

☐ Seasonal Maintenance: Start

Finish

### Lockout / Tagout Requirements:

☐ Required

☐ Not Applicable

	Valve #		Valve #
Hydraulic	#1	#2	
	Valve #	Valve #	
Pneumatic	#1	#2	
	Valve #	Valve #	
Steam	#1	#2	
	Breaker #	Panel Name	Breaker #
Electrical	#1		#2
	Type	Lockout	Type
Other	#1		#2

### Deleted Equipment

Equipment Number

Reason / Justification

Notes / Specific Maintenance Requirements during Warranty Period:

TO BE REMOVED AND DELETED

Preventive Maintenance Set Up		
Frequency	Required	Schedule Date
	Yes	Month/Year
Weekly	<input type="checkbox"/>	
Monthly	<input type="checkbox"/>	
Bi-Monthly	<input type="checkbox"/>	
Quarterly	<input type="checkbox"/>	
Semi-Annual	<input type="checkbox"/>	
Annual	<input type="checkbox"/>	
Warranty	<input type="checkbox"/>	

Equipment No. Label Provided:

☐ ☐

Warranty Card Provided

☐ ☐

PM Included in Route:

Asset No:

Submitted by: (Print Name)

Date

CMMS Use Only

☐ Equipment Created ☐ PM's Attached or ☐ Equipment Added to List



Duration in days:

Department /  
Business Unit

Date:



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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX I**

**INTERIOR FINISH, MATERIAL AND COLOUR SCHEDULE**

REFERENCE SPECIFICATION SECTION	ACCEPTABLE PRODUCTS			REMARKS
	LEGEND	MATERIALS	MANUFACTURER / STYLE / COLOUR	
08 80 50 Glazing	<b>SCGF2</b>	Glazing Film	"Fasara" Glass Finishes, Milky Milky (San Marino) by 3M Scotchshield	
08 87 53 Security Films	<b>SCGF1</b>	Clear Security Film	"Ultra 600" by 3M Scotchshield	
	SCGF3	Frosted Security Film	"Ultra 600" with "Fasara" Milky Milky (San Marino) Finish by 3M Scotchshield	
09 30 13 Ceramic Tiling	<b>PRT-1</b>	Floor Tile – Porcelain	"Tropical Grass", colour Taupe by Olympia	
	<b>PRT-2 &amp; 3</b>	Floor Tile – Porcelain	"Streaming Series", colour Smoke by Ames	
	<b>CT-1</b>	Wall Tile – Ceramic	"Tokio", colour Brown Grey by Mono Serra	
	<b>CT-2</b>	Wall Tile – Ceramic	"Tokio", colours White & Blue by Mono Serra	
	<b>CT-3</b>	Wall Tile – Glass	"Milano List", colour White gloss by Ceramax	
	<b>CT-4</b>	Wall Tile – Ceramic	"Time Series", colour White by Ames	
	<b>CT-5</b>	Wall Tile – Ceramic	"Time Series", colour Espresso by Ames	
	<b>CT-6</b>	Wall Tile – Ceramic	"Time Series", colour White Decor by Ames	
	<b>CT-7</b>	Wall Tile – Ceramic	"Time Series", colour Espresso Decor by Ames	
	<b>CT-8</b>	Wall Tile – Glass	"Reflections in Glass", colour Blue Lagoon Gloss by Daltile	
	-	Tile Edge Protection	"Jolly" by Schluter	
09 51 99 Acoustical Ceilings for Minor Works	<b>ACT</b>	Acoustic Ceiling Tiles	"Fine Fissured" #1824 by Armstrong	
	-	Suspended T-Bar	"Prelude XL", colour White by Armstrong	
09 65 99 Resilient Flooring for Minor Works	<b>VT-1</b>	Solid Vinyl Tile	"Natural Creations ArborArt", style TP072 Fruitwood Buckwheat by Armstrong	
	<b>VT-2</b>	Vinyl Composition Tile	"Brushwork", colour 712 Graphite by Mannington	
	<b>VT-3</b>	Conductive / Static Dissipative Vinyl Tile	"Colorex SD", colour Montblanc by Forbo	
	<b>VB</b>	Vinyl Resilient Base	"Traditional" wall base, colour Silver Grey #55 by Johnsonite	
09 68 13 Tile Carpeting	<b>CPT</b>	Carpet Tile	"Landscape Colours 03223", colour Cemented Metal by Tandus	

REFERENCE SPECIFICATION SECTION	ACCEPTABLE PRODUCTS			REMARKS
	LEGEND	MATERIALS	MANUFACTURER / STYLE / COLOUR	
09 91 23 Interior Painting	<b>PT-1</b>	Paint	Sico 6000, Freezing Rain #6207-31	
	<b>PT-2</b>	Paint	Sico 6000, Obscure Sky #6207-52	
	<b>PT-3</b>	Paint	Sico 6000, Perfect Blue #6002-31	
	<b>PT-4</b>	Paint	Sico 6000, Night Music #6047-73	
	<b>PT-5</b>	Paint	Benjamin Moore, Willow CC-542	
	<b>PT-6</b>	Paint	Benjamin Moore, Decorators White CC-20	
10 28 10 Toilet Bath Accessories	<b>TTD</b>	Toilet Tissue Dispenser	"Compact" MFG #56796 by Georgia-Pacific	
	<b>PTDD-1</b>	Paper Towel Dispenser & Disposal	"Frost" fully recessed extra large capacity, model #400A-70	
	<b>PTDD-2</b>	Paper Towel Dispenser & Disposal	"Frost" semi-recessed extra large capacity, model #400B-70	
	<b>PTDD-3</b>	Paper Towel Dispenser & Disposal	"Frost" fully recessed large capacity, model #410A-70	
	<b>SD</b>	Soap Dispenser	"Bradex" Sensor-Operated Soap Dispenser, Model #6315 by Bradley	
	<b>ND</b>	Sanitary Napkin Disposal	"Frost" recessed model #633-2	
	<b>MR</b>	Mirror – Unit Washrooms	"Bobrick" B-165 series	
	<b>SH</b>	Shelf	"Kindred" model # XINX623	
	<b>BCS</b>	Baby Changing Station	"Bradex" Surface-mounted model #962-11 by Bradley	
12 24 13 Roller Window Shades	-	Roller Window Shades	"Solarfective" motorized ceiling-mounted shades with 500 Series Solar shield shade cloth, colour Mid-Grey.	

**NOTE:**

- .1 This schedule is a separate document from the specification and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following “acceptable products” are listed in order to establish a quality of product upon which a price can be tendered. Other products having the same characteristics will not be excluded. Refer to the specification sections as listed for quality specifics.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

END OF SCHEDULE

---




**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**





**VANCOUVER, BRITISH COLUMBIA**



---

**APPENDIX J**

**FURNITURE SCHEDULE**

LEGEND	ITEM	REFERENCE PHOTOS	SPECIFICATION
F1	Soft Seating (1 Seater)		<ul style="list-style-type: none"> <li>- Seat and back cushions adapt to fit curve of frame</li> <li>- Available in stainless steel or chrome construction</li> <li>- Stainless steel frame welded in single piece construction for ultimate durability</li> <li>- Stainless steel and chrome frames are hand-buffed to a mirror Finish</li> <li>- Individual leather panels are cut, hand-welted and hand tufted</li> </ul>
F2	Cube Table	 <p>F2 Cube Table @ Soft Seating Solid Douglas Fir</p>	<ul style="list-style-type: none"> <li>- Artisan sculpted trunks of sustainable monkey pod trees.</li> <li>- Carved from a single piece of wood.</li> <li>- 18"L x 18"W x 20"H</li> </ul>
F3	Flex Table (4 people)	 <p>F3, F4 &amp; F5 - FLEX TABLE &amp; CHAIRS</p>	<ul style="list-style-type: none"> <li>- Flex Seating</li> <li>- Outdoor grade coat finish</li> <li>- SCS Indoor Advantage Gold Certified</li> <li>- 100% recyclable / 34% recycled content</li> <li>- Overall Depth: 23 1/4"</li> <li>- Overall Width: 24 3/4"</li> <li>- 32"</li> </ul>
F4	Flex Seating		
F5	Flex Table (2 people)		

LEGEND		REFERENCE PHOTOS	SPECIFICATION
<b>F6</b>	Soft Seating (2 Seaters)		<ul style="list-style-type: none"> <li>- Seat and back cushions adapt to fit curve of frame</li> <li>- Available in stainless steel or chrome construction</li> <li>- Stainless steel frame welded in single piece construction for ultimate durability</li> <li>- Stainless steel and chrome frames are hand-buffed to a mirror Finish</li> <li>- Individual leather panels are cut, hand-welted and hand tufted</li> </ul>
<b>F7</b>	Light Cube		<ul style="list-style-type: none"> <li>- 110 v socket power</li> <li>- 9W LED or 20 W compact fluorescent bulb</li> <li>- 10' long electrical cord</li> <li>- Rotational molded of a high quality polyethylene resin that is very weather resistant in all climates and has a smooth finish</li> <li>- Commercial grade product, almost break proof when knocked</li> </ul>
<b>PL1</b>	Planter Box	 <small>PL1 Planter</small>	
<b>PL2</b>	Garbage Bin		<ul style="list-style-type: none"> <li>-Stainless steel body</li> <li>- Rigid plastic liners with 18 gallon capacity in each liner</li> <li>Removable lids</li> <li>- Interchangeable steel tops</li> <li>- Four heavy duty legs to keep unit slightly elevated</li> </ul>

LEGEND		REFERENCE PHOTOS	SPECIFICATION
PL3	Recycle Bin (2 compartments)		<ul style="list-style-type: none"> <li>- Stainless steel body</li> <li>- Rigid plastic liners with 18 gallon capacity in each liner</li> <li>- Removable lids</li> <li>- Interchangeable steel tops</li> <li>- Four heavy duty legs to keep unit slightly elevated</li> </ul>
PL4	Recycle Bin (3 compartments)		<ul style="list-style-type: none"> <li>- Stainless steel body</li> <li>- Rigid plastic liners with 18 gallon capacity in each liner</li> <li>- Removable lids</li> <li>- Interchangeable steel tops</li> <li>- Four heavy duty legs to keep unit slightly elevated</li> </ul>

**NOTE:**

- .1 This schedule is a separate document from the specification and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.
- .2 The following “acceptable products” are listed in order to establish a quality of product upon which a price can be tendered. Other products having the same characteristics will not be excluded.
- .3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Furniture schedule or an approved alternative.

END OF SCHEDULE



---

**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

---

**APPENDIX K**

**DIGITAL PRINT GRAPHICS IN  
PASSPORT OFFICE**

DRAWING REFERENCE:

A20 – INTERIOR ELEVATIONS - PASSPORT OFFICE



A1.



A2.



A3.



A4.



B1.



B2.





B3.



B4.

DRAWING REFERENCE:

**A21 – INTERIOR ELEVATIONS - PASSPORT OFFICE**



C1.



C2.



C3.



C4.





C5.



C6.



C7.



D1.



D2.



D3.



D4.



D5.



D6.



D7.



---

**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

---

**APPENDIX L**

**FINAL REPORT- RESULTS OF LEAD  
LEACHATE TESTING**



**DST Consulting Engineers Inc.**  
Unit B – 4125 McConnell Drive  
Burnaby, British Columbia  
V5A 3J7  
Office: 604.436.4588

---

March 6, 2013

Project No.: BE-VC-016371

Public Works and Government Services Canada  
Suite 641 – 800 Burrard Street  
Vancouver, British Columbia  
V6Z 2V8

Attention: Ms. Amy Moizumi, B.Sc. (Agr)  
Environmental Specialist

Subject: **Final Report - Results of Lead Leachate Testing –  
Sinclair Center – 737 West Hastings, Vancouver, British Columbia**

Dear Ms. Moizumi,

## **1.0 INTRODUCTION**

DST Consulting Engineers Inc. (DST) was retained by Public Works and Government Services Canada (PWGSC) for the purpose of completing sampling and analysis for lead leachate from select areas at 737 West Hastings Street in Vancouver, British Columbia (herein referred to as the Subject Building).

This document provides our scope of work, applicable regulatory framework, the results, conclusions and appropriate recommendations.

## **2.0 SCOPE OF SERVICES**

As per the RFP, DSTs scope of work included:

- Travel to and from site;
- Collection of fifteen (15) samples of lead-based coatings for leachate testing;
- Submission of leachate samples for Toxicity Characteristic Leaching Procedure (TCLP) analysis and provision of recommendations for waste handling;
- Project Management and Senior Review; and,
- Provision of draft and final report, detailing the results of the leachate sampling results.

---

### **3.0 REGULATIONS AND GUIDELINES**

#### **3.1 Canada Labour Code**

In federal jurisdictions, hazardous building materials are regulated under the *Canada Labour Code, Part II, Part X, Hazardous Substances*.

#### **3.2 Provincial Regulations**

In British Columbia, the management of hazardous building materials in the work place is regulated by WorkSafeBC under the Workers' Compensation Act (effective April 15, 1998), as amended by the Workers' Compensation (Occupational Health and Safety) Amendment Act (effective October 1, 1999). Specific requirements of the Occupational Health and Safety Amendment Act are prescribed in the British Columbia Occupational Health and Safety Regulation (BC OH&S Regulation).

##### **3.2.1 Hazardous Materials & Demolition/Renovations**

Section 20.112 of the BC OH&S Regulation details the requirements that employers and owners are responsible for before beginning work on the demolition, renovation or salvage of machinery, equipment, buildings, or structures. The employer or owner must:

- Inspect the site to identify any asbestos, lead and/or other potentially hazardous materials that may be handled, disturbed, or removed;
- Have the inspection results available at the worksite; and,
- Ensure that the hazardous materials are safely contained or removed.

##### **3.2.2 Toxicity Characteristic Leaching Procedure (TCLP)**

Toxicity Characteristic Leaching Procedure (TCLP) testing were performed on identified lead-based paint, to facilitate the proper disposal of lead-containing wastes.

DST collected lead-based coatings (LBCs) samples throughout select areas of the Subject Building and submitted for leachate testing. If the LBCs collected are found to leach lead above 5 mg/L, the LBCs would be considered to be leachable hazardous waste.



---

### **3.2.3 Hazardous Wastes**

In British Columbia, environmental matters pertaining to waste generally fall under the jurisdiction of the British Columbia Ministry of Environment (MoE), pursuant to the Environmental Management Act. The key waste regulation under the Environmental Management Act relating to hazardous building materials is the Hazardous Waste Regulation (HWR), as amended from time to time. The HWR provides the requirements for the proper handling, storage, transportation, treatment, recycling and disposal of hazardous wastes in the province. The regulation also outlines the materials and criteria to be used to characterize waste as hazardous.

## **4.0 FINDINGS**

The lead leachate sampling was completed on February 26, 2013 by Mr. David Kernel, CLI, CLR, Environmental Technologist, under the direction of Christian Injates, CEC, CEM, Sector Head, Building Environments of DST.

The results of the sampling and analysis are provided in the following sub-sections.

### **4.1 Lead Leachate Sampling and Analysis**

DST previously completed a hazardous building materials assessment in select areas of the Subject Building. Please refer to DST report number BE-VC-015575, entitled "*Final Hazardous Building Materials Assessment – Sinclair Centre – 757 West Hastings Street, Vancouver, British Columbia*", dated December 4, 2012 (herein referred to as the Previous Report).

The previous report identified a total of eighty nine (89) surface coatings suspected of containing potentially hazardous levels of lead. Of the eighty nine (89) samples analyzed, forty seven (47) surface coatings contained potentially hazardous levels of lead.

Based on DST's previous related experience, surface coatings that contained lead concentrations of  $1.0 \text{ mg/cm}^2$  or greater were identified as having the potential for leaching lead in excess of 5 mg/L.

A total of fifteen (15) representative samples of previously identified lead-based paints containing higher levels of lead (i.e. above  $1 \text{ mg/cm}^2$ ) were collected from the Subject Building. The samples of the building materials were analyzed in accordance with USEPA Analytical Method 6020A – Toxicity Characteristic Leaching Procedure (TCLP) and USEPA Analytical Method 1331 – TCLP pH Measurements.

A summary of the sample descriptions and analytical results is provided in Table 1: Analytical Results for Leachate testing, below.

**Table 1: Analytical Results for Leachate Testing  
 737 West Hastings Street, Vancouver, British Columbia**

Sample ID	Building Material	Location	Leachate Lead (mg/L)
LL-01	Green Paint On Freight Elevator Door Frame	Food Court Corridor (Sample LS-03)	3.03
LL-02	Grey With Blue Ceramic Floor Tiles	"Fortune Wok" Kitchen (Sample LS-06)	<0.10
LL-03	Off White Ceramic Wall Tiles	"Fortune Wok" Front (Sample LS-11)	<0.10
LL-04	Blue Ceramic Floor Tiles	"Pita Fresh" Kitchen (Sample LS-13)	<0.10
LL-05	Light Blue Ceramic Wall Tiles	"Pita Fresh" Kitchen (Sample LS-20)	<0.10
LL-06	Dark Blue Ceramic Wall Tiles	"Pita Fresh" Kitchen (Sample LS-21)	0.52
LL-07	Peach Ceramic Wall Tiles	"Vacant Restaurant" (Sample LS-22)	<0.10
LL-08	Black Ceramic Wall Tiles	"Vacant Restaurant" (Sample LS-23)	<0.10
LL-09	Blue Ceramic Wall Tiles	"Vacant Restaurant" (Sample LS-24)	<0.10
LL-10	Black Ceramic Wall And Floor Tiles	Men's And Women's Change Room, Back Food Court Corridor (Sample LS-27)	<0.10
LL-11	White Paint On Windows And Frames	Retail Unit 143 (Sample LS-54)	<0.10
LL-12	White Paint On Concrete Perimeter Window Sills	Retail Unit 241 (Sample LS-62)	<0.10
LL-13	Orange Paint On Concrete Perimeter Window Sills	Retail Unit 250 (Sample LS-68)	<0.10
LL-14	White Paint On Concrete Perimeter Window Sills	Retail Unit 244 (Sample LS-76)	<0.10
LL-15	Grey Ceramic Floor Tiles In Closet	Retail Unit 246 (Sample LS-81)	<0.10

A copy of the analytical laboratory report is provided in **Appendix I**.

---

## 5.0 CONCLUSIONS

### 5.1 Lead Leachate

Samples LL-01 through LL-15 indicated leachate levels below the Provincial standard of <5 mg/L, and such, can be treated as non-leachable hazardous waste.

## 6.0 CLOSING

We hope this information meets your current requirements. Please contact us if you require additional information or have any questions and/or concerns with the information presented herein.

Thank you for the opportunity to be of service to Public Works and Government Services Canada.

Yours very truly,

**DST Consulting Engineers Inc.**

Report Prepared by:

A rectangular box containing a handwritten signature in cursive script, which appears to read "David Kernel".

David Kernel, CLI, CLR  
*Environmental Technologist*

Report Reviewed by:

A handwritten signature in cursive script, which appears to read "Christian Injates".

Christian Injates, CEC, CEM  
*Sector Head, Building Environments*

**APPENDIX I**

**LABORATORY CERTIFICATES OF ANALYSIS**

Your Project #: BE-VC-016371 LEAD LEACHATE SAM  
 Site Location: 757 W. HASTINGS, VAN, BC  
 Your C.O.C. #: G051875, G051876

**Attention: DAVE KERNEL**  
 DST CONSULTING ENGINEERS  
 #300 - 3665 KINGSWAY  
 VANCOUVER, BC  
 CANADA V5R 5W2

**Report Date: 2013/03/04**

## CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B315280**  
**Received: 2013/02/26, 14:45**

Sample Matrix: PAINT  
 # Samples Received: 15

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Metals - TCLP	15	2013/02/27	2013/02/28	BBY7SOP-00001	EPA 6020A
TCLP pH Measurements	15	N/A	2013/02/28	BBY7SOP-00005	EPA 1311

\* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Kim Domino, Burnaby Senior Project Manager  
 Email: KDomino@maxxam.ca  
 Phone# (604) 638-5018

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B315280  
Report Date: 2013/03/04

DST CONSULTING ENGINEERS  
Client Project #: BE-VC-016371 LEAD LEACHATE SAM  
Site Location: 757 W. HASTINGS, VAN, BC  
Sampler Initials: DK

### ELEMENTS BY ATOMIC SPECTROSCOPY (PAINT)

Maxxam ID		FS6140	FS6141	FS6142	FS6143	FS6144	FS6145	FS6146	FS6147	FS6148		
Sampling Date		2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26		
	<b>UNITS</b>	<b>LL-011</b>	<b>LL-021</b>	<b>LL-031</b>	<b>LL-041</b>	<b>LL-051</b>	<b>LL-061</b>	<b>LL-071</b>	<b>LL-081</b>	<b>LL-091</b>	<b>RDL</b>	<b>QC Batch</b>
<b>TCLP Extraction Procedure</b>												
Initial pH of Sample	pH Units		6.32	6.65	9.14	8.48	9.78	8.93	10.1	8.06	N/A	6604973
pH after HCl	pH Units		1.68	1.68	1.69	1.68	1.65	1.65	1.66	1.68	N/A	6604973
Final pH of Leachate	pH Units	5.17	6.05	5.09	6.00	5.22	5.36	5.24	5.27	5.11	N/A	6604973
pH of Leaching Fluid	pH Units	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	N/A	6604973

Maxxam ID		FS6149	FS6150	FS6151	FS6152	FS6153	FS6154				
Sampling Date		2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26				
	<b>UNITS</b>	<b>LL-101</b>	<b>LL-111</b>	<b>LL-121</b>	<b>LL-131</b>	<b>LL-141</b>	<b>LL-151</b>	<b>RDL</b>	<b>QC Batch</b>		
<b>TCLP Extraction Procedure</b>											
Initial pH of Sample	pH Units	10.1					9.74	N/A	6604973		
pH after HCl	pH Units	1.75					1.60	N/A	6604973		
Final pH of Leachate	pH Units	6.07	5.93	6.13	6.81	6.67	6.29	N/A	6604973		
pH of Leaching Fluid	pH Units	4.90	4.90	4.90	4.90	4.90	4.90	N/A	6604973		

### TCLP METALS (PAINT)

Maxxam ID		FS6140	FS6141	FS6142	FS6143	FS6144	FS6145	FS6146	FS6147	FS6148		
Sampling Date		2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26		
	<b>UNITS</b>	<b>LL-011</b>	<b>LL-021</b>	<b>LL-031</b>	<b>LL-041</b>	<b>LL-051</b>	<b>LL-061</b>	<b>LL-071</b>	<b>LL-081</b>	<b>LL-091</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Metals</b>												
LEACHATE Lead (Pb)	mg/L	3.03	<0.10	<0.10	<0.10	<0.10	0.52	<0.10	<0.10	<0.10	0.10	6608122

Maxxam ID		FS6149	FS6150	FS6151	FS6152	FS6153	FS6154				
Sampling Date		2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26	2013/02/26				
	<b>UNITS</b>	<b>LL-101</b>	<b>LL-111</b>	<b>LL-121</b>	<b>LL-131</b>	<b>LL-141</b>	<b>LL-151</b>	<b>RDL</b>	<b>QC Batch</b>		
<b>Metals</b>											
LEACHATE Lead (Pb)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6608122		

N/A = Not Applicable  
RDL = Reportable Detection Limit



Maxxam Job #: B315280  
Report Date: 2013/03/04

Success Through Science®

DST CONSULTING ENGINEERS  
Client Project #: BE-VC-016371 LEAD LEACHATE SAM  
Site Location: 757 W. HASTINGS, VAN, BC  
Sampler Initials: DK

<b>General Comments</b>
-------------------------

Maxxam Job #: B315280  
Report Date: 2013/03/04

DST CONSULTING ENGINEERS  
Client Project #: BE-VC-016371 LEAD LEACHATE SAM  
Site Location: 757 W. HASTINGS, VAN, BC  
Sampler Initials: DK

### QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6604973	Initial pH of Sample	2013/02/28					4.90, RDL=N/A	pH Units	2.6	20
6604973	Final pH of Leachate	2013/02/28					4.90, RDL=N/A	pH Units	4.6	20
6604973	pH of Leaching Fluid	2013/02/28					4.90, RDL=N/A	pH Units	0	20
6604973	pH after HCl	2013/02/28							3.0	20
6608122	LEACHATE Lead (Pb)	2013/02/28	103	75 - 125	98	75 - 125	<0.10	mg/L	NC	35

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.



G051875

Maxxam Job#:

B315280

**Invoice To:** Require Report? Yes ☐ No ☐

Company Name: SAMP

Contact Name: Christian Hines

Address: \_\_\_\_\_

PC:

Phone / Fax#:      Ph:      Fax:

E-mail: ciniares@dsta.gov.com

Company Name:

Contact Name: David Kerner

Address: \_\_\_\_\_

PG-

Phone / Fax#: Ph: Fax:

E-mail alhamad.alstarov@gmail.com

POB:

Quotation #:

Project #: BE-VC-016371

Proj. Name: Lead Leachate Sampling

Location: 757 W. Hastings Van BC

Sampled By: DK

## REGULATORY REQUIREMENTS SERVICE REQUESTED:

☐ CSR  
☐ CCME  
☐ BC Water Quality  
☐ Other \_\_\_\_\_  
**DRINKING WATER**

☒ Regular Turn Around Time (TAT)  
 (5 days for most tests)  
☐ RUSH (Please contact the lab)  
☐ 1 Day    ☐ 2 Day    ☐ 3 Day  
 Date Required: \_\_\_\_\_

## Special Instructions:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

## ANALYSIS REQUESTED

[illegible]

Laboratory Use Only

\*Relinquished by:

Date (YY/MM/DD):

Time:

Received by:

Date (YY/MM/DD):

Time:

Time Sensitive

Temperature on Receipt (°C)

Custody Seal Intact on Cooler?

Yes

No

Page 5 of 6

IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxam Yellow: Clav

### CHAIN OF CUSTODY RECORD

Page: 2 of 2

G051876

Maxxam Job#: \_\_\_\_\_

**Invoice To:** Require Report? Yes ☐ No ☐

Company Name: Same

Contact Name: John C

Address: \_\_\_\_\_

PG

Phone / Fax#:      Ph:      Fax:

E-mail \_\_\_\_\_

Company Name: DST Consulting

Contact Name: \_\_\_\_\_

Address: \_\_\_\_\_

PC

Phone / Fax#:      Ph:      Fax:

E-mail: [zhangyong@china.com](mailto:zhangyong@china.com)

PD #

Quotation #:

Project #: RE-VC-016376

Prac. Name: /oan/ lanchake, /c.melina

Location 757 1/2 Hastings St Van BC

Sampled By: *DK*

## REGULATORY REQUIREMENTS SERVICE REQUESTED:

☐ CSR  
☐ CCME  
☐ BC Water Quality  
☐ Other \_\_\_\_\_  
☐ DRINKING WATER

☒ Regular Turn Around Time (TAT)  
 (5 days for most tests)  
☐ RUSH (Please contact the lab)  
☐ 1 Day    ☐ 2 Day    ☐ 3 Day  
 Date Required: \_\_\_\_\_

## Special Instructions:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

## ANALYSIS REQUESTED

ANALYSIS REQUESTED									
BTEX/MPH	<input type="checkbox"/>	MTBE	<input type="checkbox"/>						
VOC/MPH	<input type="checkbox"/>								
EPH	<input type="checkbox"/>	TEH	<input type="checkbox"/>						
PAH	<input type="checkbox"/>	LEPH/HEPH	<input type="checkbox"/>						
CONE-PHC (Fractions 1-4 Plus BTEX)									
CONE-PHC (Fractions 2-4)									
CONE BTEX (Fraction 1 Plus BTEX)									
PCB	<input type="checkbox"/>								
Pesticides by 4AAP		<input type="checkbox"/>	Pesticides by GC/MS		<input type="checkbox"/>				
TOG	<input type="checkbox"/>	MOG	<input type="checkbox"/>	SWOG	<input type="checkbox"/>				
Dissolved Metals	Field Filtered?		Y	<input type="checkbox"/>	N	<input type="checkbox"/>			
	Field Acidity?		Y	<input type="checkbox"/>	N	<input type="checkbox"/>			
Trace Metals Field Acidity?		Y	<input type="checkbox"/>	N	<input type="checkbox"/>				
Nitrate	<input type="checkbox"/>	Nitrite	<input type="checkbox"/>	Ammonia	<input type="checkbox"/>				
Chloride	<input type="checkbox"/>	Fluoride	<input type="checkbox"/>	Sulfate	<input type="checkbox"/>				
Total Suspended Solids-TSS		<input type="checkbox"/>	TD5	<input type="checkbox"/>					
pH	<input type="checkbox"/>	Conductivity	<input type="checkbox"/>	Alkalinity	<input type="checkbox"/>				
BOD	<input type="checkbox"/>								
COD	<input type="checkbox"/>								
Coliform, Total & E.coli		<input type="checkbox"/>							
Asbestos	<input type="checkbox"/>								
Lead Leachate									
HOLD									

Samples are from a Drinking Water Source?  
Does source supply multiple households?

*Relinquished by:	Date (YY/MM/DD):	Time:	Received by:	Date (YY/MM/DD):	Time:
D. Kernel			M. J. Jurek	10/3/2012	14:45

Page 6 of 6

Time  
Sensitive

Temperature on Receipt (°C)	NA
-----------------------------	----

Custody Seal Intact on Cooler?			
Yes		No	

\*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS

White: Maxam Yellow: Clev

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX M**

**SITE PHOTOS OF FLOOR  
CRACK REPAIR WORKS**



No. 7



No.8



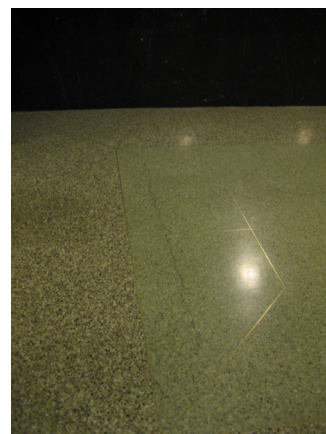
No. 9



No. 10



No.11



No.12





No. 13



No.14



No. 15



No. 16



No.17



No.18



No. 19



No.20



No. 21



No. 22



No.23



No.24





No. 25



No.26



No. 27



No. 28



No.29



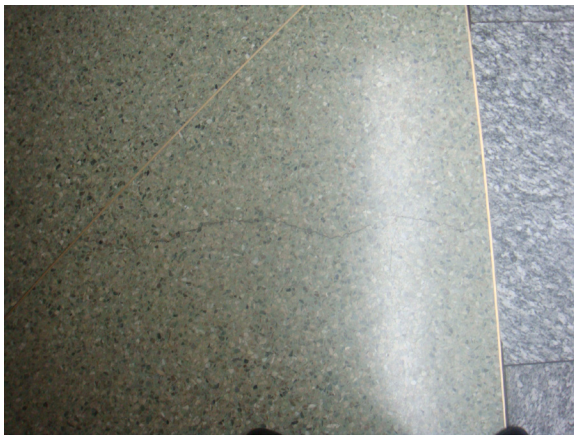
No.30



No. 31



No.32



No. 33



No. 34



No.35



No.36





No. 37



No.38



No. 38A



No. 39



No.40



No.41





No. 42



No.43



No. 44



No. 45



No.46



No.47





No. 48



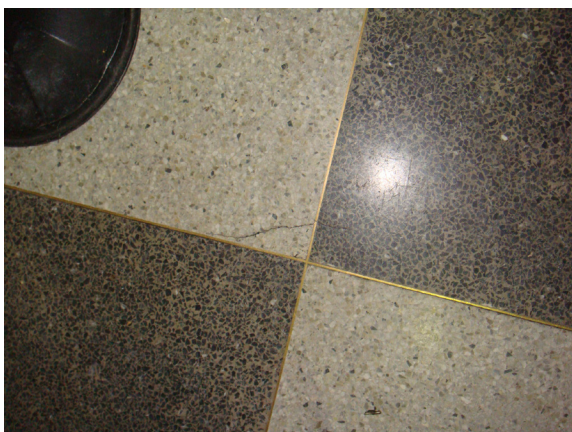
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No. 49A



No. 50



No.50A



No.51



No. 52



No.53



No. 54



No. 55

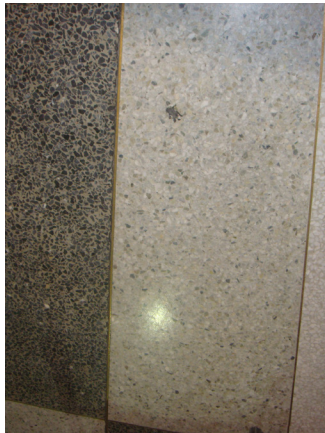


No.56



No.57





No. 58



No.59



No.60



No. 61



No.62



No.63



No.64



No.65



No.66



No.67



No.68



No.69





No.70



No.71



No.72



No.73



No.74



No.75



No.76



No.77



No.78



No.79



No.80



No.81





No.82



No.83



No.84



No.85



No.86



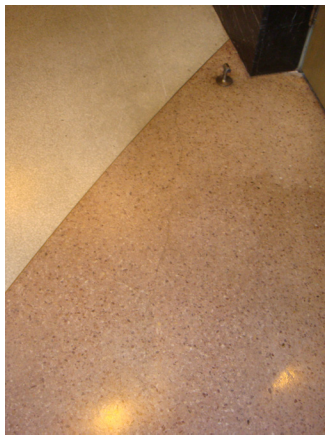
No.87



No.88



No.89



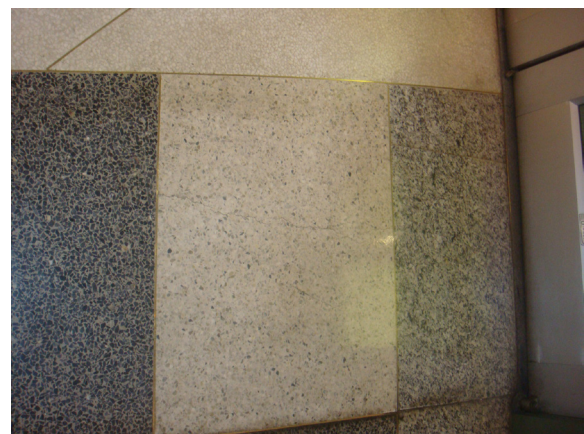
No.90



No.91



No.92



No.93





No.94



No.95



No.96



No.97



No.98



No.99





No.100



No.101



No.102



No.103



No.104



No.105





No.106



No.107



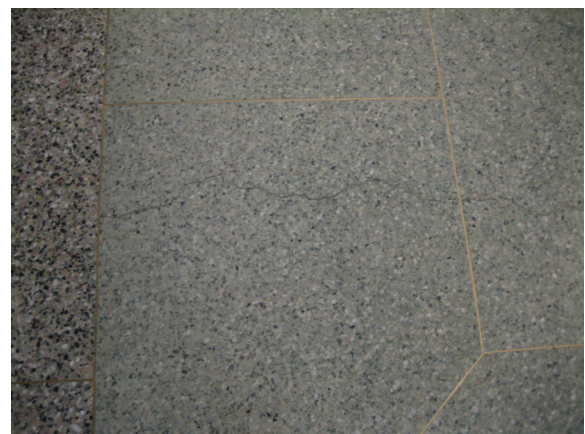
No.108



No.109



No.110



No.111



No.112



No.113



No. 114



No.115



No.116



No.117

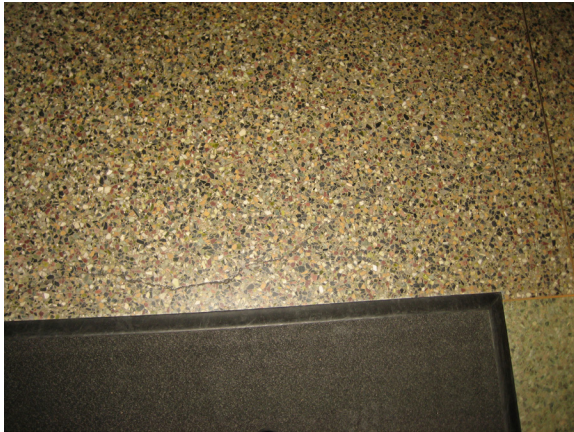




No.118



No.119



No.120



No.121

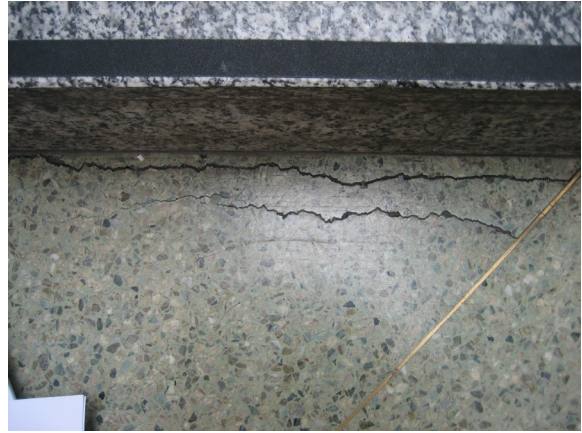


No.122





No. 1



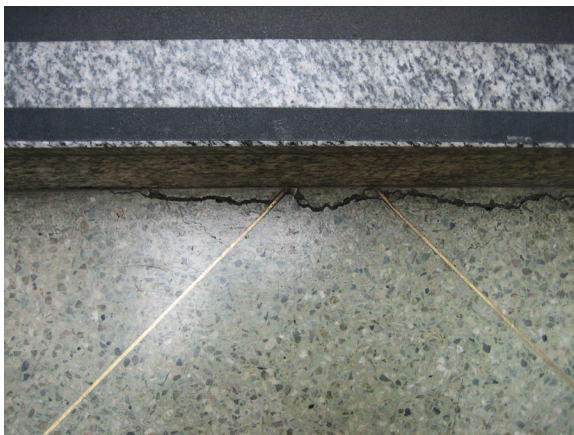
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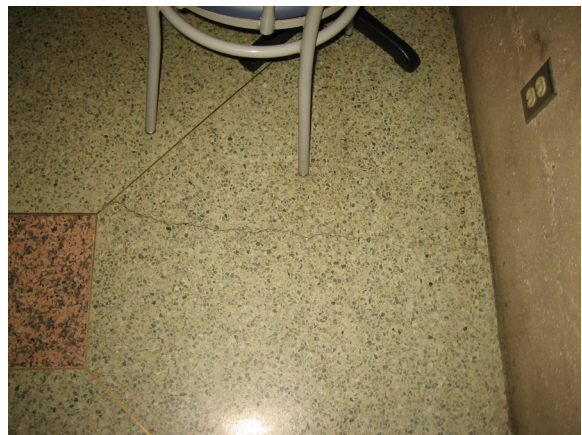
No. 3



No. 4



No.5



No.6



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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX N**

**SINCLAIR CENTRE SKYLIGHT GLAZING  
INVESTIGATION REPORT BY BERKELEY-VADOCZ  
ENGINEERING INC.  
DATED SEPTEMBER 15, 2012**



September 15, 2012

our file: L12-207

CHERNOFF THOMPSON ARCHITECTS  
110 – 1281 West Georgia Street  
Vancouver, B.C.  
V6E 3J5

**Attention:** Mr. Tony Yip, MAIBC, MRAIC, CP, LEED AP

Dear Sir:

**Re: SINCLAIR CENTRE SKYLIGHT GLAZING INVESTIGATION**

As requested by PWGSC and yourself, I visited the Sinclair Centre complex with two glaziers in order to disassemble select glazing units to try to confirm the details and condition of the existing glazing and fastening of the Galleria and Atrium skylights. We were joined on site by Tony Yip, MAIBC, Project Architect for Chernoff Thompson and Catherine Lemieux, P. Eng., Building Envelope Consultant, from Morrison Hershfield.

My investigation is an update of my earlier visual inspection and report, dated April 5, 2002, and deals with the observed condition of the existing glazing systems that are concealed in service. Based on these observations this update discusses the structural capability and recommendations for improvements. The reader is directed to my earlier report for a more general discussion of the existing skylight system.

### **Galleria**

The Galleria roof is essentially a straight gable design with a 45-degree slope to a simple drip edge without attached gutters. The rafter spacing is 635mm (25") or less on center, which is the typical layout for T-bar glazing. As noted previously, the 6mm annealed-laminated glass is adequate to meet the wind and minimum roof load requirements of the current NBCC and VBBL. Given the steep slope and sheltered location of this structure, it is a reasonable application for the single-glazed T-bar system.

The present investigation is primarily concerned with the seismic performance of this assembly. To examine the frame edge clearance and bite of the glass, we removed the glazing stops ("rolled bead") from six units; three on the lower level of the NW run and three on the upper level along the South run. In all cases the glass was 6mm annealed laminated glass, with what appeared to be 0.38mm (0.015") PVB interlayer, which is consistent with our previous visual examinations.

All of the first three locations had the glass fairly well centred in the frame opening, leaving 6mm to 8mm (1/4" to 5/16") clearance to the aluminum rafters. A short bead of silicone, approximately 100mm, had been placed along the edges near the sill, mid-span and head of these units. Most of them had a slight gap where they had pulled away from the glass edge.



In all cases the glass was not on proper setting blocks, but was set with very thin rubber shims at the extreme corners, resulting in very close contact with the aluminum sill. In addition to the difficulty in properly sealing the sill

and the potential for glass damage due to metal contact, this lack of sill clearance significantly reduces the lateral racking capability of the glass units.



One glass unit was partially removed from the frame to allow examination of the glazing seats and the head anchorage of the rafters. The head flashing covered 100mm (4") of the glass, while the flashing leg was 150mm (6") long, leaving approximately 50mm (2") of clearance at the top of the glass. Due to the length of flashing and the inset location of the rafter clips it was very difficult to accurately examine the fastening, but the vinyl glazing seats could be seen throughout. It was clear the clips had a single screw in the centre, under the rafter, and the tip could be felt projecting through the steel support plate. The screw condition with respect to corrosion could not be confirmed.

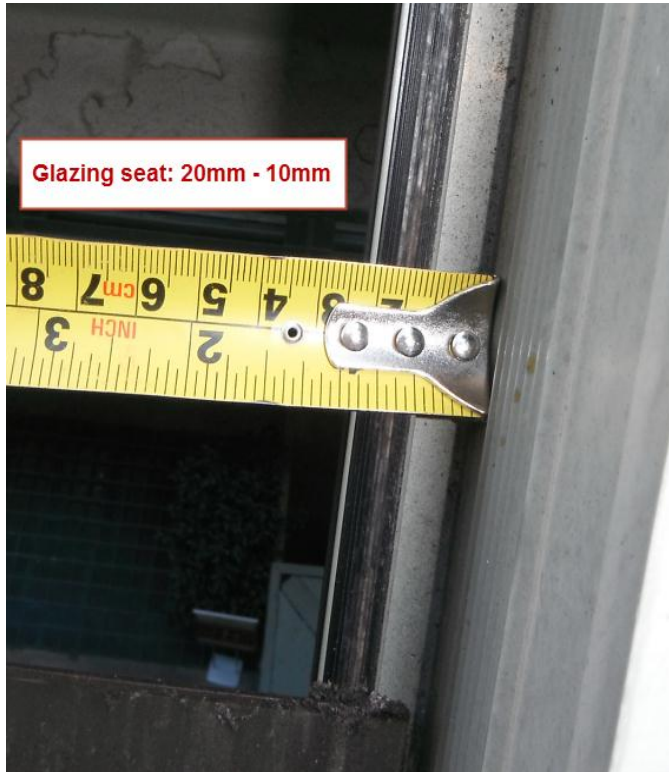


At the three units along the South side of the upper ridge the glass was found to be offset to one side of the opening. This is due to thermal movements and vibration of the skylight frame over the years. These openings also had evidence of the silicone edge beads described above; however they had not prevented the side creep of the glass.

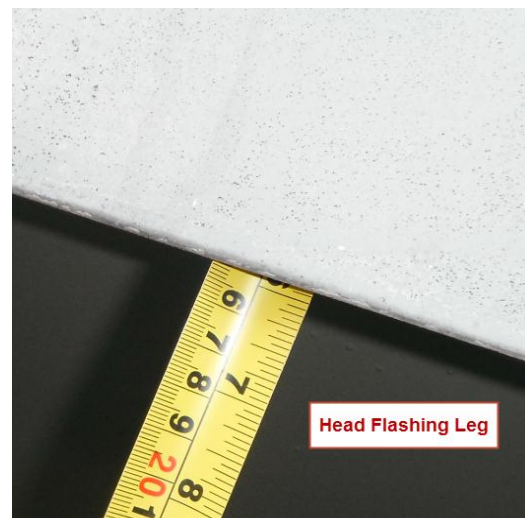
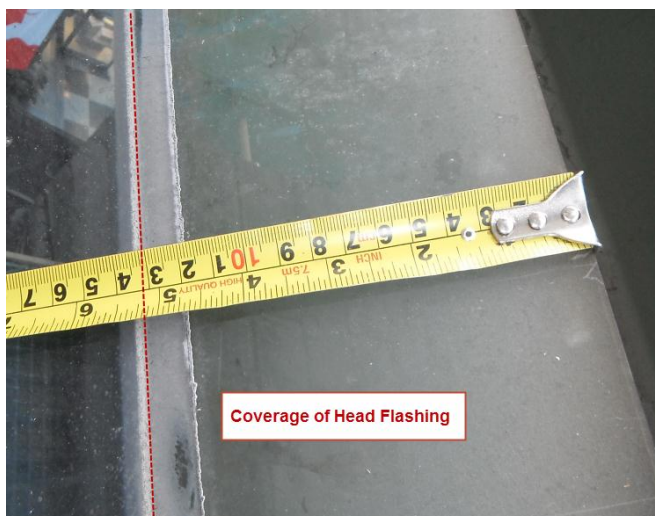




The overall edge clearance was the same as found on the NW run, and the sill edge setting blocks were also missing or improperly set. All glazing seats observed had appropriate vinyl gaskets and all appeared to be in good condition. The distance from the side of the rafter to the edge of the seat is 10mm ( $3/8$ " ) and the seat width is 10mm ( $3/8$ " ), resulting in an ideal glass bite of 12 to 14mm ( $1/2$ " +) with the glass centered.



While the head flashing dimensions are identical to the other locations, the overlap onto the glass was about 130mm ( $5 \frac{1}{4}$ " ) leaving only about 20mm ( $3/4$ " ) head clearance for the glass.





### Atrium Skylight Condition Assessment

The Atrium roof is made up of essentially the same T-bar on steel structure system as the Galleria, however the roof shape is more like a truncated pyramid and the slope is much less here; varying from 20 to 26 degrees from horizontal. Also, the rafter spacing is 32" to 33.5" (813 to 844mm) as compared to 25". The T-bar rafters themselves are well supported on the steel structure with respect to gravity loads; however the wind uplift resistance will be dependent on the clips attached to the bottom flange of the bars. These clips, which appear to be a molded or extruded plastic, depend on the integrity of the fasteners into the steel supports. Due to the details of the support structure and the skylight flashing all but the heads of the fasteners were concealed. No obvious damage or deterioration was observed.

Again, the sill setting details were inadequate, while the glazing seats on the rafters all appeared to have vinyl gaskets in place.



While the existing glass is labeled as laminated, only the overall thickness could be measured, indicating 6mm annealed laminated with 0.38mm (0.015") interlayer. As stated in previous reports, the Code referenced standard, CAN/CGSB-12.20-M89, "Structural Design of Glass for Buildings", requires a minimum interlayer thickness of 0.76mm (0.030") for overhead glazing. Due to the high of these frame openings, the laminated glass had to be supplied in two pieces. There are no purlin members at these joints, but the butt-joints have an aluminum flashing element caulked into the joint, then another strip of sheet metal (not aluminum) has been caulked over the joints. These flashing do not provide any structural support to the glass edges at the butt-joints.



Due to the low vertical rise ("storey height") relative to the rafter length, the lateral drift limitations of this skylight will be higher than the Galleria, and well above the 0.5% drift mentioned in the August 29, 2012 consultant's meeting.



## Discussion

Given that the glazing details are virtually identical throughout the Galleria roof, the shifting of the upper level skylight glass may be an indication that the upper portion of the structure experiences greater magnitude and or frequency of lateral movement than the lower level. The building structural engineers may be able to relate this to the relative flexibility of the structural frames.

Considering the skylight framing itself, and using the observed edge clearances, calculations (based on the Modified Bouwkamp & Meehan formulae) of the limiting drift (racking) deformations result in a theoretical capability of almost 28mm (1.1"). Of course, this assumes the glass is properly set and blocked to allow it to rotate as the frame deforms, which is not the present condition.

For the BCBC & VBBL, CAN/CGSB-12.20 mandates the use of laminated glass with a minimum polyvinylbutyral (PVB) interlayer thickness of 0.76mm (0.030") for "sloped glazing and skylights over areas normally occupied by people". The thicker the interlayer, the greater will be the resistance to penetration of hard objects. Where the risk of falling objects is high, an interlayer thickness of 1.52mm (0.060") will substantially increase the safety of occupants below.

Considering the structural capacity of the existing glass, independent of other Code requirements, snow load on the Atrium is the critical criteria. Not only is the slope very low, and the sill/curb condition prevents snow from sliding off the glass, the annealed glass is particularly sensitive to prolonged bending stress.

The low slope means a significant strength reduction due to long-term dead load and snow load. Also, the location of this skylight is on a lower roof adjacent to a relatively high building, which may not cause drifting but would certainly result in a snow accumulation greater than an exposed roof.

To meet the snow load requirements of the then current Code, VBBL 1980, the glass should have been 10mm heat-strengthened laminated (5HS+0.030" PVB+5HS). One could argue the interlayer thickness as it was not in the Code until 1990, however good industry practice would have been to use thicker than 0.015" in such a low-slope application.

To comply with today's VBBL 2007, which has a slightly higher reference snow load; the existing skylight glass should be at least 20mm thick annealed laminate (10mm + 0.76 PVB + 10mm). This can be reduced to 12mm by using heat-strengthened glass (6HS + 0.76 PVB + 6HS). Fully tempered glass should not be used in this location because it would be more likely to fall through the opening if broken.

The building structural engineer would have to advise as to how much racking movement would be expected in the roof structure.

## Recommendations

### Short-Term:

- The glass stops (rolled bead) must be silicone sealed to the glass to prevent disengagement.
- Proper setting blocks (minimum 6mm thick by 50mm long and side-blocks should be installed to centre and support the glass.
- The Galleria glass does not require replacement at this time.
- The Atrium glass should be replaced with 12mm heat-strengthened laminate to meet Code requirements for snow load. If purlins were also installed at the butt-joints, the thickness may be reduced to 10mm HS-laminated.
- If replacing the glass as above, serious consideration should be given to increasing the interlayer thickness beyond the code minimum, to 1.52mm PVB for impact resistance as discussed above.

Long-Term:

- The existing T-bar system should be completely replaced with a system designed to accept insulating glazing units (IGU) and provide the required structural and building envelope performance.
- When preparing documents and specifications for new skylight work, the “Glazing Systems Specification Manual” published by the Glazing Contractors Association of B.C. is an invaluable guide.

Prepared by:

Gary W. Berkeley, P.Eng.

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**SINCLAIR CENTRE REVITALIZATION  
PHASE 2**

**VANCOUVER, BRITISH COLUMBIA**

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**APPENDIX P**

**LETTER OF ASSURANCE FOR  
USE WITH NATIONAL BUILDING CODE**

## Schedule A

### Confirmation of Commitment by Owner's Agent and Coordinating Registered Professional

- Note:
1. This letter must be submitted before issuance of a *building* permit.
  2. In this letter the words in italics are as defined in the National Building Code of Canada or as defined herein.
  3. A *copy or duplicate original* of this Schedule shall be submitted to Fire Protection Engineering Services of Human Resources Development Canada.

#### Re: Design and Field Review of Construction by a Coordinating Registered Professional

To: The Manager  
Fire Protection Engineering Services  
Human Resources Development Canada  
1400 - 300 West Georgia Street  
Vancouver, BC V6B 6G3

Date: \_\_\_\_\_

(Professional Seal)

Re: \_\_\_\_\_  
Name of Project (Print)

\_\_\_\_\_  
Address of Project (Print)

\_\_\_\_\_  
Legal Description of Project (Print)

The undersigned has retained \_\_\_\_\_ as a *coordinating registered professional* to coordinate the design work and *field reviews* of the *registered professionals* required for this project. The *coordinating registered professional* shall coordinate the design work and *field reviews* of the *registered professionals* required for the project in order to ascertain that the design will substantially comply with the National Building Code of Canada and other applicable enactments respecting safety and that the construction of the project will substantially comply with the National Building Code of Canada and other applicable enactments respecting safety, not including the construction safety aspects.

"*field reviews*" are defined to mean those reviews of the work

- (a) at a project site of a development to which a *building* permit relates, and
- (b) where applicable, at fabrication locations where *building* components are fabricated for use at the project site that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the *registered professional* for which the *building* permit is issued.

The owner's agent and the *coordinating registered professional* each acknowledge their responsibility to notify the addressee of this letter of the date the *coordinating registered professional* ceases to be retained by the owner's agent before the date the *coordinating registered professional* ceases to be retained or, if that is not possible, then as soon as possible. The *coordinating registered professional* acknowledges the responsibility to notify the addressee of this letter of the date a *registered professional* ceases to be retained before the date the *registered professional* ceases to be retained or, if that is not possible, then as soon as possible.

## Schedule A (continued)

The owner's agent and the *coordinating registered professional* understand that where the *coordinating registered professional* or a *registered professional* ceases to be retained at any time during construction, work on the above project will cease until such time as:

- (a) a new *coordinating registered professional* or *registered professional*, as the case may be, is retained, and
- (b) a new letter in the form set out in Schedule A or in the forms set out in Schedules B-1 and B-2, as the case may be, is filed with the *authority having jurisdiction*.

The undersigned *coordinating registered professional* certifies that he or she is a *registered professional* as defined herein, and agrees to coordinate the design work and *field reviews* of the *registered professionals* required for the project as outlined in the attached Schedules B1 and B2 including coordination and integration of functional testing of fire and life safety systems.

### Coordinating Registered Professional

### Owner's agent

\_\_\_\_\_  
*Coordinating Registered Professional's Name (Print)*

\_\_\_\_\_  
Signing Officer's Name (Print)

\_\_\_\_\_  
*Coordinating Registered Professional's Signature*

\_\_\_\_\_  
Signing Officer's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

(*Coordinating Registered Professional's Seal here*)

In the Province of British Columbia, a *registered professional* is defined to mean:

- (a) a person who is registered or licensed to practice as an architect under the Architects Act, or
- (b) a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act.

A *coordinating registered professional* is defined to mean the *registered professional* who coordinates the design work and *field reviews* of the *registered professionals* required for the project as outlined in the attached Schedules B1 and B2 including coordination and integration of functional testing of fire and life safety systems.

## Schedule B-1

### Assurance of Professional Design and Commitment for Field Review

- Note:
1. This letter must be submitted before issuance of a *building* permit.
  2. In this letter the words in italics are as defined in the National Building Code of Canada or as defined herein.
  3. A *copy or duplicate original* of this Schedule shall be submitted to Fire Protection Engineering Services of Human Resources Development Canada.

**To: The Manager**  
**Fire Protection Engineering Services**  
**Human Resources Development Canada**  
**1400 - 300 West Georgia Street**  
**Vancouver, BC V6B 6G3**

Date: \_\_\_\_\_

Re: \_\_\_\_\_  
Name of Project (Print)

\_\_\_\_\_  
Address of Project (Print)

\_\_\_\_\_  
Legal Description of Project (Print)

The undersigned hereby gives assurance that the design of the (Initial those of the items listed below that apply to this *registered professional*. All the disciplines will not necessarily be employed on every project.)

\_\_\_\_\_ **Architectural**  
\_\_\_\_\_ **Structural**  
\_\_\_\_\_ **Mechanical**  
\_\_\_\_\_ **Plumbing**  
\_\_\_\_\_ **Fire Suppression Systems**  
\_\_\_\_\_ **Electrical**  
\_\_\_\_\_ **Geotechnical - temporary**  
\_\_\_\_\_ **Geotechnical - permanent**

(Professional Seal)

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building* permit as outlined on the attached Schedule B2 substantially comply with the National Building Code of Canada and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction as indicated on the attached "Summary Of Design And Field Review Requirements" (Schedule B-2).

## Schedule B-1 (continued)

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined herein.

\_\_\_\_\_  
Name (Print)

\_\_\_\_\_  
Signed

\_\_\_\_\_  
Date

\_\_\_\_\_  
Address (Print)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Phone

(Affix Professional Seal here)

(If the *Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm \_\_\_\_\_

and I sign this letter on behalf of the firm.

(print name of firm)

Note: The above letter must be signed by a *registered professional*. In the Province of British Columbia, a *registered professional* is defined to mean:

- (a) a person who is registered or licensed to practice as an architect under the Architects Act, or
- (b) a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act.

## Schedule B-2

### Summary Of Design And Field Review Requirements

- Note:
1. This form must be submitted with Schedule B-1 before issuance of a *building* permit.
  2. In this letter the words in italics have the same meaning as in the National Building Code of Canada and as defined in the attached Schedule B1.

Date: \_\_\_\_\_  
(Registered Professional)

Project: \_\_\_\_\_  
(Name)  
\_\_\_\_\_  
(Address)

(Initial applicable discipline below and cross out and initial non-applicable items within the discipline.)

#### Architectural

- 1.1 Fire resisting assemblies
- 1.2 *Fire separations* and their continuity
- 1.3 *Closures*, including tightness and operation
- 1.4 Egress systems, including *access to exit* within *suites* and *floor areas*
- 1.5 Performance and physical safety features (guardrails, handrails, etc.)
- 1.6 Structural capacity of architectural components, including anchorage and seismic restraint
- 1.7 Sound control
- 1.8 Landscaping, screening and site grading
- 1.9 Provisions for fire fighting access
- 1.10 *Access* requirements for *persons with disabilities*
- 1.11 Elevating devices
- 1.12 Functional testing of architecturally related fire emergency systems and devices
- 1.13 Development Permit and conditions therein
- 1.14 Interior signage, including acceptable materials, dimensions and locations
- 1.15 Review of all applicable shop drawings
- 1.16 Interior and exterior finishes
- 1.17 Dampproofing and/or waterproofing of walls and slabs below *grade* (Professional Seal)
- 1.18 Roofing and flashings
- 1.19 Wall cladding systems
- 1.20 Thermal insulation systems, including condensation control and cavity ventilation
- 1.21 Exterior glazing
- 1.22 Integration of building envelope components
- 1.23 Environmental separation requirements (Part 5)

#### Structural

- 2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
- 2.2 Structural aspects of *deep foundations*
- 2.3 Review of all applicable shop drawings
- 2.4 Structural aspects of unbonded post-tensioned concrete design and construction

#### Mechanical

- 3.1 HVAC systems and devices, including high *building* requirements where applicable
- 3.2 *Fire dampers* at required *fire separations*
- 3.3 Continuity of *fire separations* at HVAC penetrations
- 3.4 Functional testing of mechanically related fire emergency systems and devices
- 3.5 Maintenance manuals for mechanical systems
- 3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
- 3.7 Review of all applicable shop drawings



**Project:** \_\_\_\_\_  
(Address)

**Registered Professional:** \_\_\_\_\_

**Plumbing**

- 4.1 Roof *drainage systems*
- 4.2 Site and foundation *drainage systems*
- 4.3 *Plumbing systems* and devices
- 4.4 Continuity of *fire separations* at plumbing penetrations
- 4.5 Functional testing of plumbing related fire emergency systems and devices
- 4.6 Maintenance manuals for *plumbing systems*
- 4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
- 4.8 Review of all applicable shop drawings

**Fire Suppression Systems**

- 5.1 Suppression system classification for type of *occupancy*
- 5.2 Design coverage, including concealed or special areas
- 5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
- 5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
- 5.5 Qualification of welder, quality of welds and material
- 5.6 Review of all applicable shop drawings
- 5.7 Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
- 5.8 Maintenance program and manual for suppression systems
- 5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
- 5.10 For partial systems - confirm sprinklers are installed in all areas where required
- 5.11 Fire Department connections and hydrant locations
- 5.12 Fire hose standpipes
- 5.13 Functional testing of fire suppression systems and devices

**Electrical**

- 6.1 Electrical systems and devices, including high building requirements where applicable
- 6.2 Continuity of *fire separations* at electrical penetrations
- 6.3 Functional testing of electrical related fire emergency systems and devices
- 6.4 Electrical systems and devices maintenance manuals
- 6.5 Structural capacity of electrical components, including anchorage and seismic restraint
- 6.6 Clearances from *buildings* of all electrical utility equipment
- 6.7 Fire protection of wiring for emergency systems
- 6.8 Review of all applicable shop drawings

**Geotechnical - temporary**

- 7.1 *Excavation*
- 7.2 Shoring
- 7.3 Underpinning
- 7.4 Temporary construction dewatering

**Geotechnical - permanent**

(Professional Seal)

- 8.1 Bearing capacity of the soil
- 8.2 Geotechnical aspects of deep *foundations*
- 8.3 Compaction of engineered fill
- 8.4 Structural considerations of soil, including slope stability and seismic loading
- 8.5 Backfill
- 8.6 Permanent dewatering
- 8.7 Permanent underpinning

## Schedule C-A

### Assurance of Coordination of Professional Field Review

- Note:
1. This letter must be submitted after completion of the project but before the occupancy permit is issued, or a final inspection is made, by the *authority having jurisdiction*.
  2. In this letter the words in italics have the meaning as defined in the previously submitted Schedule A.
  3. A *copy or duplicate original* of this Schedule shall be submitted to Fire Protection Engineering Services of Human Resources Development Canada.

**To: The Manager**  
**Fire Protection Engineering Services**  
**Human Resources Development Canada**  
**1400 - 300 West Georgia Street**  
**Vancouver, BC V6B 6G3**

Date: \_\_\_\_\_

(Professional Seal)

Re: \_\_\_\_\_  
Name of Project (Print)

\_\_\_\_\_  
Address of Project (Print)

\_\_\_\_\_  
Legal Description of Project (Print)

I hereby give assurance that

- (a) I have fulfilled my obligations for coordination of *field review* of the *registered professionals* required for the project as described in the previously submitted Schedule A, "Confirmation Of Commitment By Owner And By Coordinating Registered Professional"
- (b) I have coordinated the functional testing of the fire emergency systems and devices to ascertain that they substantially comply in all material respects with
  - (i) the applicable requirements of the National Building Code of Canada and other applicable enactments respecting safety, not including construction safety aspects, and
  - (ii) the plans and supporting documents submitted in support of the application for the *building* permit.
- (c) I am a *registered professional* as defined herein.

## Schedule C-A (continued)

**Project:** \_\_\_\_\_  
(Address)

(The *coordinating registered professional* shall complete the following:)

\_\_\_\_\_  
Name (Print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Phone

(Affix Professional Seal here)

(If the *coordinating registered professional* is a member of a firm, complete the following:)

I am a member of the firm of \_\_\_\_\_  
and I sign this letter on behalf of the firm. (Print name of firm)

Note: The above letter must be signed by a *coordinating registered professional*, who is also a *registered professional*. In the Province of British Columbia a *registered professional* is defined to mean:

- (a) a person who is registered or licensed to practice as an architect under the Architects Act, or
- (b) a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act.

## Schedule C-B

### Assurance of Professional Field Review and Compliance

- Note:
1. This letter must be submitted after completion of the project but before the occupancy permit is issued, or a final inspection is made, by the *authority having jurisdiction*. A separate letter must be submitted by each *registered professional*.
  2. In this letter the words in italics have the same meaning as defined in the previously submitted Schedules B1 and B2.
  3. A *copy or duplicate original* of this Schedule shall be submitted to Fire Protection Engineering Services of Human Resources Development Canada.

**To: The Manager**  
**Fire Protection Engineering Services**  
**Human Resources Development Canada**  
**1400 - 300 West Georgia Street**  
**Vancouver, BC V6B 6G3**

Date: \_\_\_\_\_

(Professional Seal)

Re: \_\_\_\_\_  
Area of responsibility (e.g. Architectural, etc.) (Print)

\_\_\_\_\_  
Name of Project (Print)

\_\_\_\_\_  
Address of Project (Print)

\_\_\_\_\_  
Legal Description of Project (Print)

I hereby give assurance that

- (a) I have fulfilled my obligations for *field review* as outlined in the previously submitted Schedule B-1, "Assurance of Professional Design and Commitment for Field Review," and Schedule B-2, "Summary of Design and Field Review Requirements," and
- (b) those components of the project opposite my initials in Schedule B-2 substantially comply in all material respects with
  - (i) the applicable requirements of the National Building Code of Canada and other applicable enactments respecting safety, not including construction safety aspects, and
  - (ii) the plans and supporting documents submitted in support of the application for the *building* permit.
- (c) I am a *registered professional* as defined herein.

## Schedule C-B (continued)

**Project:** \_\_\_\_\_  
(Address)

(Each *registered professional* shall complete the following:)

\_\_\_\_\_  
Name (Print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Address

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Phone

(Affix Professional Seal here)

(If the *registered professional* is a member of a firm, complete the following:)

I am a member of the firm of \_\_\_\_\_  
and I sign this letter on behalf of the firm. (Print name of firm)

Note: The above letter must be signed by a *registered professional*. In the Province of British Columbia a *registered professional* is defined to mean:

(a) a person who is registered or licensed to practice as an architect under the Architects Act, or

(b) a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act.

## **1. GENERAL**

### **1.1 Submittals**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Provinces of BC, Canada.
- .3 Shop drawings to show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .3 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.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

## **1.2 Quality Assurance**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.3 Maintenance**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One glass for each gauge glass.
  - .2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

## **1.4 Delivery, Storage, and Handling**

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

## **2. PRODUCTS**

## **3. EXECUTION**

### **3.1 Painting Repairs and Restoration**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.



- .3 Restore to new condition, finishes which have been damaged.

### **3.2 Cleaning**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

### **3.3 Field Quality Control**

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

### **3.4 Demonstration**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative will record these demonstrations on video tape for future reference.

### **3.5 Protection**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

### **1.2 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings.
- .4 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.3 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 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Multi-Purpose Dry Chemical Extinguishers**

- .1 Cartridge operated type or Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
  - .1 Sizes 1.14 2.25 4.5 9 and 14 kg or as indicated.

## **2.2 Ordinary Dry Chemical Extinguishers**

- .1 Cartridge operated type or Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for B and C class protection.
  - .1 Sizes 1.27 2.25 4.5 9 and 14 kg or as indicated.

## **2.3 Carbon Dioxide**

- .1 Extinguishers Insulated handle, hose and horn discharge assembly, self-closing lever or squeeze-grip operation, fully charged, ULC labelled for B and C class protection.
  - .1 Sizes 2.25 4.5 6.8 and 9.0 kg or as indicated.

## **2.4 Extinguisher Brackets**

- .1 Type recommended by extinguisher manufacturer.

## **2.5 Cabinets**

- .1 Flush surface or semi-recessed type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.
- .2 Cabinet to maintain fire resistive rating of construction in which they occur.
- .3 Cabinet door: with 5 mm full glass panel metal panel.
- .4 Finish:
  - .1 Tub: prime coated.
  - .2 Door and frame: No.4 satin finish stainless steel.

## **2.6 Identification**

- .1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10 CAN/ULC-S508.
- .2 Attach bilingual tag bar code or label to extinguishers, indicating month and year of installation. Provide space for service dates.

# **3. EXECUTION**

## **3.1 Manufacturer's Instructions**

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

## **3.2 Installation**

- .1 Install or mount extinguishers in cabinets or on brackets as indicated in accordance with NFPA 10.

### **3.3 Field Quality Control**

.1 Manufacturer's Field Services:

- .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 National Fire Prevention Association (NFPA)
  - .1 NFPA 13- [2007], Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 25-[2008], Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN4 S543-[M984], Standard for Internal Lug Quick Connect Couplings for Fire Hose.

### **1.2 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets, 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 BC, Canada.
  - .2 Indicate:
    - .1 Materials.
    - .2 Finishes.
    - .3 Method of anchorage
    - .4 Number of anchors.
    - .5 Supports.
    - .6 Reinforcement.
    - .7 Assembly details.
    - .8 Accessories.
- .4 Samples:
  - .1 Submit samples of following:
    - .1 Each type of sprinkler head.

- .2 Signs.SPEC NOTE: Specify which test reports are required and identify material to which they are to apply.
- .5 Test reports:
  - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
- .8 Field Quality Control Submittals:
  - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

### 1.3 Closeout Submittals

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
- .2 Manufacturer's Catalog Data, including specific model, type, and size for: Pipe and fittings.
  - .1 Valves, including gate, check, and globe.
  - .2 Sprinkler heads.
  - .3 Pipe hangers and supports.
  - .4 Pressure or flow switch.
  - .5 Mechanical couplings.
- .3 Drawings:
  - .1 Sprinkler heads and piping system layout.
    - .1 Prepare [760] mm by [1050] mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
    - .2 Show data essential for proper installation of each system.
    - .3 Show details, plan view, elevations, and sections of systems supply and piping.
    - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
  - .2 Electrical wiring diagrams.

- .4 Design Data:
  - .1 Calculations of sprinkler system design.
  - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than [18] months.
- .5 Field Test Reports: Preliminary tests on piping system.
- .6 Records:
  - .1 As-built drawings of each system.
    - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
    - .2 Submit [760] mm by [1050] mm drawings on reproducible Mylar film with title block similar to full size contract drawings.
- .7 Operation and Maintenance Manuals:
  - .1 Provide Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with [NFPA 13].

#### **1.4 Quality Assurance**

- .1 Qualifications:
  - .1 Installer: company or person specializing in wet sprinkler systems [with documented experience] [approved by manufacturer].
- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

#### **1.5 Maintenance Material Submittals**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

#### **1.6 Delivery, Storage and Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Storage and Protection:

- .1 Store materials in dry location.
- .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

## **2. PRODUCTS**

### **2.1 Design Requirements**

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by pipe schedules for ordinary hazard occupancy.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings. Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .4 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .5 Design systems for earthquake protection for buildings in seismic zones [3] and [4], and only essential and high risk buildings in seismic zone [2].
- .6 Location of Sprinkler Heads:
  - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed [that permitted by NFPA 13 for ordinary hazard occupancy.
  - .2 Uniformly space sprinklers on branch.
- .7 Water Distribution:
  - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
  - .2 Discharge from individual heads in hydraulically most remote area to be [100] % of specified density.
- .8 Density of Application of Water:
  - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
- .9 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.



## **2.2 Sustainable Requirements**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Grooved couplings and fittings made from minimum 90% recycled metal.

## **2.3 Above Ground Piping Systems**

- .1 Provide fittings for changes in direction of piping and for connections.
  - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will [not] be permitted.
- .3 Conceal piping in areas with suspended ceiling.

## **2.4 Pipe, Fittings and Valves**

- .1 Pipe:
  - .1 Ferrous: to NFPA 13.
  - .2 Copper tube: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
    - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
  - .2 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
  - .3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will [not] be permitted.
  - .4 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes [32] mm and larger.
  - .5 Fittings: ULC approved for use in wet pipe sprinkler systems.
  - .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
  - .7 Side outlet tees using rubber gasketted fittings are [not] permitted.
  - .8 Sprinkler pipe and fittings: metal.
- .3 Valves:

- .1 ULC listed for fire protection service.
- .2 Gate valves: open by counterclockwise rotation.
- .3 Provide [rising stem] [OS & Y] [wall indicator] valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
- .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes [10] cm and larger.
- .5 Provide gate valve in piping protecting [elevator hoistways,] [machine rooms,] [and] [machinery spaces].
- .4 Pipe hangers:
  - .1 ULC listed for fire protection services in accordance with NFPA.

## **2.5 Sprinkler Heads**

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
  - .1 Type A: upright bronze.
  - .2 Type B: pendant chrome link and lever type.
  - .3 Type C: pendant chrome glass bulb type.
  - .4 Type D: recessed [polished] [satin] [chrome] [glass bulb] [fusible link] type with ring and cup.
  - .5 Type E: flush [polished] [satin] [chrome] link and lever type.
  - .6 Type F: side wall [polished] [satin] [chrome] link and lever type.
- .3 Provide nominal [1.2] cm orifice sprinkler heads.
  - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
  - .2 Provide polished stainless steel ceiling plates sprinklers below suspended ceilings.
  - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
  - .4 Deflector: not more than [75] mm below suspended ceilings.
  - .5 Ceiling plates: not more than [25] mm deep.
  - .6 Ceiling cups: not permitted.

## **2.6 Pipe Sleeves**

- .1 Provide pipe sleeves where piping passes through walls, and floors.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls, and floors.
- .4 Provide [2.5] cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
  - .1 Firmly pack space with mineral wool insulation.
  - .2 Seal space at both ends of sleeve or core-drilled hole with [plastic waterproof cement which will dry to firm but pliable mass.] [provide mechanically adjustable segmented elastomeric seal].
  - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
  - .1 Provide [hot-dip galvanized steel,] [ductile-iron,] [cast-iron sleeves].
  - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
  - .1 Provide [0.61] mm thick galvanized steel sheet.

## **2.7 Escutcheon Plates**

- .1 Provide [one piece] [split hinge] type metal plates for piping passing through [walls,] [floors,] [and] [ceilings] in exposed spaces.
- .2 Provide polished [stainless steel plates] [chromium-plated finish on copper alloy plates] in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

## **2.8 Inspector's Test Connection**

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately [3] m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

## **2.9 Signs**

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

### **3.3 Pipe Installation**

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.

### **3.4 Electrical Connections**

- .1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide fire alarm system under Section 28 31 00 - Fire Detection and Alarm.
- .3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.

### **3.5 Disinfection**

- .1 Disinfect new piping.
- .2 Fill piping systems with solution containing minimum of [50] parts per million of chlorine and allow solution to stand for minimum of [24] hours.
- .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than [0.2] part per million or residual chlorine content of domestic water supply.

- .4 Obtain at least [two] consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

### **3.6 Connections to Existing Water Supply Systems**

- .1 Notify Contracting Officer in writing at least [15] days prior to connection date.
- .2 Use [tapping] or [drilling machine] valve and mechanical joint type sleeves for connections to be made under pressure.
- .3 Bolt sleeves around main piping.
- .4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.
- .5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

### **3.7 Field Painting**

- .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with [1] coat of pretreatment primer applied to minimum dry film thickness of [0.3] mil, and one coat of zinc chromate primer applied to minimum dry film thickness of [1.0] mil.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
  - .1 Piping in Finished Areas:
    - .1 Provide primed surfaces with [2] coats of paint to match adjacent surfaces.
    - .2 Provide valves and operating accessories with [1] coat of red alkyd gloss enamel applied to minimum dry film thickness of [1.0] mil.
    - .3 Provide piping with [[50] mm wide red enamel bands] [self-adhering red plastic bands] spaced at maximum of [6] m intervals throughout piping systems.
  - .2 Piping in Unfinished Areas:
    - .1 Provide primed surfaces with [one] coat of red alkyd gloss enamel applied to minimum dry film thickness of [1.0] mil in [attic spaces,] [spaces above suspended ceilings,] [crawl spaces,] [pipe chases,] [mechanical equipment

room,] [and] [spaces where walls or ceiling are not painted or not constructed of a prefinished material].

- .2 Provide piping with [[50] mm wide red enamel bands] [self-adhering red plastic bands] spaced at maximum of [6] m intervals.

### 3.8 Field Quality Control

#### .1 Site Test, Inspection:

- .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
- .2 Test, inspect, and approve piping before covering or concealing.
- .3 Preliminary Tests:
  - .1 Hydrostatically test each system at [200] psig for a [2] hour period with no leakage or reduction in pressure.
  - .2 Flush piping with potable water in accordance with NFPA 13.
  - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
  - .4 Test alarms and other devices.
  - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
- .4 Formal Tests and Inspections:
  - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
  - .2 Submit written request for formal inspection at least [15] days prior to inspection date.
  - .3 Repeat required tests as directed.
  - .4 Correct defects and make additional tests until systems comply with contract requirements. Furnish [appliances,] [equipment,] [instruments,] [connecting devices,] [and] [personnel] for tests.
  - .5 [Authority of Jurisdiction], will witness formal tests and approve systems before they are accepted.

#### .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 - ACTION AND INFORMATIONAL 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 Site Tests:
  - .1 Field test each fire pump, driver and controllers in accordance with NFPA 20. Testing shall include:
    - .1 Verification of proper [installation][system initiation] [adjustment] [and] [fine tuning].
    - .2 Verification of the sequence of [operations] [and] [alarm systems].
  - .2 Testing to be witnessed by [Fire Commissioner of Canada] [Canadian Forces Fire Marshal] [authority having jurisdiction].
  - .3 Develop, with Departmental Representative assistance, detailed instructions for O & M of this installation.
- .4 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Low-emitting materials.

### **3.9 Cleaning**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## 1. GENERAL

### 1.1 References

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15-[06], Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18-[01], Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22-[01], Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24-[01], Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
  - .1 ASTM A307-[07b], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A536-[84(2004)e1], Standard Specification for Ductile Iron Castings.
  - .3 ASTM B88M-[05], Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
  - .1 ANSI/AWWA C111/A21.11-[07], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA B242-[05], Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67-[02a], Butterfly Valves.
  - .2 MSS-SP-70-[06], Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-[05], Gray Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80-[03], Bronze Gate, Globe, Angle and Check Valves.



.8 National Research Council (NRC)/Institute for Research in Construction

.1 NRCC 38728, National Plumbing Code of Canada (NPC) - [1995].

.9 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

## **1.2 Action and Informational Submittals**

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## **1.3 Delivery, Storage and Handling**

.1 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Packaging Waste Management: remove for reuse [and return] [by manufacturer] of [pallets] Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance Regional and Municipal regulations.

## **1.4 Sustainable Requirements**

.1 Construction:

.1 Construction requirements detailed in Section 01 47 15 - Sustainable Requirements: Construction form integral part of this project including materials and products of this Section. Sustainable construction requirements include:

.1 Specific construction requirements for project.

.2 Administrative, temporary and procedural requirements for the use of materials and methods of construction.

## **2. PRODUCTS**

### **2.1 Piping**

.1 Domestic hot, cold and recirculation systems, within building.

- .1 Above ground: copper tube, hard drawn, type K: to ASTM B88M.

## **2.2 Fittings**

- .1 Bronze pipe flanges and flanged fittings, Class 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 1/2 and smaller : wrought copper to ANSI/ASME B16.22, ANSI/ASME B16.18; with [301] [ ] stainless steel internal components and EPDM seals. Suitable for operating pressure to [1380] [ ] kPa.

## **2.3 Joints**

- .1 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .2 Solder: [95/5] [tin copper alloy] [ ].
- .3 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

## **2.4 Gate Valves**

- .1 NPS 2 and under, soldered:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.
- .2 NPS 2 and under, screwed:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.
- .3 NPS 2 1/2 and over, [in mechanical rooms] [ ], flanged:
  - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim.
- .4 NPS 2 1/2 and over, [other than mechanical rooms] [ ], flanged:
  - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

## **2.5 Globe Valves**

- .1 NPS2 and under, soldered:

- .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.
- .2 Lockshield handles: as indicated.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.
  - .2 Lockshield handles: as indicated.

## **2.6 Swing Check Valves**

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .3 NPS 2 1/2 and over, flanged:
  - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, [regrind] [renewable] seat, bronze disc, bolted cap.

## **2.7 Ball Valves**

- .1 NPS 2 and under, screwed:
  - .1 Class 150.
  - .2 [Bronze] [Forged Brass] body, [chrome plated brass] [stainless steel] ball, PTFE adjustable packing, brass gland and [PTFE] [Bunan] [TFE] seat, steel lever handle.
- .2 NPS 2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.
  - .2 Bronze body, [chrome plated brass] [stainless steel] ball, PTFE adjustable packing, brass gland and [PTFE] [Bunan] seat, steel lever handle, with NPT to copper adaptors.

## **2.8 Butterfly Valves**

- .1 NPS 2-1/2 and over, [wafer] [lug] [grooved].
  - .1 To MSS-SP-67, Class 200.
  - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
  - .3 [Lever operated], [NPS8 and over, gear operated].

### **3. EXECUTION**

#### **3.1 Application**

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

#### **3.2 Installation**

- .1 Install in accordance with local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

#### **3.3 Valves**

- .1 Isolate equipment, fixtures and branches with [gate] [butterfly] [ball] valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

#### **3.4 Pressure Tests**

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

#### **3.5 Flushing and Cleaning**

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

#### **3.6 Pre-Start-Up Inspections**

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.

- .4 Ensure that air chambers, expansion compensators are installed properly.

### **3.7 Disinfection**

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction approval of Departmental Representative.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative.

### **3.8 Start-Up**

- .1 Timing: start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

### **3.9 Performance Verification**

- .1 Scheduling:
  - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  - .3 Verify performance of temperature controls.
  - .4 Verify compliance with safety and health requirements.

- .5 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .6 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
  - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

### **3.10 Operation Requirements**

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05 - Installation of Pipework.

### **3.11 Cleaning**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 ASTM International Inc.
  - .1 ASTM B32-[08], Standard Specification for Solder Metal.
  - .2 ASTM B306-[02], Standard Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564-[03a], Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA B67-[1972(R1996)], Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.CAN/CSA-B70-[06], Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .2 CAN/CSA-B125.3-[05], Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-[00], Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.

### **1.2 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.3 Delivery, Storage and Handling**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **2. PRODUCTS**

### **2.1 Cast Iron Piping and Fittings**

- .1 Buried [sanitary] [storm] and [vent] minimum NPS [3], to: CAN/CSA-B70, with one layer of protective coating.

.1 Joints:

.1 Mechanical joints:

- .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.ASTM C564 or
- .2 Stainless steel clamps.

.2 Hub and spigot:

- .1 Caulking lead: to CSA B67.
- .2 Cold caulking compounds.

.2 Above ground [sanitary] [storm] and [vent]: to CAN/CSA-B70.

.1 Joints:

.1 Hub and spigot:

- .1 Caulking lead: to CSA B67.

.2 Mechanical joints:

- .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

### 3. EXECUTION

#### 3.1 Application

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.INSTALLATION
- .2 Install in accordance with National Plumbing Code and local authority having jurisdiction.

#### 3.2 Testing

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

#### 3.3 Performance Verification

- .1 Cleanouts:
  - .1 Ensure accessible and that access doors are correctly located.
  - .2 Open, cover with linseed oil and re-seal.
  - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.



- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
  - .1 Verify domes are secure.
  - .2 Ensure weirs are correctly sized and installed correctly.
  - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

### **3.4 Cleaning**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-B45 Series-[02(R2008)], Plumbing Fixtures.
  - .2 CAN/CSA-B125.3-[05], Plumbing Fittings.
  - .3 CAN/CSA-B651-[04], Accessible Design for the Built Environment.

### **1.2 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Indicate fixtures and trim:
  - .1 Dimensions, construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.
  - .3 (For water closets, urinals): minimum pressure required for flushing.
- .4 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.

### **1.3 Closeout Submittals**

- .1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

### **1.4 Delivery, Storage and Handling**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **2. PRODUCTS**

### **2.1 Manufactured Units**

- .1 Refer to drawings for details on plumbing fixtures and associated equipment and accessories.

## **3. EXECUTION**

### **3.1 Application**

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

### **3.2 Installation**

- .1 Mounting heights:
  - .1 Standard: to manufacturer's recommendations.
  - .2 Wall-hung fixtures: as indicated, measured from finished floor.
  - .3 Barrier free: to most stringent CAN/CSA B651.

### **3.3 Adjusting**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .3 Adjust flush valves to suit actual site conditions.
  - .4 Adjust urinal flush timing mechanisms.
  - .5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.
- .3 Checks:
  - .1 Water closets, urinals: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

### **3.4 Cleaning**

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for [reuse] [and] [recycling] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-B45 Series- [02(R2008)], Plumbing Fixtures.
  - .2 CAN/CSA-B125.3- [05], Plumbing Fittings.
  - .3 CAN/CSA-B651- [04], Accessible Design for the Built Environment.

### **1.2 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.3 Closeout Submittals**

- .1 Provide maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

### **1.4 Delivery, Storage and Handling**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse [and return] [by manufacturer] of [pallets] [crates] [padding] [and] [packaging materials] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Manufactured Units**

- .1 Refer to drawings for details on fixtures and associated equipment and accessories.

### **3. EXECUTION**

#### **3.1 Application**

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

#### **3.2 Installation**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
  - .2 Wall-hung fixtures: as indicated, measured from finished floor.
  - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA-B651.

#### **3.3 Adjusting**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
  - .1 Aerators: operation, cleanliness.
  - .2 Vacuum breakers, backflow preventers: operation under all conditions.
  - .3 Wash fountains: operation of flow-actuating devices.
- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

#### **3.4 Cleaning**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for [reuse] [and] [recycling] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal] [01 35 21 - LEED Requirements.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 Definitions:
  - .1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including (within scope of work):
    - .1 Rigid supply and exhaust ductwork;
    - .2 Flexible ductwork;
    - .3 Return ductwork;
    - .4 Plenums including ceiling plenums;
    - .5 Cooling and heating coils and compartments;
    - .6 Condensate drain pans, eliminator blades and humidifiers;
    - .7 Fans, fan blades and fan housing;
    - .8 Filter housing and frames;
    - .9 Acoustically insulated duct linings;
    - .10 Diffusers, registers and terminal units;
    - .11 Dampers and controls;
    - .12 Existing kitchen exhaust ductwork;
    - .13 Other, as shown of drawings.
- .2 Reference Standards:
  - .1 National Air Duct Cleaners Association (NADCA)
    - .1 ACR Standard, 2006 edition: Assessment, Cleaning and Restoration of HVAC Systems.
  - .2 North American Insulation Manufacturers Association (NAIMA)
    - .1 NAIMA 2005, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.

### **1.2 Administrative Requirements**

- .1 Site Evaluation: conduct site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.

- .1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.
- .2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.
  - .1 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs, and other internal features.
- .3 Departmental Representative to review video survey and cleaning plan 1 week minimum prior to start of work.
  - .1 Proceed with survey and cleaning work only after receiving written approval from Departmental Representative.
- .2 Project Co-ordination: assign Project Co-ordinator to oversee air duct cleaning processes.
  - .1 Provide Departmental Representative with contact information of Project Co-ordinator including: name, telephone number, cell phone number.

### **1.3 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit video survey and cleaning plan developed during site evaluation.
  - .1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.
- .3 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.
- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

### **1.4 Closeout Submittals**

- .1 Provide submittals in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Post Cleaning Inspection Report: submit 4 copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:
  - .1 Name and address of facility;
  - .2 Name and address of HVAC cleaning contractor;
  - .3 Description of HVAC systems with drawings sketches identifying systems cleaned;
  - .4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;
  - .5 Identification of points where samples were collected and type of analysis used for each collection;



- .6 Identification of each sample collected;
  - .7 Comments complete with photographs of each sampling location and other observed system features;
  - .8 Identify systems tested, observations, actions taken and recommendations for future maintenance.
- .3 Record post cleaning video survey; submit 2 copies of video survey DVD USB Drive SD ED Compact Flash memory card media, and include on video survey following:
- .1 Areas tested for particulate analysis or microbial growth evaluation;
  - .2 Areas of special interest and location;
  - .3 Special internal features;
  - .4 Problems such as broken or damaged controls or components;
  - .5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English and French on video using text or voice over.
- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility.

#### **1.5 Maintenance Material Submittals**

- .1 Extra Stock Materials:
  - .1 Supply 2 extra filters for each HVAC System cleaned.
  - .2 Ensure filters are correct match, size, type and configuration of existing HVAC Systems.

## **2. PRODUCTS**

### **2.1 Access Doors and Panels**

- .1 Equipment Access Doors and Panels: construct from same materials as equipment panelling complete with sealing gasket and positive locking device.
  - .1 Size access doors and panels in equipment to allow for inspection and cleaning.
- .2 Ductwork Access Doors: construct access doors from 1.27 mm minimum galvanized sheet steel with gasketed seal.
  - .1 Ensure access door is 25 mm greater in every dimension than access opening.
  - .2 Access door size 200 mm x 200 mm minimum.
  - .3 Secure access doors with sheet metal screws on 75 mm centres minimum. Ensure 3 screws per side minimum.
- .3 Access Doors and Panels Acoustic Lining:

- .1 Install acoustic lining to match existing.
- .2 Self-adhesive glass fibre tape capable of adhering to both acoustic lining and metal access door or panel materials.
- .3 Water-based duct sealer for repairing cut acoustic lining.

## **2.2 Antimicrobial Agent**

- .1 Use antimicrobial agents registered with US EPA-40 CFR.

## **2.3 System Filters**

- .1 Supply and install new filters for each HVAC System cleaned.

## **2.4 Air Duct Cleaning Equipment**

- .1 Manually propelled full contact brushes:
  - .1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
    - .1 Ensure brushes are sized to fit various duct sizes in HVAC system.
  - .2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.

# **3. EXECUTION**

## **3.1 Preparation**

- .1 Close down HVAC system.
- .2 Locate and identify externally visible HVAC system features which may affect cleaning process including:
  - .1 Control devices;
  - .2 Fire and smoke control dampers;
  - .3 Balancing dampers: indicate and record positions for resetting;
  - .4 Air volume control boxes: indicate and record positions for resetting;
  - .5 Fire alarm devices;
  - .6 Monitoring devices and controls;
  - .7 Other.
- .3 Cut openings in equipment panels and ductwork for access to system interior.
  - .1 Square or rectangular opening sizes: 200 mm minimum each side.

- .2 Circular opening sizes: 200 mm minimum diameter.
- .4 Installation of Access Doors and Panels: install access doors and panels for equipment where required to facilitate system inspection and cleaning.
  - .1 Install access doors and panels for inspection and cleaning of equipment as follows:
    - .1 Heating and cooling coils;
    - .2 Fan units;
    - .3 Filters;
    - .4 Dampers;
    - .5 Sensors;
  - .5 Installation of Access Doors in Ductwork: install access doors in ductwork where required to facilitate system inspection and cleaning.
    - .1 Access door installation is not permitted in flexible ductwork.
      - .1 Inspect flexible ductwork only by disconnecting from main duct and inspecting from open end.
  - .6 When acoustically lined duct is cut for access, repair cut edges of acoustic lining using self-adhesive fibre glass tape and water based duct sealer.
    - .1 Adhere new acoustic lining to match existing to inside of access panel or door to ensure continuity of acoustic properties of system.
  - .7 Remove and reinstall ceiling tiles panels to gain access to HVAC system as required.
    - .1 Replace ceiling tiles panels damaged or soiled by air duct cleaning procedures.

### **3.2 Examination / Pre-Cleaning Inspection**

- .1 Verification of Conditions:
  - .1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.
  - .2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.
- .2 Evaluation and Assessment:
  - .1 Identify location and type of internal components.
  - .2 Identify extent of potential problems.
  - .3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Departmental Representative.

- .1 Do not proceed further with inspection operations until written approval from Departmental Representative.

### **3.3 Particulate Collection**

- .1 Before starting duct cleaning, identify locations for sample collection and collect particulate samples.
- .2 Take samples from interior surfaces of HVAC system using sterile wipes for submission to independent testing laboratory.
- .3 For each HVAC system collect 4 samples from each HVAC unit as follows:
  - .1 Sample 1: collect from inside ventilation unit downstream of air filters but before fan discharge;
  - .2 Sample 2: collect downstream of fan discharge and 1 metre maximum downstream in first horizontal branch;
  - .3 Sample 3: collect at junction of last horizontal branch and start of low-pressure duct;
  - .4 Sample 4: collect at junction each air terminal unit and supply duct.

### **3.4 Laboratory Analysis**

- .1 Ensure independent testing laboratory has demonstrated experience in work associated with air duct cleaning.
- .2 Ensure Super Electron Microscope (SEM) is used for analyzing and determining components of particulate collection samples:
  - .1 Identify components by grade and size;
  - .2 Report findings including percentage concentration of components to Departmental Representative.
- .3 Proceed with HVAC System Cleaning only after laboratory analysis test results have been received.
- .4 Ensure cleaning technicians have safety equipment appropriate for toxic or hazardous conditions identified by laboratory analysis before proceeding with cleaning operations.

### **3.5 Duct Cleaning**

- .1 Do duct cleaning in accordance with NADCA ACR Standard.
- .2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through another zones which has already been cleaned.
  - .1 Isolate zone of duct using closed-cell polyurethane foam air inflated zone bag before cleaning.
- .3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.

- .4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.
- .5 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.
- .6 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.
- .7 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.
- .8 Clean diffusers, registers, louvers, and other terminal units.
- .9 Remove perforated supply diffusers from suspended tee-bar ceiling.
  - .1 Dismantle and clean perforated plates and supply diffuser duct collars.
  - .2 Re-assemble perforated plate diffusers and reconnect to HVAC system using supply diffuser duct collar after cleaning.
- .10 Advise Departmental Representative 72 hour's minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.

### **3.6 Acoustically Lined Ductwork Cleaning**

- .1 Clean glass fibre acoustically insulated ducts to NAIMA recommended practices.
  - .1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fibre lining.
  - .2 Monitor cleaning process progress by onboard camera.

### **3.7 Components and Equipment Cleaning**

- .1 Brush and vacuum coils, humidifiers, air handling unit enclosures, , and heat exchanger surfaces to achieve required cleanliness.
- .2 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by Departmental Representative for cleaning.
  - .1 Pressure wash with water and cleaning solution until required cleanliness is achieved.
  - .2 Clean equipment and components in place only if there is no hazard to adjacent materials.
- .3 Compressed air and manual cleaning is acceptable only for cleaning individual components and small areas as follows and only after written approval from Departmental Representative:
  - .1 Fan blades;
  - .2 Dampers;

- .3 Turning vanes;
- .4 Controls;
- .5 Sensor bulbs;
- .6 Fire alarms;
- .7 Smoke detectors;

### **3.8 Field Quality Control/Final Inspections**

- .1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.
  - .1 Carry out video survey as directed by Departmental Representative.
  - .2 Include in final survey areas inspected by Departmental Representative prior to cleaning.
  - .3 Identify on HVAC system record drawings access points used for inspection and cleaning.
  - .4 Re-collect and analyze particulates collected at same locations where original samples were collected before cleaning.
  - .5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

### **3.9 System Start-up**

- .1 Install new system filters after cleaning operations are completed.
- .2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.
- .3 Restart each HVAC system.

### **3.10 Cleaning**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Dispose of hazardous or toxic waste materials extracted from ductwork system to appropriate contaminated waste facility and provide proof.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes:
  - .1 Electrical motors, drives and guards for mechanical equipment and systems.
  - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
  - .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

### **1.2 References**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 Submittals**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control .
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals
  - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## **1.4 Delivery, Storage, and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 General**

- .1 Motors: all to be premium efficiency.

### **2.2 Motors**

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 575 V, unless otherwise indicated.

### **2.3 Belt Drives**

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.



- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

## **2.4 Drive Guards**

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
  - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.-
- .5 Guard for flexible coupling:
  - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
  - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

**END OF SECTION**

## **1. GENERAL**

- .1 All HWS/R and CHWS/R piping (exposed or within service rooms) is to be welded.

### **1.1 References**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1-2007, Power Piping.
  - .2 ANSI/ASME B31.3-2006, Process Piping.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
  - .1 AWS C1.1M/C1.1-2000 (R2006), Recommended Practices for Resistance Welding.
  - .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
  - .3 AWS W1-2000, Welding Inspection Handbook..
- .4 Canadian Standards Association (CSA International)
  - .1 CSA W47.2-M1987 (R2008), Certification of Companies for Fusion Welding of Aluminum.
  - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .3 CSA B51-03 (R2007), Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2-2008, Certification of Welding Inspectors.

### **1.2 Action and Informational Submittals**

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

### **1.3 Quality Assurance**

- .1 Qualifications:
  - .1 Welders:
    - .1 Welding qualifications in accordance with CSA B51.
    - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

- .3 Submit welder's qualifications to Departmental Representative.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors:
  - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
  - .1 Registration of welding procedures in accordance with CSA B51.
  - .2 Copy of welding procedures available for inspection.
  - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

#### **1.4 Delivery, Storage and Handling**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

### **2. PRODUCTS**

#### **2.1 Electrodes**

- .1 Electrodes: in accordance with CSA W48 Series.

### **3. EXECUTION**

#### **3.1 Application**

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

#### **3.2 Quality of Work**

- .1 Welding: in accordance with ANSI/ASME B31.1 B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Division 23 applicable requirements of provincial authority having jurisdiction.

#### **3.3 Installation Requirements**

- .1 Identify each weld with welder's identification symbol.

- .2 Backing rings:
  - .1 Where used, fit to minimize gaps between ring and pipe bore.
  - .2 Do not install at orifice flanges.
- .3 Fittings:
  - .1 NPS 2 and smaller: install welding type sockets.
  - .2 Branch connections: install welding tees or forged branch outlet fittings.

### **3.4 Inspection and Tests - General Requirements**

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

### **3.5 Specialist Examinations and Tests**

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
  - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
  - .3 Inspect and test 100% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and spot full gamma ray radiographic (hereinafter referred to as "radiography") tests.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
  - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 30 % of welds, selected at random by Departmental Representative by radiographic particle tests.
- .5 Full radiographic tests for HWS/R and CHWS/R piping systems.
  - .1 Spot radiography:

- .1 Conduct spot radiographic tests of up to 30 % of welds, selected at random by Departmental Representative from welds which would be most difficult to repair in event of failure after system is operational.
- .2 Radiographic film:
  - .1 Identify each radiographic film with date, location, name of welder, and submit to Departmental Representative. Replace film if rejected because of poor quality.
- .3 Interpretation of radiographic films:
  - .1 By qualified radiographer.
- .4 Failure of radiographic tests:
  - .1 Extend tests to welds by welder responsible when those welds fails tests.

### **3.6 Defects Causing Rejection**

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

### **3.7 Repair of Welds Which Failed Tests**

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

### **3.8 Cleaning**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-[07], Power Piping.
- .2 ASTM International
  - .1 ASTM A125-[1996(2007)], Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307-[07b], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563-[07a], Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58-[2002], Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP69-[2003], Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89-[2003], Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC)

### **1.2 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.
- .4 Certificates:

- .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

### **1.3 Closeout Submittals**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **2. PRODUCTS**

### **2.1 System Description**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:
  - .1 Design supports, platforms, catwalks, hangers to withstand seismic events as specified Section.

### **2.2 Sustainable Requirements**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### **2.3 General**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.



- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

## 2.4 Pipe Hangers

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized after manufacture.
  - .2 Use [electro-plating galvanizing process] [hot dipped galvanizing process].
  - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut [and] [carbon steel retaining clip].
    - .1 Rod: [9 mm UL listed] [13 mm FM approved].
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, [UL listed [FM approved][to MSS-SP58] [and] [MSS-SP69]].
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, [UL listed] [FM approved] [to MSS SP69].
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut [UL listed] [FM approved].
- .4 Upper attachment to concrete:
  - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye [6] mm minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate[UL listed] [FM approved] to MSS SP69.
- .5 Shop and field-fabricated assemblies:
  - .1 Trapeze hanger assemblies.
  - .2 Steel brackets.
  - .3 Sway braces for seismic restraint systems: to Section.
- .6 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.

- .3 Do not use [22] mm or [28] mm rod.
- .7 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel [black] [galvanized].
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP69 [UL listed] [FM approved], clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 [Ensure "U" has hole in bottom for rivetting to insulation shields].
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: galvanized.
  - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

## **2.5 Riser Clamps**

- .1 Steel or cast iron pipe: [galvanized] [black] carbon steel to MSS SP58, type 42, [UL listed] [FM approved].
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

## **2.6 Insulation Protection Shields**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

## **2.7 Constant Support Spring Hangers**

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: [10]% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

## **2.8 Variable Support Spring Hangers**

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with [2] springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

## **2.9 Equipment Supports**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section [05 12 23 - Structural Steel for Buildings]. Submit calculations with shop drawings.

## **2.10 Equipment Anchor Bolts and Templates**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **2.11 Platforms and Catwalks**

- .1 To Section 05 50 00 - Metal Fabrications.

## **2.12 House-Keeping Pads**

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads [50] mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

## **2.13 Other Equipment Supports**

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
- .2 Submit structural calculations with shop drawings.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to industry standards.
  - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with [4] minimum concrete inserts, [one] at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.

- .2 Variation in supporting effect does not exceed 25 % of total load.

### 3.3 Hanger Spacing

- .1 Plumbing piping: to Canadian Plumbing Code and authority having jurisdiction].
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .6 Within [300] mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .7 Pipework greater than NPS 12: to MSS SP69.

### 3.4 Hanger Installation

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### 3.5 Horizontal Movement

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### **3.6 Final Adjustment**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

### **3.7 Cleaning**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Vibration isolation materials and components, seismic control measures and their installation.

### **1.2 References**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 13-[2002], Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC) - [1995]

### **1.3 Submittals**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Provide separate shop drawings for each isolated system, system shop drawings complete with performance and product data.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
  - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

### **1.4 Delivery, Storage, and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 General**

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

### **2.2 Elastomeric Mounts**

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

### **2.3 Springs**

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for [outdoor] [100% relative humidity] installations.
- .4 Colour code springs.

### **2.4 Spring Mount**

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring; support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring; 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring; supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

### **2.5 Hangers**

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.



- .5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

## **2.6 Acoustic Barriers for Anchors and Guides**

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
  - .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.
  - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

### **3.3 Field Quality Control**

- .1 Manufacturer's Field Services:
  - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
  - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
    - .1 After delivery and storage of Products.

- .2 After preparatory work is complete but before installation commences.
- .3 Twice during the installation, at 25% and 60% completion stages.
- .4 Upon completion of installation.
- .3 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
- .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
  - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC system[s] after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .2 Take vibration measurements for equipment such as LAN packaged units.
  - .3 Provide Departmental Representative with notice 24 hours in advance of commencement of tests.
  - .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
  - .5 Submit complete report of test results.

### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

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

### **1.2 Qualifications of Tab Personnel**

- .1 Submit names of personnel to perform TAB to Departmental Representative within 30 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

### **1.3 Purpose of Tab**

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

### **1.4 Exceptions**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

### **1.5 Co-Ordination**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

### **1.6 Start-Up**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

### **1.7 Operation of Systems During Tab**

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

### **1.8 Start of Tab**

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Coil fins combed, clean.
  - .6 Access doors, installed, closed.
  - .7 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

#### **1.9 Application Tolerances**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 10%.
  - .2 HVAC systems: plus 5%.
  - .3 Hydronic systems: plus or minus 10%.

#### **1.10 Accuracy Tolerances**

- .1 Measured values accurate to within plus or minus 2% of actual values.

#### **1.11 Submittals**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

### **1.12 Tab Report**

- .1 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .2 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

### **1.13 Verification**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

### **1.14 Settings**

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

### **1.15 Completion of Tab**

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

### **1.16 Air Systems**

- .1 Standard: TAB to most stringent of [this section] [or] [TAB standards of [AABC] [NEBB] [SMACNA] [ASHRAE]].
- .2 Do TAB of systems, equipment, components, controls specified Division 23 following systems, equipment, components, controls.
- .3 Quality assurance: perform TAB under direction of supervisor qualified to standards of [AABC] [or] [NEBB].
- .4 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .5 Locations of equipment measurements: to include as appropriate:
  - .1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled device.
- .6 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

**1.17 Other Tab Requirements**

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.
- .2 Building pressure conditions:
  - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.

**2. PRODUCTS**

**2.1 Not Used**

- .1 Not used.

**3. EXECUTION**

**3.1 Not Used**

- .1 Not used.

**END OF SECTION**

## 1. GENERAL

### 1.1 References

- .1 Definitions:
  - .1 For purposes of this section:
    - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
    - .2 "EXPOSED" - means "not concealed" as previously defined.
    - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
  - .2 TIAC Codes:
    - .1 CRD: Code Round Ductwork,
    - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
  - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
    - .1 ANSI/ASHRAE/IESNA 90.1-[04], SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - .2 ASTM International Inc.
    - .1 ASTM B209M-[07], Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
    - .2 ASTM C335-[05ae1], Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
    - .3 ASTM C411-[05], Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
    - .4 ASTM C449/C449M-[00], Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
    - .5 ASTM C547-[07e1], Standard Specification for Mineral Fiber Pipe Insulation.
    - .6 ASTM C553-[02e1], Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
    - .7 ASTM C612-[04e1], Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
    - .8 ASTM C795-[03], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.



- .9 ASTM C921-[03a], Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-[00], Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-[03], Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-[05], Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

## 1.2 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
    - .2 Details of operation, servicing and maintenance.
    - .3 Recommended spare parts list.
- .3 Samples:
  - .1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
  - .2 Mount sample on 12 mm plywood board.
  - .3 Affix typewritten label beneath sample indicating service.
- .4 Manufacturers' Instructions:

- .1 Provide manufacture's written duct insulation jointing recommendations, and special handling criteria, installation sequence, cleaning procedures [and] [\_\_\_].

### **1.3 Quality Assurance**

- .1 Qualifications:
  - .1 Installer: specialist in performing work of this section, and have at least three (3) years successful experience in this size and type of project, qualified to standards.

### **1.4 Delivery, Storage and Handling**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

## **2. PRODUCTS**

### **2.1 Fire and Smoke Rating**

- .1 To CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25
  - .2 Maximum smoke developed rating: 50

### **2.2 Insulation**

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C553.

### **2.3 Jackets**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

- .2 Lagging adhesive: compatible with insulation.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .3 Aluminum:
  - .1 To ASTM B209 [with] [and] [without] moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: [Smooth] [Stucco embossed] [Corrugated].
  - .4 Jacket banding and mechanical seals: [12] [19] mm wide, 0.5 mm thick stainless steel.
    - .1 Stainless steel:
      - .5 Type: [304] [316].
      - .6 Thickness: [0.25] [0.50] mm sheet.
      - .7 Finish: [Smooth] [Corrugated] [Stucco embossed].
    - .8 Jacket banding and mechanical seals: [12] [19] mm wide, 0.5 mm thick stainless steel.

## 2.4 Accessories

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
    - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Tape: self-adhesive, aluminum, 75 mm wide minimum.
- .6 Contact adhesive: quick-setting
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .7 Canvas adhesive: washable.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

- .8 Tie wire: 1.5 mm stainless steel.
- .9 Banding: [12] [19] mm wide, [0.5] mm thick stainless steel.
- .10 Facing: 25 mm [stainless] [galvanized] steel hexagonal wire mesh stitched on [[one face] [both faces] of insulation] [one face of insulation with expanded metal lath on other face].
- .11 Fasteners: [2] [4] mm diameter pins with 35 mm [diameter] [square] clips, length to suit thickness of insulation.

### 3. EXECUTION

#### 3.1 Application

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

#### 3.2 Pre-Installation Requirements

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

#### 3.3 Installation

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

#### 3.4 Ductwork Insulation Schedule

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	[C-1]	[yes]	[50]

	<b>TIAC Code</b>	<b>Vapour Retarder</b>	<b>Thickness (mm)</b>
Round cold and dual temperature supply air ducts	[C-2]	[yes]	[50]
Rectangular warm air ducts	[C-1]	[no]	[25]
Round warm air ducts	[C-1]	[no]	[25]
Supply, return and exhaust ducts exposed in space being served			[none]
Outside air ducts to mixing plenum	[C-1]	[yes]	[25]
Mixing plenums	[C-1]	[yes]	[25]
Exhaust duct between dampers and louvers	[C-1]	[no]	[25]
Rectangular ducts outside	[C-1]	[special]	[50]
Round ducts outside	[C-1]	[special]	[50]
Acoustically lined ducts	[none]		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: conform to following table:

	<b>TIAC Code</b>	
	<b>Rectangular</b>	<b>Round</b>
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

### 3.5 Cleaning

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Thermal insulation for piping and piping accessories in commercial type applications.

### **1.2 References**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
  - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus) Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
  - .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

### **1.3 Definitions**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

### **1.4 Action and Informational Submittals**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit [two] copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section [01 33 00 - Submittal Procedures].
- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.



- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

#### **1.5 Quality Assurance**

- .1 Qualifications:
- .2 Installer: specialist in performing work of this Section, and have at least [3] years successful experience in this size and type of project, qualified to standards of TIAC.
- .3 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

#### **1.6 Delivery, Storage and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
  - .1 Protect from weather, construction traffic.
  - .2 Protect against damage.
  - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
  - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
  - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

## **2. PRODUCTS**

### **2.1 Fire And Smoke Rating**

- .1 In accordance with CAN/ULC-S102.
  - .1 Maximum flame spread rating: [25].
  - .2 Maximum smoke developed rating: [50].

### **2.2 Insulation**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].
- .5 TIAC Code C-2: mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
  - .1 Insulation: [with vapour retarder jacket].
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: [\_\_\_].
  - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to ASTM C533.

- .2 Maximum "k" factor: to [\_\_\_\_].
- .3 Design to permit periodic removal and re-installation.

## **2.3 Insulation Securement**

- .1 Tape: self-adhesive, aluminum, [plain] [reinforced], [50] mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: [1.5] mm diameter stainless steel.
- .5 Bands: stainless steel, [19]mm wide, [0.5] mm thick.

## **2.4 Cement**

- .1 Thermal insulating and finishing cement:
  - .1 [Hydraulic setting] [or] [Air drying] on mineral wool, to ASTM C449/C449M.

## **2.5 Vapour Retarder Lap Adhesive**

- .1 Water based, fire retardant type, compatible with insulation.

## **2.6 Indoor Vapour Retarder Finish**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

## **2.7 Outdoor Vapour Retarder Finish**

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m<sup>2</sup>.

## **2.8 Jackets**

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: [to match adjacent finish paint] [by [Departmental Representative] [DCC Representative] [Consultant] ].
  - .3 Minimum service temperatures: -20 degrees C.
  - .4 Maximum service temperature: 65 degrees C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Thickness: [\_\_\_\_] mm.

- .7 Fastenings:
  - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
  - .2 Tacks.
  - .3 Pressure sensitive vinyl tape of matching colour.
- .8 Special requirements:
  - .1 Indoor: [\_\_\_].
  - .2 Outdoor: UV rated material at least [0.5] mm thick.
- .2 ABS Plastic:
  - .1 One-piece moulded type [and sheet] with pre-formed shapes as required.
  - .2 Colours: [to match adjacent finish paint] [by [Departmental Representative] [DCC Representative] [Consultant] ].
  - .3 Minimum service temperatures: -40 degrees C.
  - .4 Maximum service temperature: 82 degrees C.
  - .5 Moisture vapour transmission: 0.012 perm.
  - .6 Thickness: [0.75] mm.
  - .7 Fastenings:
    - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .8 Locations:
    - .1 For outdoor use ONLY.
- .3 Canvas:
  - .1 [220] [and 120] gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: compatible with insulation.
- .4 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: [0.50] mm sheet.

- .3 Finish: [smooth] [stucco embossed] [corrugated].
- .4 Joining: longitudinal and circumferential slip joints with [50] mm laps.
- .5 Fittings: [0.5] mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, [19] mm wide, [0.5]mm thick at [300] mm spacing.
- .5 Stainless steel:
  - .1 Type: [304] [316].
  - .2 Thickness: [0.25] mm.
  - .3 Finish: [smooth] [corrugated] [stucco embossed].
  - .4 Joining: longitudinal and circumferential slip joints with [50] mm laps.
  - .5 Fittings: [0.5] mm thick die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, [19] mm wide, [0.5]mm thick at [300] mm spacing.

## **2.9 Weatherproof Caulking for Jackets Installed Outdoors**

- .1 Caulking to: Section [07 92 00 - Joint Sealants].

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Pre-Installation Requirement**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

### **3.3 Installation**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification. Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.

.4 Supports, Hangers:

- .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.4 Removable, Pre-Fabricated, Insulation and Enclosures**

- .1 Application: at [expansion joints], [valves], [primary flow measuring elements] [flanges and unions at equipment].
- .2 Design: [to permit movement of expansion joint] [and] [to permit periodic removal and replacement] without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: [aluminum] [SS] [PVC] [ABS] [high temperature fabric].

**3.5 Installation of Elastomeric Insulation**

- .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

**3.6 Piping Insulation Schedules**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. TIAC Code: [A-1].
  - .1 Securements: [SS [wire] [bands] ] [Tape] at [300] mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code [1501-H].
- .2 TIAC Code: [A-3].
  - .1 Securements: [SS [wire] [bands] ] [Tape] at [300] mm on centre.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: [1501-C].
- .3 TIAC Code: [A-6].
  - .1 Insulation securements: [\_\_\_].
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: [\_\_\_].
- .4 TIAC Code: [C-2] [with] [without] vapour retarder jacket.

- .1 Insulation securements: [\_\_\_].
- .2 Seals: lap seal adhesive, lagging adhesive.
- .3 Installation: TIAC Code: [1501-C].
- .5 TIAC Code: [A-2].
  - .1 Insulation securements: [\_\_\_].
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: [1501-H].
- .6 Thickness of insulation as listed in following table.
  - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
  - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Steam	up to 175	[A-1]	38	50	65	75	90	90
Steam, Saturated and Super heated	over 175	[A-1]	38	65	65	75	90	90
Condensate Return	60 - 94	[A-1]	25	38	38	38	38	38
Pumped Condensate return	up to 94	[A-1]	25	38	38	38	38	38
Boiler Feed Water		[A-1]	25	25	25	25	25	25
Hot Water Heating	60 - 94	[A-1]	25	38	38	38	38	38
Hot Water Heating	up to 59	[A-1]	25	25	25	25	38	38
Glycol Heating	60 - 94	[A-1]	25	38	38	38	38	38
Glycol Heating	up to 59	[A-1]	25	25	25	25	38	38

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HWS		[A-1]	25	25	25	38	38	38
Chilled Water	4 - 13	[A-3]	25	25	25	25	25	25
Chilled Water or Glycol	below 4	[A-3]	25	25	38	38	38	38
Dual Temp. Heating		[A-3]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Dual Temp. Cooling		[A-3]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Chilled Water Pump Casing		[A-3]	25	25	25	25	25	25
Condenser Water Outdoors			[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Condenser Water Indoors			[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Refrigerated Drinking Water		[A-3]	25	25	25	25	25	25
Domestic CWS		[A-3]	25	25	25	25	25	25
Domestic CWS with vapour retarder		[C-2]	25	25	25	25	25	25
Refrigerant[hot gas] [liquid] [suction]	4 - 13	[A-6]	25	25	25	25	25	25
Refrigerant[hot gas] [liquid] [suction]	below 4	[A-6]	25	25	38	38	38	38
RWL and RWP		[C-2]	25	25	25	25	25	25
Cooling Coil cond. drain		[C-2]	25	25	25	25	25	25
Diesel generator exhaust system		[A-2]	38	65	65	75	90	90



.7 Finishes:

- .1 Exposed indoors: [canvas] [[aluminum] [SS] [PVC] jacket].
- .2 Exposed in mechanical rooms: [canvas] [[aluminum] [SS] [PVC] jacket].
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Outdoors: water-proof [aluminum] [SS] [ABS] jacket.
- .6 Finish attachments: SS [screws] [bands], at [150] mm on centre. Seals: [wing] [closed].
- .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

**3.7 Field Quality Control**

- .1 Verification requirements in accordance with Section [01 47 17 - Sustainable Requirements: Contractor's Verification], include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

**3.8 Cleaning**

- .1 Proceed in accordance with Section [01 74 11 - Cleaning].
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

### **1.2 References**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202-[00], Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 Submittals**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Instructions: submit manufacturer's installation instructions.

### **1.4 Quality Assurance**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.5 Delivery, Storage, and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Cleaning Solutions**

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Cleaning Hydronic Systems**

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
  - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .4 Cleaning procedures:
  - .1 Provide detailed report outlining proposed cleaning procedures at least four (4) weeks prior to proposed starting date. Report to include:
    - .1 Cleaning procedures, flow rates, elapsed time.
    - .2 Chemicals and concentrations used.
    - .3 Inhibitors and concentrations.
    - .4 Specific requirements for completion of work.
    - .5 Special precautions for protecting piping system materials and components.
    - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
  - .1 Systems: free from construction debris, dirt and other foreign material.

- .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
- .3 Strainers: clean prior to initial fill.
- .4 Install temporary filters on pumps not equipped with permanent filters.
- .5 Install pressure gauges on strainers to detect plugging.
- .6 Report on Completion of Cleaning:
  - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic Systems:
  - .1 Fill system with water, ensure air is vented from system.
  - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
  - .3 Use water metre to record volume of water in system to +/- 0.5%.
  - .4 Add chemicals under direct supervision of chemical treatment supplier.
  - .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
  - .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
  - .7 Add chemical solution to system.
  - .8 Establish circulation, raise temperature slowly to [maximum design] [82 degrees C minimum]. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

### **3.3 Start-Up of Hydronic Systems**

- .1 After cleaning is completed and system is filled:
  - .1 Establish circulation and expansion tank level, set pressure controls.
  - .2 Ensure air is removed.
  - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
  - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

- .5 Clean out strainers repeatedly until system is clean.
- .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.
- .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
- .8 Repeat with water at design temperature.
- .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
- .10 Bring system up to design temperature and pressure slowly over a 48 hour period.
- .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .12 Adjust pipe supports, hangers, springs as necessary.
- .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .14 If [sliding type expansion joints bind] [or if] [bellows type expansion joints flex incorrectly], shut down system, re-align, repeat start-up procedures.
- .15 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .16 Check operation of drain valves.
- .17 Adjust valve stem packings as systems settle down.
- .18 Fully open balancing valves (except those that are factory-set).
- .19 Check operation of over-temperature protection devices on circulating pumps.
- .20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## 1. GENERAL

### 1.1 References

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C111/A21.11-06, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.1-10, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  - .2 ASME B16.3-06, Malleable Iron Threaded Fittings: Classes 150 and 300.
  - .3 ASME B16.5-09, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
  - .4 ASME B16.9-07, Factory-Made Wrought Butt welding Fittings.
  - .5 ASME B18.2.1-10, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Loded Head and Lag Screws (Inch Series).
  - .6 ASME B18.2.2-10, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
- .3 ASTM International
  - .1 ASTM A47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  - .3 ASTM A536-84(2009), Standard Specification for Ductile Iron Castings.
  - .4 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .6 ASTM E202-10, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .4 CSA International
  - .1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)
  - .1 MSS-SP-67-2002a, Butterfly Valves.
  - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.

- .3 MSS-SP-71-05, Gray Iron Swing Check Valves Flanged and Threaded Ends.
- .4 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
- .5 MSS-SP-85-02, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

## **1.2 Action and 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 hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Submit shop drawings.
    - .2 Components and accessories.

## **1.3 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.
  - .1 Include special servicing requirements.

## **1.4 Extra Stock Materials**

- .1 Supply spare parts as follows:
  - .1 Valve seats: 1 minimum for every ten valves, each size. Minimum one. Discs: 1 minimum for every ten valves, each size. Minimum one.
  - .2 Stem packing: 1 minimum for every ten valves, each size. Minimum one.
  - .3 Valve handles: 2 minimum of each size.
  - .4 Gaskets for flanges: 1 minimum for every ten flanges.

## **1.5 Delivery, Storage and Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect hydronic systems from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Pipe**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 To NPS 6: Schedule 40.
  - .2 NPS 8 and over, 10.
  - .3 NPS 12 and over, 10 mm wall thickness.

### **2.2 Pipe Joints**

- .1 NPS 2 and under: screwed fittings with PTFE tape or lead-free pipe dope.
- .2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.
- .3 Roll grooved: standard rigid coupling to CSA B242.
- .4 Flanges: plain or raised face, slip-on weld neck to ANSI/AWWA C111/ A21.11.
- .5 Orifice flanges: slip-on raised face, 2100 kPa.
- .6 Flange gaskets: to ANSI/AWWA C111/ A21.11.
- .7 Pipe thread: taper.
- .8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .9 Roll grooved coupling gaskets: type EPDM.

### **2.3 Fittings**

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
  - .1 Cast iron: to ASME B16.1, Class 125.



- .2 Steel: to ASME B16.5.
- .3 Butt-welding fittings: steel, to ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.
- .5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M ductile iron to ASTM A536.

## 2.4 Valves

- .1 Connections:
  - .1 NPS 2 and smaller: screwed ends.
  - .2 NPS 2-1/2 and larger: flanged grooved ends.
- .2 Gate valves: to MSS-SP-70 to MSS-SP-80 application: isolating equipment, control valves, pipelines:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms : Class 125, rising stem, split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze. Elsewhere: Class 125, non- rising stem, solid wedge disc.
  - .2 NPS 2-1/2 and over:
    - .1 Mechanical Rooms: rising stem, split wedge disc, lead free bronze trim.
      - .1 Operators: chain manual gear.
    - .2 Elsewhere: non- rising stem, solid wedge disc, lead free bronze trim.
      - .1 Operators
- .3 Butterfly valves: to MSS-SP-67 application: isolating cells or section of multiple component equipment (i.e. multi-section coils, multi-cell cooling towers):
  - .1 NPS 2-1/2 and over: lug type grooved ends: as specified Section 23 05 17 - Pipe Welding.
- .4 Globe valves: to MSS-SP-80 85 application: throttling, flow control, emergency bypass:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: with PTFE disc.
    - .2 Elsewhere: globe, with composition disc.
  - .2 NPS 2-1/2 and over:
    - .1 With composition lead free bronze disc, lead free bronze trim.
    - .2 Operators.

- .5 Balancing, for TAB:
  - .1 Sizes: calibrated balancing valves, as specified this section.
  - .2 NPS 2 and under:
    - .1 Mechanical Rooms: globe, with plug disc.
    - .2 Elsewhere: globe, with plug disc.
- .6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc.
- .7 Bypass valves on gate globe valves NPS 8 and larger: NPS 3/4, Globe, with PTFE disc.
- .8 Swing check valves: to MSS-SP-71.
  - .1 NPS 2 and under:
    - .1 Class 125, swing, with composition disc.
  - .2 NPS 2-1/2 and over:
    - .1 Flanged Grooved ends.
- .9 Silent check valves: NPS 2 and under:
  - .1 As specified Section.
  - .2 NPS 2-1/2 and over:
    - .1 Flanged Grooved ends: as specified Section.
- .10 Ball valves:
  - .1 NPS 2 and under: as specified Section .
- .11 Lubricated Plug Valves
  - .1 NPS 2 and under: .
  - .2 NPS 2-1/2 and over:
    - .1 As specified Section 23 05 23.02 - Valves - Cast Iron.

### **3. EXECUTION**

#### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic systems 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 Piping Installation**

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

### **3.3 Circuit Balancing Valves**

- .1 Install flow measuring stations and flow balancing valves as indicated.
- .2 Remove handwheel after installation and when TAB is complete.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

### **3.4 Cleaning, Flushing and Start-Up**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

### **3.5 Testing**

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical.
- .2 For glycol systems, retest with ethylene propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

### **3.6 Balancing**

- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

### **3.7 Glycol Charging**

- .1 Include mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.

### **3.8 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 21 - Construction/Demolition Waste Management and Disposal.

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

### **3.9 Protection**

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

**END OF SECTION**

## **1. GENERAL**

### **1.1 References**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME-04 (2007), Boiler and Pressure Vessel Code.
- .2 ASTM International Inc.
  - .1 ASTM A47/A47M- 99(2004), Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A278/A278M- 01 (2006), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
  - .3 ASTM A516/A516M- 06, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  - .4 ASTM A536- 84(2004), Standard Specification for Ductile Iron Castings.
  - .5 ASTM B62- 02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B51- 03(R2003), Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2 CSA B51- 03(R2005), Boiler, Pressure Vessel, and Pressure Piping Code, Supplement #1.

### **1.2 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.3 Closeout Submittals**

- .1 Submit maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.

### **1.4 Delivery, Storage and Handling**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse by manufacturer of [pallets] [crates] [padding] [and] [packaging materials] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Automatic Air Vent**

- .1 Standard float vent: brass body and NPS 1/8 connection and rated at 690 kPa working pressure.
- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.

### **2.2 Pipe Line Strainer**

- .1 NPS 1/2 to 2: bronze body to ASTM B62, [solder end] [screwed] connections, Y pattern.
- .2 NPS 2 1/2 to 12: [cast steel body to ASTM A278/A278M, Class 30,] [cast iron body to ASTM A278/A278M, Class 30] [flanged] connections.
- .3 NPS 2 to 12: T type with [ductile iron body to ASTM A536] [malleable iron body to ASTM A47M], grooved ends.
- .4 Blowdown connection: NPS 1.
- .5 Screen: [stainless steel] [brass] with 1.19 mm perforations.
- .6 Working pressure: 860 kPa.

## **3. EXECUTION**

### **3.1 Application**

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

### **3.2 General**

- .1 Run drain lines and blow off connections to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.
- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

### **3.3 Strainers**

- .1 Install in horizontal or down flow lines.

- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve as indicated.

### **3.4 Air Vents**

- .1 Install at high points of systems.
- .2 Install gate valve on automatic air vent inlet. Run discharge to nearest [drain] [or] [service sink].

### **3.5 Pressure Safety Relief Valves**

- .1 Run discharge pipe to terminate above nearest drain.

### **3.6 Performance Verification**

- .1 Operational requirements in accordance with Section 01 47 19 - Sustainable Requirements: Operation, include:
  - .1 Repair and maintenance materials and instructions.

### **3.7 Cleaning**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Materials and installation for copper tubing and fittings for refrigerant.

### **1.2 References**

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME B16.22- [01], Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.

- .2 ASME B16.24- [02], Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

- .3 ASME B16.26- [88], Cast Copper Alloy Fittings for Flared Copper Tubes.

- .4 ASME B31.5- [01], Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)

- .1 ASTM A307- [04], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

- .2 ASTM B280- [03], Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)

- .1 CSA B52-[99], Mechanical Refrigeration Code.

.4 Environment Canada (EC)

- .1 EPS 1/RA/1-[96], Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

### **1.3 Action and Informational Submittals**

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

.2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.

.3 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.



- .2 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
- .4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Instructions: submit manufacturer's installation instructions.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.4 Quality Assurance**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

#### **1.5 Delivery, Storage and Handling**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition 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 bins] for recycling in accordance with Waste Management Plan (WMP).
  - .4 Separate for [reuse] [and] [recycling] and place in designated containers [Steel] [Metal] [Plastic] waste in accordance with Waste Management Plan (WMP).
  - .5 Divert unused [metal] materials from landfill to [metal] recycling facility as approved by [Departmental Representative] [DCC Representative] [Consultant].

### **2. PRODUCTS**

#### **2.1 Materials**

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

#### **2.2 Tubing**

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

- .1 Hard copper: to ASTM B280, type [ACR] [B].
- .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

## **2.3 Fittings**

- .1 Service: design pressure [2070] kPa and temperature [121] degrees C.
- .2 Brazed:
  - .1 Fittings: wrought copper to ASME B16.22.
  - .2 Joints: silver solder, [15% Ag-80% Cu-5%P] [or] [copper-phosphorous, 95% Cu-5%P] and non-corrosive flux.
- .3 Flanged:
  - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
  - .2 Gaskets: suitable for service.
  - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
- .4 Flared:
  - .1 Bronze or brass, for refrigeration, to ASME B16.26.

## **2.4 Pipe Sleeves**

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

## **2.5 Valves**

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 General**

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 01 - Installation of Pipework.

### **3.3 Brazing Procedures**

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

### **3.4 Piping Installation**

- .1 General:
  - .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Hot gas lines:
  - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
  - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
  - .3 Provide inverted deep trap at top of risers.
  - .4 Provide double risers for compressors having capacity modulation.
    - .1 Large riser: install traps as specified.
    - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

### **3.5 Pressure and Leak Testing**

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.
- .3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

### **3.6 Field Quality Control**

- .1 Site Tests/Inspection:
  - .1 Close service valves on factory charged equipment.

- .2 Ambient temperatures to be at least [13] degrees C for at least [12] hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
  - .1 Twice to 14 Pa absolute and hold for 4 h.
  - .2 Break vacuum with refrigerant to 14 kPa.
  - .3 Final to 5 Pa absolute and hold for at least 12 h.
  - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
  - .5 Submit test results to Departmental Representative.
- .7 Charging:
  - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
  - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
  - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
  - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
  - .2 Record and report measurements to Departmental Representative.
- .9 Manufacturer's Field Services:
  - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its product[s] and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, at stages listed:

- .1 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within [3] days of review, and submit, immediately, to Departmental Representative.

### **3.7 Demonstration**

- .1 Instructions:
  - .1 Post instructions in frame with glass cover in accordance with Section 01 78 00 - Closeout Submittals and CSA B52.

### **3.8 Cleaning**

- .1 Perform cleaning operations in accordance with manufacturer's recommendations.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

### **1.2 References**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
  - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
  - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.
- .7 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

### **1.3 Submittals**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 Quality Assurance**

- .1 Certification of Ratings:
  - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Sustainable Requirements:
  - .1 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### **1.5 Delivery, Storage and Handling**

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 47 19 - Construction/Demolition 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 bins for recycling in accordance with Waste Management Plan.
  - .4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.
  - .5 Place materials defined as hazardous or toxic in designated containers.
  - .6 Handle and dispose of hazardous materials in accordance with CEPA, Regional and Municipal regulations.
  - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## 2. PRODUCTS

### 2.1 Seal Classification

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	C

- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
- .3 Class C: transverse joints and connections made air tight with gaskets sealant tape or combination thereof. Longitudinal seams unsealed.
- .4 Unsealed seams and joints.

### 2.2 Sealant

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

### 2.3 Tape

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

### 2.4 Duct Leakage

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

### 2.5 Fittings

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
  - .1 Rectangular: standard radius short radius with single thickness turning vanes  
Centreline radius: 1.5 times width of duct .
  - .2 Round: smooth radius five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm: with single double thickness turning vanes.



- .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
  - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
  - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

## **2.6 Fire Stopping**

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.
- .2 Fire stopping material and installation must not distort duct.

## **2.7 Galvanized Steel**

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE SMACNA.
- .3 Joints: to ASHRAE SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

## **2.8 Kitchen Exhaust Systems**

- .1 Construct in accordance with NFPA 96.
- .2 Material: Type stainless steel black galvanized steel 3003-H-14 aluminum sheet.
- .3 Thickness: mm.
- .4 Fabrication: as indicated.
- .5 Reinforcement.

- .6 Drainage.
- .7 Grease filters: to Section 23 41 00 - Particulate Air Filtration.

## 2.9 Hangers and Supports

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    - .1 Maximum size duct supported by strap hanger: 500.
  - .2 Hanger configuration: to ASHRAE and SMACNA.
  - .3 Hangers: black galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA following table :

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp steel plate washer .
  - .3 For steel beams: manufactured beam clamps:

## 3. EXECUTION

### 3.1 General

- .1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate strap hangers 100 mm beyond insulated duct Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE SMACNA as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation.

- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions .
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining .

### 3.2 Hangers

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE SMACNA as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

### 3.3 Kitchen Exhaust Systems

- .1 Install to NFPA 96 and as indicated.

### 3.4 Sealing and Taping

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

### 3.5 Leakage Tests

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial test has been passed.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .6 Complete test before performance insulation or concealment Work.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes:
  - .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.

### **1.2 References**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials (ASTM).
  - .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .3 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 Sheet Metal Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 95 (Addendum No. 1, (1997).
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition 1985.
  - .3 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

### **1.3 Submittals**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 Quality Assurance**

- .1 Certification of Ratings:
  - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.5 Delivery, Storage and Handling**

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition 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 bins for recycling in accordance with Waste Management Plan.
  - .4 Place materials defined as hazardous or toxic in designated containers.
  - .5 Handle and dispose of hazardous materials in accordance with CEPA and Regional and Municipal regulations.
  - .6 Ensure emptied containers are sealed and stored safely.
  - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## **2. PRODUCTS**

### **2.1 Ductwork**

- .1 Material:
  - .1 Galvanized steel with Z90 designation zinc coating lock forming quality; to ASTM A653/A653M.
  - .2 Thickness: to SMACNA.
- .2 Construction - round and oval.
  - .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
  - .2 Transverse joints up to 900 mm: slip type with tape and sealants.
  - .3 Transverse joints over 900 mm: Vanstone.
  - .4 Fittings:
    - .1 Elbows: smooth radius five -piece (for 90 degrees) three-piece (for 45 degrees). Centreline radius: 1.5 x diameter.

- .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.
- .3 Construction - rectangular:
  - .1 Ducts: to SMACNA.
  - .2 Transverse joints: welded proprietary duct joints SMACNA seal Class A and B.
  - .3 Fittings:
    - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
    - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow.
- .4 Firestopping:
  - .1 50 x 50 x 3 mm retaining angles around duct, on both sides of fire separation.
  - .2 Firestopping material must not distort duct.

## 2.2 Seal Classification

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	A
1500	A
1000	A
750	B

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets sealant tape or combination thereof.

## 2.3 Sealant

- .1 Oil resistant, water-borne polymer type flame resistant high velocity duct sealing compound.

## 2.4 Tape

- .1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

## 2.5 Hangers and Supports

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

- .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct .
- .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to ASHRAE SMACNA .
- .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

### 3. EXECUTION

#### 3.1 General

- .1 Do work in accordance with ASHRAE and SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate band hangers 100 mm beyond insulated duct.
  - .2 Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE and SMACNA as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Ensure installation of firestopping does not distort duct.

#### 3.2 Hangers

- .1 Band hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

### **3.3 Sealing And Taping**

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

### **3.4 Leakage Tests**

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Perform leakage tests in sections.
- .3 Perform trial leakage tests, as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial tests have been achieved.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degree elbows.
- .6 Complete tests before performing insulation or concealment Work.

**END OF SECTION**



## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

### **1.2 References**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-[1985].
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 Submittals**

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

### **1.4 Quality Assurance**

.1 Health and Safety Requirements:

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.5 Delivery, Storage, and Handling**

.1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

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

## **2. PRODUCTS**

### **2.1 General**

- .1 Manufacture to SMACNA standards.

## **2.2 Splitter Dampers**

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

## **2.3 Single Blade Dampers**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant [with shaft extension to accommodate insulation thickness] [\_\_\_].
- .4 Inside and outside [nylon] [bronze] end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

## **2.4 Multi-Bladed Dampers**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: [pin in bronze bushings] [self-lubricating nylon].
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by Engineer.

### **3.3 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes:
  - .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

### **1.2 References**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A653/A653M-[04a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 Submittals**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Closeout Submittals
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.4 Quality Assurance**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Certificates:
  - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

### **1.5 Delivery, Storage, and Handling**

- .1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for [recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Multi-Leaf Dampers**

- .1 Opposed and parallel blade type as indicated.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Performance:
  - .1 Leakage: in closed position less than 2% of rated air flow at [ ] Pa differential across damper.
  - .2 Pressure drop: at full open position less than [ ] Pa differential across damper at [ ] m/s.
- .6 Insulated aluminum dampers:
  - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
  - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

### **2.2 Disc Type Dampers**

- .1 Frame: [insulated] [ ] brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.
- .2 Disc: [insulated] [ ] spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.
- .3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.
- .4 Bearings: roller self lubricated and sealed.

- .5 Operator: compatible with damper, linear stroke operator, [spring loaded] [ ] actuator, zinc-aluminum foundry alloy casting cam follower.
- .6 Performance:
  - .1 Leakage: in closed position less than 0.001 % of rated air flow at [ ] kPa pressure differential across damper.
  - .2 Pressure drop: at full open position less than [ ] kPa differential across damper at [ ] m/s.

### **2.3 Back Draft Dampers**

- .1 [Automatic gravity operated,] [multi] [single] leaf, [aluminum] [steel] construction with [nylon] [ ] bearings, [centre pivoted] [spring assisted] [or] [counterweighted,] [as indicated].

### **2.4 Relief Dampers**

- .1 Automatic multi-leaf [steel] [aluminum] dampers with ball bearing centre pivoted and counter-weights set to open at [ ] Pa static pressure, [as indicated] [ ].

## **3. EXECUTION**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

### **3.3 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Materials and installation of flexible ductwork, joints and accessories.

### **1.2 References**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-02, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
  - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.
- .6 Underwriters' Laboratories Inc. (UL).
  - .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.
- .7 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S110-1986(R2001), Fire Tests for Air Ducts.

### **1.3 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

## **1.4 Quality Assurance**

- .1 Certification of Ratings:
  - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.5 Delivery, Storage and Handling**

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition 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 bins for recycling in accordance with Waste Management Plan.
  - .4 Place materials defined as hazardous or toxic in designated containers.
  - .5 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
  - .6 Ensure emptied containers are sealed and stored safely.
  - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## **1.6 Indoor Air Quality (IAQ) Management Plan**

- .1 Develop and implement an Indoor Air Quality (IAQ) Management Plan in accordance with Section 01 47 15 - Sustainable Requirements: Construction for construction and preoccupancy phases of building.
- .2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

## **2. PRODUCTS**

### **2.1 General**

- .1 Factory fabricated to CAN/ULC-S110.



- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

## **2.2 Metallic - Uninsulated**

- .1 Type 1: spiral wound flexible aluminum, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
  - .3 .

## **2.3 Metallic - Insulated**

- .1 Type 2: spiral wound flexible aluminum with factory applied, 37 mm thick flexible glass fibre thermal insulation with vapour barrier and aluminum jacket, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.

## **2.4 Non-Metallic - Uninsulated**

- .1 Type 3: non-collapsible, coated mineral base fabric aluminum foil mylar type, mechanically bonded to, and helically supported by, external steel wire, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.

## **2.5 Non-Metallic - Insulated**

- .1 Type 4: non-collapsible, coated mineral base fabric aluminum foil/mylar type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fibre thermal insulation with vapour barrier and vinyl reinforced mylar/neoprene laminate jacket, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3 .
  - .3 Thermal loss/gain: W/m<sup>2</sup>. Degrees C mean.

**3. EXECUTION**

**3.1 Duct Installation**

- .1 Install in accordance with: CAN/ULC-S110 UL-181 NFPA 90A NFPA 90B SMACNA.

**END OF SECTION**

## 1. GENERAL

### 1.1 References

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C423-02a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .2 ASTM C916-85(2001)e1, Standard Specification for Adhesives for Duct Thermal Insulation.
  - .3 ASTM C1071-00, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
  - .4 ASTM C1338-00, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
  - .5 ASTM G21-96(2002), Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-02, Standard for the Installation of Air Conditioning and Ventilating Systems.
  - .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- .5 North American Insulation Manufacturers Association (NAIMA).
  - .1 NAIMA AH116-5th Edition, Fibrous Glass Duct Construction Standards.
- .6 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).
  - .1 SMACNA, HVAC DCS, HVAC, Duct Construction Standards, Metal and Flexible-95 (Addendum No.1, Nov. 97).
  - .2 SMACNA IAQ Guideline for Occupied Buildings 95.
- .7 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .8 Underwriter's Laboratories of Canada (ULC).

- .1 CAN/ULC-S102-03-EN, Methods of Test for Surface Burning Characteristics of Building Materials and Assemblies.

## **1.2 Submittals**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.

## **1.3 Health and Safety**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.4 Delivery, Storage and Handling**

- .1 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Protect on site stored or installed absorptive material from moisture damage.

## **1.5 Waste Management and Disposal**

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition 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 bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .6 Ensure emptied containers are sealed and stored safely.
- .7 Fold up metal banding, flatten and place in designated area for recycling.

## **2. PRODUCTS**

### **2.1 Duct Liner**

- .1 General:
  - .1 Mineral Fibre duct liner: air surface coated.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102 and NFPA 90A NFPA 90B.
  - .3 Recycled Content: EcoLogo certified with minimum 35 % by weight recycled content.

- .4 Fungi resistance: to ASTM C1338 ASTM G21.
- .2 Rigid:
  - .1 Use on flat surfaces where indicated.
  - .2 25 mm thick, to ASTM C1071, Type 2, fibrous glass rigid board duct liner.
  - .3 Density: 48 kg/m<sup>3</sup> minimum.
  - .4 Thermal resistance to be minimum 0.76 (m<sup>2</sup>.degrees C)/W for 25 mm thickness 1.15 (m<sup>2</sup>.degrees C)/W for 38 mm thickness 1.53 (m<sup>2</sup>.degrees C)/W for 50 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
  - .5 Maximum velocity on faced air side: 20.3 m/sec.
  - .6 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.
- .3 Flexible:
  - .1 Use on round or oval surfaces surfaces indicated.
  - .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
  - .3 Density: 24 kg/m<sup>3</sup> minimum.
  - .4 Thermal resistance to be minimum 0.37 (m<sup>2</sup>.degrees C)/W for 12 mm thickness 0.74 (m<sup>2</sup>.degrees C)/W for 25 mm thickness 1.11 (m<sup>2</sup>.degrees C)/W for 38 mm thickness 1.41 (m<sup>2</sup>.degrees C)/W to 50 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
  - .5 Maximum velocity on coated air side: 25.4 30.5 m/sec .
  - .6 Minimum NRC of 0.65 at 25 mm thickness based on Type A mounting to ASTM C423.

## **2.2 Adhesive**

- .1 Adhesive: to NFPA 90A and NFPA 90B ASTM C916.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degreesC to plus 93 degreesC.
- .3 Water-based fire retardant type.

## **2.3 Fasteners**

- .1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Polymer Nylon Metal retaining clips, 32 mm square.

## **2.4 Joint Tape**

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

## **2.5 Sealer**

- .1 Meet requirements of NFPA 90A and NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

## **3. EXECUTION**

### **3.1 General**

- .1 Do work in accordance with SMACNA HVAC DCS.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

### **3.2 Duct Liner**

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100 % coverage of adhesive to ASTM C916
    - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres impact driven mechanical fasteners to compress duct liner sufficiently to hold it firmly in place.
    - .1 Spacing of mechanical fasteners in accordance with SMAC HVAC DCS.
- .2 In systems, where air velocities exceeds 20.3 m/sec, install galvanized sheet metal nosing to leading edges of duct liner.

### **3.3 Joints**

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply two coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative.
- .3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Fans, motors, accessories and hardware for commercial use.

### **1.2 References**

- .1 Air Conditioning and Mechanical Contractors (AMCA)
  - .1 AMCA Publication 99-2003, Standards Handbook.
  - .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
  - .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 System Description**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
  - .2 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  - .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
  - .4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal .
  - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

#### **1.4 Submittals**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
  - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide:
  - .1 Fan performance curves showing point of operation, BHP kW and efficiency.
  - .2 Sound rating data at point of operation.
- .4 Indicate:
  - .1 Motors, sheaves, bearings, shaft details.
  - .2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.
- .5 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.5 Quality Assurance**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements .

#### **1.6 Maintenance**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
    - .1 Spare parts to include:
      - .1 Matched sets of belts.
  - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
    - .1 Bearings and seals.
    - .2 Addresses of suppliers.
    - .3 List of specialized tools necessary for adjusting, repairing or replacing.



## **1.7 Delivery, Storage, and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements .
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **2. PRODUCTS**

### **2.1 Centrifugal Fans**

- .1 Fan wheels:
  - .1 Welded steel aluminum construction.
  - .2 Maximum operating speed of centrifugal fans not more than 40 50 % of first critical speed.
  - .3 Air foil backward inclined blades, as indicated.
- .2 Bearings: heavy duty split pillow-block flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 200,000 hours.
- .3 Housings:
  - .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, steel, aluminum, for smaller wheels, braced, and with welded supports.
  - .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
  - .3 Provide bolted latched airtight access doors with handles.
- .4 Variable volume control devices:
  - .1 Mounted by fan manufacturer.
  - .2 Adjustable inlet vanes: operated from a centre mechanism linked to each damper vane. Support each vane at ends in bronze bearings. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation.

### **2.2 Cabinet Fans - General Purpose**

- .1 Fan characteristics and construction: as centrifugal fans.

## **2.3 Utility Sets**

- .1 Characteristics and construction: for centrifugal fans.
- .2 Preassemble single width centrifugal fan with removable weatherproof protective hood with vents, and automatic spring loaded back draft dampers and 12 mm mesh birdscreens.
- .3 Provide belt driven sets with adjustable motor bed plate.

## **2.4 In-Line Centrifugal Fans**

- .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct belt drive.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

# **3. EXECUTION**

## **3.1 Manufacturer's Instructions**

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

## **3.2 Fan Installation**

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories .
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

## **3.3 Anchor Bolts And Templates**

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified .

## **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Variable volume boxes, and electronic variable air volume boxes.

### **1.2 References**

.1 American National Standards Institute (ANSI)

- .1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

- .2 ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

.3 International Organization of Standardization (ISO)

- .1 ISO 3741-2001, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 Underwriter's Laboratories (UL)

- .1 UL 181-2003, Factory-Made Air Ducts and Air Connectors.

### **1.3 System Description**

.1 Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

### **1.4 Submittals**

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

- .2 Test data: to ANSI/AMCA 210 .

- .1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.

- .2 Sound power level with minimum inlet pressure of 0.25 0.5 1 1.5 kPa in accordance with ISO 3741 for 2nd through 7th octave band.
- .3 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate the following:
    - .1 Capacity.
    - .2 Pressure drop.
    - .3 Noise rating.
    - .4 Leakage.
- .3 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## **1.5 Quality Assurance**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.6 Delivery, Storage, and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.7 Maintenance**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:

- .1 Bearings and seals.
- .2 Addresses of suppliers.
- .3 List of specialized tools necessary for adjusting, repairing or replacing.

## **2. PRODUCTS**

### **2.1 Manufactured Units**

- .1 Terminal units of the same type to be product of one manufacturer.

### **2.2 Variable Volume Boxes**

- .1 Pressure independent dependent factory reset to air flow between zero minimum and maximum air volume.
- .2 Sizes, capacities, differential pressures and sound ratings: as indicated.
- .3 Differential pressure not to exceed 25 Pa at inlet air velocity of 10 m/s.
- .4 Sound ratings of assembly not to exceed NC at Pa.
- .5 Complete with:
  - .1 Operator and controller: as specified under Section.
  - .2 Sound attenuator: as specified in Section 23 32 48 - Acoustical Air Plenums.
  - .3 Multiport outlet adapter: as indicated.
  - .4 Reheat coil: as indicated.
  - .5 Pneumatic controller to operate damper operator between independent of maximum or minimum air volume settings:
- .6 Minimum 35 kPa reset span.
- .7 Adjustable reset start point.
- .8 Adjustable reset span to maximum 70 kPa when supplied with minimum 140 kPa main control air.
- .9 No control air bleeds off through inlet sensor.
- .10 Operator to be factory mounted and calibrated:
  - .1 Gauge taps for balancing with standard pressure gauge.
  - .2 Controller to have adjustable flow settings.

- .11 Casing: constructed of mm thick galvanized steel, internally lined with 25 mm, 0.7 kg density fibrous glass, to UL181 and ANSI/NFPA 90A. Mount control components inside protective metal shroud.
- .12 Damper: mm thick galvanized steel with peripheral gasket and self-lubricating bearings. Air leakage past closed damper not to exceed 2% of nominal rating at 750 Pa inlet static pressure, in accordance with Air Diffusion Council test procedure.

### **2.3 Electronic Variable Air Volume Boxes**

- .1 Pressure independent, reset to air flow between zero and maximum air volume.
- .2 At inlet velocity of 10 m/s, differential static pressure for unit with attenuator section not to exceed 25 Pa.
- .3 Sound ratings of assembly not to exceed NC at Pa.
- .4 Air velocity sensor resistance wire or pitot rack as standard to manufacturer.
- .5 Signals between temperature sensing device, velocity controller, velocity sensor and damper actuator analogue and or digital as indicated. Shielded or twisted wire requirements is not acceptable.
- .6 Electronic thermostat furnished by terminal unit manufacturer and have set points and velocity adjustments located in thermostat. Heating and cooling set point range 13 to 30 degrees C. Set points not overlapping. Thermostat to have C proportional band at velocity settings.
- .7 Electronic control package factory calibrated and set at factory. Features to accommodate field calibration and readjustment of air volume settings to include:
  - .1 Metre taps for balancing with digital DC voltmeter.
  - .2 Adjustable flow settings at thermostat.
- .8 Factory installed 20 VA transformer, 115 V to 24 V. Power consumption of terminal not to exceed 15 VA.
- .9 Terminal unit to be CSA certified.
- .10 Casing: mm thick galvanized steel, internally lined with 25 mm. 0.7 kg density fibrous glass, to UL 181 and ANSI/NFPA 90A. Mount control components inside protective metal shroud.
- .11 Damper: mm thick steel with peripheral gasket and self lubricating bearings. Air leakage past closed damper not to exceed 2% of nominal rating at 750 Pa inlet static pressure, in accordance with Air Diffusion Council test procedure.
- .12 Sizes and capacity: as indicated.

### **3. EXECUTION**

#### **3.1 Manufacturer's Instructions**

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

#### **3.2 Installation**

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of ductwork.
- .3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.
- .4 Locate controls, dampers and access panels for easy access.

#### **3.3 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes:
  - .1 General requirements for building Control System .

### **1.2 References**

- .1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
  - .1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
  - .1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
  - .1 ASHRAE STD 135-R2001, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
  - .1 CEA-709.1-B-2002, Control Network Protocol Specification.
- .6 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .7 Electrical and Electronic Manufacturers Association (EEMAC).
  - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .9 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.



### 1.3 Acronyms And Abbreviations

- .1 Acronyms used in EMCS:
  - .1 AEL - Average Effectiveness Level.
  - .2 AI - Analog Input.
  - .3 AIT - Agreement on International Trade.
  - .4 AO - Analog Output.
  - .5 BACnet - Building Automation and Control Network.
  - .6 BC(s) - Building Controller(s).
  - .7 BECC - Building Environmental Control Center.
  - .8 CAD - Computer Aided Design.
  - .9 CDL - Control Description Logic.
  - .10 CDS - Control Design Schematic.
  - .11 COSV - Change of State or Value.
  - .12 CPU - Central Processing Unit.
  - .13 DI - Digital Input.
  - .14 DO - Digital Output.
  - .15 DP - Differential Pressure.
  - .16 ECU - Equipment Control Unit.
  - .17 EMCS - Energy Monitoring and Control System.
  - .18 HVAC - Heating, Ventilation, Air Conditioning.
  - .19 IDE - Interface Device Equipment.
  - .20 I/O - Input/Output.
  - .21 ISA - Industry Standard Architecture.
  - .22 LAN - Local Area Network.
  - .23 LCU - Local Control Unit.
  - .24 MCU - Master Control Unit.
  - .25 NAFTA - North American Free Trade Agreement.

- .26 NC - Normally Closed.
- .27 NO - Normally Open.
- .28 OS - Operating System.
- .29 O&M - Operation and Maintenance.
- .30 OWS - Operator Work Station.
- .31 PC - Personal Computer.
- .32 PCI - Peripheral Control Interface.
- .33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
- .34 PID - Proportional, Integral and Derivative.
- .35 RAM - Random Access Memory.
- .36 SP - Static Pressure.
- .37 ROM - Read Only Memory.
- .38 TCU - Terminal Control Unit.
- .39 USB - Universal Serial Bus.
- .40 UPS - Uninterruptible Power Supply.
- .41 VAV - Variable Air Volume.

#### **1.4 Definitions**

- .1 Point: may be logical or physical.
  - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
  - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
  - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
    - .1 Area descriptor: building or part of building where point is located.
    - .2 System descriptor: system that point is located on.

- .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
- .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
- .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
  - .1 AI (analog input).
  - .2 AO (analog output).
  - .3 DI (digital input).
  - .4 DO (digital output).
  - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
  - .1 Printouts: to ANSI/IEEE 260.1.
  - .2 Refer also to Section 25 05 54- EMCS: Identification.

## 1.5 System Description

- .1 Work covered by sections referred to above consists of fully operational control system (as addition to existing system), including, but not limited to, following:
  - .1 Building Controllers.
  - .2 Control devices as listed in I/O point summary tables.
  - .3 OWS(s).
  - .4 Data communications equipment necessary to effect EMCS data transmission system.
  - .5 Field control devices.
  - .6 Software/Hardware complete with full documentation.
  - .7 Complete operating and maintenance manuals.
  - .8 Training of personnel.

- .9 Acceptance tests, technical support during commissioning, full documentation.
- .10 Wiring interface co-ordination of equipment supplied by others.
- .11 Miscellaneous work as specified in these sections and as indicated.
- .2 Design Requirements:
  - .1 Design and provide conduit and wiring linking elements of system.
  - .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.
  - .3 Location of controllers as reviewed by Departmental Representative prior to installation.
  - .4 Provide utility power to EMCS and emergency power to EMCS as indicated.
  - .5 Metric references: in accordance with CAN/CSA Z234.1.

#### **1.6 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control:
  - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
  - .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
  - .3 Submit proof of compliance to specified standards with shop drawings and product data.
  - .4 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
  - .5 Permits and fees: in accordance with general conditions of contract.
  - .6 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative.
  - .7 Existing devices intended for re-use: submit test report.

#### **1.7 Quality Assurance**

- .1 Have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,
- .2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

- .3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- .4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.
- .5 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **2. PRODUCTS**

### **2.1 Equipment**

- .1 Control Network Protocol and Data Communication Protocol: to ASHRAE STD 135.
- .2 Complete list of equipment and materials to be used on project and forming part of bid tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

### **2.2 Adaptors**

- .1 Provide adaptors between metric and imperial components.

## **3. EXECUTION**

### **3.1 Manufacturer's Recommendations**

- .1 Installation: to manufacturer's recommendations.

### **3.2 Painting**

- .1 Painting: in accordance with Section 09 91 23 - Interior Painting, supplemented as follows:
  - .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
  - .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
  - .3 Clean and prime exposed hangers, racks, fastenings, and other support components.
  - .4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes.
  - .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

### **1.2 Definitions**

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

### **1.3 Submittals**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.
- .2 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.
- .3 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .4 Soft copy to be in AutoCAD - latest version and WordPerfect latest version Microsoft Word latest version format, structured using menu format for easy loading and retrieval on OWS.

### **1.4 Detail Shop Drawing Review**

- .1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
  - .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
  - .2 Wiring diagrams.
  - .3 Piping diagrams and hook-ups.
  - .4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
  - .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
    - .1 Sensing element type and location.
    - .2 Transmitter type and range.
    - .3 Associated field wiring schematics, schedules and terminations.
    - .4 Complete Point Name Lists.

- .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
- .6 Software and programming details associated with each point.
- .7 Manufacturer's recommended installation instructions and procedures.
- .8 Input and output signal levels or pressures where new system ties into existing control equipment.
- .6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
- .7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
- .8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
- .9 Listing and example of specified reports.
- .10 Listing of time of day schedules.
- .11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
- .12 Type and size of memory with statement of spare memory capacity.
- .13 Full description of software programs provided.
- .14 Sample of "Operating Instructions Manual" to be used for training purposes.
- .15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

## 1.5 Quality Assurance

- .1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
  - .1 Undertake functional review of preliminary design documents, resolve inconsistencies.
  - .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
  - .3 Review interface requirements of materials supplied by others.
  - .4 Review "Sequence of Operations".
  - .5 Review building control network structure.
- .2 Contractor's programmer to attend meeting.

- .3 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

## **2. PRODUCTS**

### **2.1 Not Used**

- .1 Not Used.

## **3. EXECUTION**

### **3.1 Not Used**

- .1 Not Used.

**END OF SECTION**



## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes.
  - .1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

### **1.2 Definitions**

- .1 BECC - Building Environmental Control Centre.
- .2 OWS - Operator Work Station.
- .3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

### **1.3 Submittals**

- .1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.
- .2 Submit Record Documents As-built drawings Operation and Maintenance Manual to Departmental Representative in English and French.
- .3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.
  - .1 Binders to be 2/3 maximum full.
  - .2 Provide index to full volume in each binder.
  - .3 Identify contents of each manual on cover and spine.
  - .4 Provide Table of Contents in each manual.
  - .5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

### **1.4 As-Built**

- .1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:
  - .1 Changes to contract documents as well as addenda and contract extras.
  - .2 Changes to interface wiring.
  - .3 Routing of conduit, wiring and control air lines associated with EMCS installation.
  - .4 Locations of obscure devices to be indicated on drawings.

- .5 Listing of alarm messages.
- .6 Panel/circuit breaker number for sources of normal/emergency power.
- .7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
- .8 Basic system design and full documentation on system configuration.
- .2 Submit for final review by Departmental Representative.
- .3 Provide before acceptance 4 Hard and 1 soft copy incorporating changes made during final review.

### **1.5 O&M Manuals**

- .1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
- .2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests
- .3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
- .4 Functional description to include:
  - .1 Functional description of theory of operation.
  - .2 Design philosophy.
  - .3 Specific functions of design philosophy and system.
  - .4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
  - .5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
  - .6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.
- .5 System operation to include:
  - .1 Complete step-by-step procedures for operation of system including required actions at each OWS.
  - .2 Operation of computer peripherals, input and output formats.
  - .3 Emergency, alarm and failure recovery.

- .4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.
- .6 Software to include:
  - .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
  - .2 Detailed descriptions of program requirements and capabilities.
  - .3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
  - .4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
  - .5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
  - .6 Software for each Controller and single section referencing Controller common parameters and functions.
- .7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.
- .8 System configuration document:
  - .1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.
  - .2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.
- .9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

## **2. PRODUCTS**

### **2.1 Not Used**

- .1 Not Used.

**3. EXECUTION**

**3.1 Not Used**

.1 Not Used.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes.
  - .1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

### **1.2 References**

- .1 Canadian Standards Association (CSA International).
  - .1 CSA C22.1-02, The Canadian Electrical Code, Part I (19th Edition), Safety Standard for Electrical Installations.

### **1.3 Definitions**

- .1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

### **1.4 System Description**

- .1 Language Operating Requirements: provide identification for control items in English.

### **1.5 Submittals**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.
- .2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

## **2. PRODUCTS**

### **2.1 Nameplates for Panels**

- .1 Identify by Plastic laminate, 3 mm thick Melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.
- .2 Sizes: 25 x 67 mm minimum.
- .3 Lettering: minimum 7 mm high, black.
- .4 Inscriptions: machine engraved to identify function.

### **2.2 Nameplates for Field Devices**

- .1 Identify by plastic encased cards attached by chain plastic tie.
- .2 Sizes: 50 x 100 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.

- .4 Data to include: point name and point address.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

### **2.3 Nameplates for Room Sensors**

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by Departmental Representative.
- .3 Letter size: to suit, clearly legible.

### **2.4 Warning Signs**

- .1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.
- .2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative's.

### **2.5 Wiring**

- .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
- .2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.
- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

### **2.6 Conduit**

- .1 Colour code EMCS conduit.
- .2 Pre-paint box covers and conduit fittings.
- .3 Coding: use fluorescent orange paint and confirm colour with Departmental Representative.

## **3. EXECUTION**

### **3.1 Nameplates and Labels**

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

### **3.2 Existing Panels**

- .1 Correct existing nameplates and legends to reflect changes made during Work.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

.2 Related Sections:

- .1 Section 25 05 01 - EMCS: General Requirements.

### **1.2 References**

.1 Canadian Standards Association (CSA International).

- .1 CSA T529-95(R2000), Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications).
- .2 CSA T530-99(R2004), Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications).

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.

- .1 IEEE Std 802.3™-2002, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)

- .1 TIA/EIA-568-March 2004, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements Part 2 Balanced Twisted-Pair Cabling Components Part 3 Optical Fiber Cabling Components Standard.
- .2 TIA/EIA-569-A-December 2001, Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).

- .1 TBITS 6.9-2000, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications.

### **1.3 Definitions**

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS - General Requirements.

### **1.4 System Description**

- .1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529 TIA/EIA-568 and CSA T530 TIA/EIA-569-A and TBITS 6.9.

- .1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.
- .2 Allow for future expansion of network, with selection of networking technology and communication protocols.
- .2 Data communication network to include, but not limited to:
  - .1 EMCS-LAN.
  - .2 Modems.
  - .3 Network interface cards.
  - .4 Network management hardware and software.
  - .5 Network components necessary for complete network.

### 1.5 Design Requirements

- .1 EMCS Local Area Network (EMCS-LAN).
  - .1 High speed, high performance, local area network over which MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
  - .2 EMCS-LAN to: BACnet.
  - .3 Each EMCS-LAN to be capable of supporting at least 50 devices.
  - .4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.
  - .5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.
  - .6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
  - .7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.
- .2 Dynamic Data Access.
  - .1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.
  - .2 Access to data to be based upon logical identification of building equipment.



.3 Network Medium.

.1 Network medium: twisted cable, shielded twisted cable compatible with network protocol to be used within buildings.

## **2. PRODUCTS**

### **2.1 Not Used**

.1 Not Used.

## **3. EXECUTION**

### **3.1 Not Used**

.1 Not Used.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

- .1 Section Includes:
  - .1 Materials and installation for building automation controllers including:
    - .1 Master Control Unit (MCU).
    - .2 Local Control Unit (LCU).
    - .3 Equipment Control Unit (ECU).
    - .4 Terminal Control Unit (TCU).

### **1.2 References**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).
  - .1 ASHRAE 2003, Applications Handbook, SI Edition.
- .2 Canadian Standards Association (CSA International).
  - .1 C22.2 No.205-M1983(R1999), Signal Equipment.
- .3 Institute of Electrical and Electronics Engineers (IEEE).
  - .1 IEEE C37.90.1-02, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.
- .4 Public Works and Government Services Canada (PWGSC)/Real Property Branch/Architectural and Engineering Services.
  - .1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: <ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf>

### **1.3 Definitions**

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

### **1.4 System Description**

- .1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided to support building systems and associated sequence(s) of operations as detailed in these specifications.
  - .1 Provide sufficient controllers to meet intents and requirements of this section.
  - .2 Controller quantity, and point contents to be approved by Departmental Representative at time of preliminary design review.
- .2 Controllers: stand-alone intelligent Control Units.

- .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
- .2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.
- .3 Capable of interfacing with operator interface device.
- .4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
  - .1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
- .3 Interface to include provisions for use of dial-up modem for interconnection with remote modem.
  - .1 Dial-up communications to use 56 Kbit modems and voice grade telephone lines.
  - .2 Each stand-alone panel may have its own modem or group of stand-alone panels may share modem.

## 1.5 Design Requirements

- .1 To include:
  - .1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.
  - .2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.
  - .3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.
  - .4 Control of systems as described in sequence of operations.
  - .5 Execution of optimization routines as listed in this section.
- .2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.
- .3 Field Termination and Interface Devices:
  - .1 To: CSA C22.2 No.205.
  - .2 Electronically interface sensors and control devices to processor unit.
  - .3 Include, but not be limited to, following:
    - .1 Programmed firmware or logic circuits to meet functional and technical requirements.

- .2 Power supplies for operation of logics devices and associated field equipment.
- .3 Lockable wall cabinet.
- .4 Required communications equipment and wiring (if remote units).
- .5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.
- .6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.
- .7 Wiring terminations: use conveniently located screw type or spade lug terminals.
- .4 AI interface equipment to:
  - .1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.
  - .2 Provide for following input signal types and ranges:
    - .1 4 - 20 mA;
    - .2 0 - 10 V DC;
    - .3 100/1000 ohm RTD input;
  - .3 Meet IEEE C37.90.1 surge withstand capability.
  - .4 Have common mode signal rejection greater than 60 dB to 60 Hz.
  - .5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.
- .5 AO interface equipment:
  - .1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.
  - .2 Provide for following output signal types and ranges:
    - .1 4 - 20 mA.
    - .2 0 - 10 V DC.
  - .3 Meet IEEE C37.90.1 surge withstand capability.
- .6 DI interface equipment:
  - .1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
  - .2 Meet IEEE C37.90.1 surge withstand capability.

- .3 Accept pulsed inputs up to 2 kHz.
- .7 DO interface equipment:
  - .1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.
  - .2 Switch up to 5 amps at 220 V AC using optional interface relay.
- .4 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.
- .5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.
  - .1 Provide for conduit entrance from top, bottom or sides of panel.
  - .2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.
  - .3 Mounting details as approved by Departmental Representative for ceiling mounting.
- .6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.
- .7 Provide surge and low voltage protection for interconnecting wiring connections.

## **1.6 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit product data sheets for each product item proposed for this project.

## **1.7 Maintenance Procedures**

- .1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03 - EMCS: Project Record Documents .

## **2. PRODUCTS**

### **2.1 Master Control Unit (MCU)**

- .1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.
- .2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices.
  - .1 MCU must support BACnet.
- .3 MCU local I/O capacity as follows:
  - .1 MCU I/O points as allocated in I/O Summary Table referenced in MD13800.

- .2 LCUs may be added to support system functions.
- .4 Central Processing Unit (CPU).
  - .1 Processor to consist of minimum 16 bit microprocessor capable of supporting software to meet specified requirements.
  - .2 CPU idle time to be more than 30% when system configured to maximum input and output with worst case program use.
  - .3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:
    - .1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.
    - .2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.
  - .4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.

## **2.2 Local Control Unit (LCU)**

- .1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.
- .2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.
- .3 Points integral to one Building System to be resident on only one controller.
- .4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:
  - .1 Include minimum 2 interface ports for connection of local computer terminal.
  - .2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.
  - .3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
  - .4 Include power supplies for operation of LCU and associated field equipment.
  - .5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
  - .6 Provide conveniently located screw type or spade lug terminals for field wiring.

## **2.3 Terminal/Equipment Control Unit (TCU/ECU)**

- .1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.
  - .1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.
- .2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.
- .3 VAV Terminal Controller.
  - .1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.
  - .2 Controller to support point definition; in accordance with Section 25 05 01 - EMCS: General Requirements .
  - .3 Controller to operate independent of network in case of communication failure.
  - .4 Controller to include damper actuator and terminations for input and output sensors and devices.

## **2.4 Software**

- .1 General.
  - .1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.
  - .2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.
  - .3 Include initial programming of Controllers, for entire system.
- .2 Program and data storage.
  - .1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.
  - .2 Maintain CDL and operating data including setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.
- .3 Programming languages.
  - .1 Program Control Description Logic software (CDL) using English like or graphical, high level, general control language.

- .2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed unless approved by Departmental Representative.
- .4 Operator Terminal interface.
  - .1 Operating and control functions include:
    - .1 Multi-level password access protection to allow user/manager to limit workstation control.
    - .2 Alarm management: processing and messages.
    - .3 Operator commands.
    - .4 Reports.
    - .5 Displays.
    - .6 Point identification.
- .5 Pseudo or calculated points.
  - .1 Software to provide access to value or status in controller or other networked controller in order to define and calculate pseudo point. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.
  - .2 Inputs and outputs for process: include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to number of other processes (e.g. cascading).
- .6 Control Description Logic (CDL):
  - .1 Capable of generating on-line project-specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.
  - .2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.
  - .3 Perform changes to CDL on-line.
  - .4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.
  - .5 Energy optimization routines including enthalpy control, supply temperature reset, to be LCU or MCU resident functions and form part of CDL.
  - .6 MCU to be able to perform following pre-tested control algorithms:
    - .1 Two position control.



- .2 Proportional Integral and Derivative (PID) control.
- .7 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.
- .8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
- .9 Power Fail Restart: upon detection of power failure system to verify availability of Emergency Power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under Emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.
- .7 Event and Alarm management: use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition.
- .8 Energy management programs: include specific summarizing reports, with date stamp indicating sensor details which activated and or terminated feature.
  - .1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:
    - .1 Time of day scheduling.
    - .2 Calendar based scheduling.
    - .3 Holiday scheduling.
    - .4 Temporary schedule overrides.
    - .5 Optimal start stop.
    - .6 Night setback control.
    - .7 Enthalpy (economizer) switchover.
    - .8 Peak demand limiting.
    - .9 Temperature compensated load rolling.
    - .10 Fan speed/flow rate control.
    - .11 Cold deck reset.

- .12 Hot deck reset.
- .13 Hot water reset.
- .14 Chilled water reset.
- .15 Condenser water reset.
- .16 Chiller sequencing.
- .17 Night purge.
- .2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.
- .3 Apply programs to equipment and systems as specified or requested by the Departmental Representative.
- .9 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.
  - .1 MCUs to accumulate and store automatically run-time for binary input and output points.
  - .2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.
  - .3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.
  - .4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.
  - .5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWh, litres, tonnes, etc.).
  - .6 Store event totalization records with minimum of 9,999,999 events before reset.
  - .7 User to be able to define warning limit and generate user-specified messages when limit reached.

## **2.5 Levels of Address**

- .1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.
  - .1 Display analog values digitally to 1 place of decimals with negative sign as required.
  - .2 Update displayed analog values and status when new values received.
  - .3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.
  - .4 Updates to be change-of-value (COV) -driven or if polled not exceeding 2 second intervals.

## **2.6 Point Name Support**

- .1 Controllers (MCU, LCU) to support PWGSC point naming convention as defined in Section 25 05 01 - EMCS: General Requirements.

## **3. EXECUTION**

### **3.1 Location**

- .1 Location of Controllers to be approved by Departmental Representative.

### **3.2 Installation**

- .1 Install Controllers in secure locking enclosures as indicated or as directed by Departmental Representative.
- .2 Provide necessary power from local 120 V branch circuit panel for equipment.
- .3 Install tamper locks on breakers of circuit breaker panel.
- .4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Summary**

.1 Section Includes:

- .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors, controls, meters, switches, transducers, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

### **1.2 References**

- .1 American National Standards Institute (ANSI).
  - .1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.
  - .2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.
- .3 National Electrical Manufacturer's Association (NEMA).
  - .1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .4 Air Movement and Control Association, Inc. (AMCA).
  - .1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.
- .5 Canadian Standards Association (CSA International).
  - .1 CSA-C22.1-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

### **1.3 Definitions**

- .1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

### **1.4 Action and Informational Submittals**

- .1 Submit shop drawings and manufacturer's installation instructions.
- .2 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions for specified equipment and devices.

### **1.5 Existing Conditions**

- .1 Cutting and Patching: in accordance with Section 01 73 00 - Execution Requirements supplemented as specified herein.

- .2 Repair surfaces damaged during execution of Work. Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

## **2. PRODUCTS**

### **2.1 General**

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant, assembly.
- .3 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.
- .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.
- .9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

### **2.2 Temperature Sensors**

- .1 General: except for room sensors to be resistance or thermocouple type to following requirements:
  - .1 Thermocouples: limit to temperature range of 200 degrees C and over.
  - .2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
  - .3 Sensing element: hermetically sealed.
  - .4 Stem and tip construction: copper or type 304 stainless steel.
  - .5 Time constant response: less than 3 seconds to temperature change of 10 degrees C.
  - .6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 150 mm as indicated.
- .2 Room temperature sensors and display wall modules.

- .1 Temperature sensing and display wall module.
  - .1 LCD display to show space temperature and temperature setpoint.
  - .2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.
  - .3 Jack connection for plugging in laptop personal computer contractor supplied zone terminal unit contractor supplied palm compatible handheld device for access to zone bus.
  - .4 Integral thermistor sensing element 10,000 ohm at 24 degrees.
  - .5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.
  - .6 Stability 0.02 degrees C drift per year.
  - .7 Separate mounting base for ease of installation. Room temperature sensors.
  - .8 Wall mounting, in slotted type covers having brushed aluminum brushed stainless steel finish, with guard as indicated.
  - .9 Element 10-50mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2 degrees C.
- .3 Duct temperature sensors:
  - .1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length 460 mm or as indicated.
  - .2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6000 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.
- .4 Outdoor air temperature sensors:
  - .1 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure.

## **2.3 Temperature Transmitters**

- .1 Requirements:
  - .1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
  - .2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.
  - .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
  - .4 Input and output short circuit and open circuit protection.

- .5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.
- .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
- .7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
- .8 Integral zero and span adjustments.
- .9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50degrees C.
- .10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.
- .11 Transmitter ranges: select narrowest range to suit application from following:
  - .1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
  - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
  - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
  - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
  - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

## **2.4 Humidity Sensors**

- .1 Room and Duct Requirements:
  - .1 Range: 5 - 90 % RH minimum.
  - .2 Operating temperature range: 0 - 60 degrees C. Absolute accuracy:
    - .1 Duct sensors: plus or minus 3 %.
    - .2 Room sensors: plus or minus 2 %.
  - .3 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
  - .4 Maximum sensor non-linearity: plus or minus 2% RH with defined curves.
  - .5 Room sensors: locate in air stream near RA grille wall mounted as indicated.
  - .6 Duct mounted sensors: locate so that sensing element is in air flow in duct.
- .2 Outdoor Humidity Requirements:
  - .1 Range: 0 - 100 % RH minimum.
  - .2 Operating temperature range: -40 - 50 degrees C.
  - .3 Absolute accuracy: plus or minus 2%.

- .4 Temperature coefficient: plus or minus 0.03%RH/ degrees C over 0 to 50 degrees C.
- .5 Must be unaffected by condensation or 100% saturation.
- .6 No routine maintenance or calibration is required.

## **2.5 Humidity Transmitters**

- .1 Requirements:
  - .1 Input signal: from RH sensor.
  - .2 Output signal: 4 - 20 mA onto 500 ohm maximum load.
  - .3 Input and output short circuit and open circuit protection.
  - .4 Output variations: not to exceed 0.2 % of full scale output for supply voltage variations of plus or minus 10 %.
  - .5 Output linearity error: plus or minus 1.0% maximum of full scale output.
  - .6 Integral zero and span adjustment.
  - .7 Temperature effect: plus or minus 1.0 % full scale/ 6 months.
  - .8 Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.

## **2.6 Pressure Transducers**

- .1 Requirements:
  - .1 Combined sensor and transmitter measuring pressure.
    - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
  - .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
  - .3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.
  - .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.
  - .5 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
  - .6 Over-pressure input protection to at least twice rated input pressure.
  - .7 Output short circuit and open circuit protection.
  - .8 Accuracy: plus or minus 1% of Full Scale.



## **2.7 Differential Pressure Transmitters**

- .1 Requirements:
  - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
  - .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
  - .3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.
  - .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.
  - .5 Integral zero and span adjustment.
  - .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
  - .7 Over-pressure input protection to at least twice rated input pressure.
  - .8 Output short circuit and open circuit protection.
  - .9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

## **2.8 Static Pressure Sensors**

- .1 Requirements:
  - .1 Multipoint element with self-averaging manifold.
    - .1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).
  - .2 Accuracy: plus or minus 1 % of actual duct static pressure.

## **2.9 Static Pressure Transmitters**

- .1 Requirements:
  - .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
  - .2 Calibrated span: not to exceed 150 % of duct static pressure at maximum flow.
  - .3 Accuracy: 0.4 % of span.
  - .4 Repeatability: within 0.5 % of output.
  - .5 Linearity: within 1.5 % of span.
  - .6 Deadband or hysteresis: 0.1% of span.
  - .7 External exposed zero and span adjustment.
  - .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

## **2.10 Velocity Pressure Sensors**

- .1 Requirements:
  - .1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.
  - .2 Maximum pressure loss: 37Pa at 1000 m/s.
  - .3 Accuracy: plus or minus 1 % of actual duct velocity.

## **2.11 Velocity Pressure Transmitters**

- .1 Requirements:
  - .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
  - .2 Calibrated span: not to exceed 125 % of duct velocity pressure at maximum flow.
  - .3 Accuracy: 0.4 % of span.
  - .4 Repeatability: within 0.1 % of output.
  - .5 Linearity: within 0.5 % of span.
  - .6 Deadband or hysteresis: 0.1% of span.
  - .7 External exposed zero and span adjustment.
  - .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

## **2.12 Pressure and Differential Pressure Switches**

- .1 Requirements:
  - .1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.
  - .2 Adjustable setpoint and differential.
  - .3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.
  - .4 Switch assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.
  - .5 Accuracy: within 2% repetitive switching.
  - .6 Provide switches with isolation valve and snubber, where code allows, between sensor and pressure source.
  - .7 Switches on steam and high temperature hot water service: provide pigtail syphon.

## **2.13 Current / Pneumatic (I/P) Transducers**

- .1 Requirements:
  - .1 Input range: 4 to 20 mA.
  - .2 Output range: proportional 20-104 kPa or 20-186 kPa as applicable.
  - .3 Housing: dustproof or panel mounted.
  - .4 Internal materials: suitable for continuous contact with industrial standard instrument air.
  - .5 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 2 % of full scale over entire range.
  - .6 Integral zero and span adjustment.
  - .7 Temperature effect: plus or minus 2.0 % of full scale/ 50degrees C or less.
  - .8 Regulated supply pressure: 206 kPa maximum.
  - .9 Air consumption: 16.5 ml/s maximum.
  - .10 Integral gauge manifold c/w gauge (0-206 kPa).

## **2.14 Solenoid Control Air Valves**

- .1 Coil: 120V AC or 24V DC, as indicated.
- .2 Capacity: to pass a minimum of 0.15 l/s air at 140 kPa differential.

## **2.15 Air Pressure Gauges**

- .1 Diameter: 38 mm minimum.
- .2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

## **2.16 Electromechanical Relays**

- .1 Requirements:
  - .1 Double voltage, DPDT, plug-in type with termination base.
  - .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
  - .3 Contacts: rated at 5 amps at 120 V AC.
  - .4 Relay to have visual status indication

## **2.17 Solid State Relays**

- .1 General:

- .1 Relays to be socket or rail mounted.
- .2 Relays to have LED Indicator
- .3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
- .4 Operating temperature range to be -20 degrees C to 70 degrees C.
- .5 Relays to be CSA Certified.
- .6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.
- .7 Operational frequency range, 45 to 65 HZ.
- .2 Input:
  - .1 Control voltage, 3 to 32 VDC.
  - .2 Drop out voltage, 1.2 VDC.
  - .3 Maximum input current to match AO (Analog Output) board.
- .3 Output.
  - .1 AC or DC Output Model to suit application.

## **2.18 Current Transducers**

- .1 Requirements:
- .2 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:
  - .1 4-20 mA DC.
  - .2 0-1 volt DC.
  - .3 0-10 volts DC.
  - .4 0-20 volts DC.
- .3 Frequency insensitive from 10 - 80 hz.
- .4 Accuracy to 0.5% full scale.
- .5 Zero and span adjustments. Field adjustable range to suit motor applications.
- .6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

## **2.19 Current Sensing Relays**

- .1 Requirements:

- .1 Suitable to detect belt loss or motor failure.
- .2 Trip point adjustment, output status LED.
- .3 Split core for easy mounting.
- .4 Induced sensor power.
- .5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.
- .6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
- .7 Adjustable latch level.

## **2.20 Control Dampers**

- .1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 1219 mm high. Three or more sections to be operated by jack shafts.
- .2 Materials:
  - .1 Frame: 2.03 mm minimum thickness extruded aluminum. For outdoor air and exhaust air applications, frames to be insulated.
  - .2 Blades: extruded aluminum. For outdoor air/exhaust air applications, blades to be internally insulated.
  - .3 Bearings: maintenance free, synthetic type of material.
  - .4 Linkage and shafts: aluminum, zinc and nickel plated steel.
  - .5 Seals: synthetic type, mechanically locked into blade edges.
    - .1 Frame seals: synthetic type, mechanically locked into frame sides.
- .3 Performance: minimum damper leakage meet or exceed AMCA Standard 500-D ratings.
  - .1 Size/Capacity: refer to damper schedule
  - .2 25 L/s/m<sup>5</sup> maximum allowable leakage against 1000 Pa static pressure for outdoor air and exhaust air applications.
  - .3 Temperature range: minus 40degrees C to plus 100 degrees C.
- .4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.
- .5 Jack shafts: 25 mm diameter solid shaft, constructed of corrosion resistant metal complete with required number of pillow block bearings to support jack shaft and operate dampers throughout their range.

- .1 Include corrosion resistant connecting hardware to accommodate connection to damper actuating device.
- .2 Install using manufacturers installation guidelines.
- .3 Use same manufacturer as damper sections.

## **2.21 Electronic Control Damper Actuators**

- .1 Requirements:
  - .1 Direct mount proportional type as indicated.
  - .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
  - .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
  - .4 Power requirements: 5 VA maximum at 24 V AC.
  - .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
  - .6 For VAV box applications floating control type actuators may be used.
  - .7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

## **2.22 Control Valves**

- .1 Body: globe style, characterized ball.
  - .1 Flow characteristic as indicated on control valve schedule: linear, equal percentage, quick opening.
  - .2 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.
  - .3 Normally open Normally closed, as indicated.
  - .4 Two Three port, as indicated.
  - .5 Leakage rate ANSI class IV, 0.01% of full open valve capacity.
  - .6 Packing easily replaceable.
  - .7 Stem, stainless steel.
  - .8 Plug and seat, stainless steel, brass, bronze.
  - .9 Disc, replaceable, material to suit application.
  - .10 NPS 2 and under:Screwed National Pipe Thread (NPT) tapered female connections.
    - .1 Valves to ANSI Class 250, valves to bear ANSI mark.

- .2 Rangeability 50:1 minimum.
- .11 NPS 2 1/2 and larger:
  - .1 Flanged connections.
  - .2 Valves to ANSI Class 150 or 250 as indicated, valves to bear ANSI mark.
  - .3 Rangeability 100:1 minimum.
- .2 Butterfly Valves NPS 2 and larger:
  - .1 Body: for chilled water ANSI Class 150 cast iron lugged body and wafer body installed in locations as indicated. For steam and heating water ANSI Class 150 carbon steel lugged body and wafer body.
  - .2 End connections to suit flanges that are ANSI Class 150.
  - .3 Extended stem neck to provide adequate clearance for flanges and insulation.
  - .4 Pressure limit: bubble tight sealing to 170 kilopascals.
  - .5 Disc/vane: 316 stainless steel, aluminum bronze to ASTM B148 .
  - .6 Seat: for service on chilled water PTFE (polytetrafluoroethylene), EPDM (ethylene propylene diene monomer). For service on steam and heating water PTFE, RTFE (reinforced PTFE).
  - .7 Stem: 316 stainless steel.
  - .8 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.
  - .9 Flow characteristic linear.
  - .10 Maximum flow requirement as indicated on control valve schedule.
  - .11 Maximum pressure drop as indicated on control valve schedule: pressure drop not to exceed one half of inlet pressure.
  - .12 Normally open Normally closed, as indicated.
  - .13 Valves are to be provided complete with mounting plate for installation of actuators.

## **2.23 Electronic / Electric Valve Actuators**

- .1 Requirements:
  - .1 Construction: steel, cast iron, aluminum.
  - .2 Control signal: 0-10V DC or 4-20 mA DC. Positioning time: to suit application. 90 sec maximum.
  - .3 Fail to normal position as indicated.

- .4 Scale or dial indication of actual control valve position.
- .5 Size actuator to meet requirements and performance of control valve specifications.
- .6 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.
- .7 Minimum shut-off pressure: refer to control valve schedule.

## **2.24 Panels**

- .1 Free-standing wall mounted enamelled steel cabinets with hinged and key-locked front door.
- .2 Multiple panels as required indicated to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.
- .3 Panels to be lockable with same key.

## **2.25 Wiring**

- .1 In accordance with Section 26 27 10 - Modular Wiring System 26 27 26 - Wiring Devices.
- .2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.
- .3 Wiring must be continuous without joints.
- .4 Sizes:
  - .1 Field wiring to digital device: #18AWG 20AWG stranded twisted pair.
  - .2 Analog input and output: shielded #18 minimum solid copper #20 minimum stranded twisted pair.

## **3. EXECUTION**

### **3.1 Installation**

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
- .4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
- .5 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00 - Firestopping. Maintain fire rating integrity.



- .6 Electrical:
  - .1 Complete installation in accordance with Section 26 05 00 - Common Work Results for Electrical.
  - .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
  - .3 Refer to electrical control schematics included as part of control design schematics in Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.
  - .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
  - .5 Install communication wiring in conduit.
    - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
    - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
    - .3 Maximum conduit fill not to exceed 40%.
    - .4 Design drawings do not show conduit layout.
  - .6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.
- .7 VAV Terminal Units: supply, install and adjust as required.
  - .1 Air probe, actuator and associated vav controls.
  - .2 Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators.
  - .3 Co-ordinate air flow adjustments with balancing trade.

### **3.2 Temperature and Humidity Sensors**

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
- .3 Outdoor installation:
  - .1 Protect from solar radiation and wind effects by non-corroding shields.
  - .2 Install in NEMA 4 enclosures.

- .4 Duct installations:
  - .1 Do not mount in dead air space.
  - .2 Locate within sensor vibration and velocity limits. Securely mount extended surface sensor used to sense average temperature.
  - .3 Thermally isolate elements from brackets and supports to respond to air temperature only.
  - .4 Support sensor element separately from coils, filter racks.
- .5 Averaging duct type temperature sensors.
  - .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
  - .2 Wire multiple sensors in series for low temperature protection applications.
  - .3 Wire multiple sensors separately for temperature measurement.
  - .4 Use software averaging algorithm to derive overall average for control purposes.
- .6 Thermowells: install for piping installations.
  - .1 Locate well in elbow where pipe diameter is less than well insertion length.
  - .2 Thermowell to restrict flow by less than 30%.
  - .3 Use thermal conducting paste inside wells.

### **3.3 Panels**

- .1 Arrange for conduit and tubing entry from top, bottom or either side.
- .2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.
- .3 Identify wiring and conduit clearly.

### **3.4 Magnehelic Pressure Indicators**

- .1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensor as reviewed by Departmental Representative.
- .2 Locations: as indicated as specified.

### **3.5 Pressure And Differential Pressure Switches And Sensors**

- .1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.

- .1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

### **3.6 I/P Transducers**

- .1 Install air pressure gauge on outlet.

### **3.7 Air Pressure Gauges**

- .1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.
- .2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

### **3.8 Identification**

- .1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

### **3.9 Air Flow Measuring Stations**

- .1 Protect air flow measuring assembly until cleaning of ducts is completed.

**END OF SECTION**

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This Section describes the Common Work Results applicable to electrical disciplines.
- .2 See the architectural specifications for schedule specifics and include in tender price for any overtime or abnormal shift required to complete the project to meet this schedule.

1.2 GENERAL

- .1 The general conditions and general requirements together with all amendments and supplements contained in the General Specifications shall form an integral part of the electrical specification and will be made part of this contract.
- .2 Reference to "Electrical Divisions" shall mean all Divisions 26, 27, 28, 33, 34 and 48 in the Master Format or the Canadian Master Specifications.
- .3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
- .4 "Consultant" or "Engineer" shall mean "Departmental Representative".
- .5 Confirm with the architectural plans and specifications the extent and nature of the work and how it will affect the electrical work. Include in the tender sum for any complications or additional work described therein.
- .6 Review mechanical plans and specifications for the extent of electrical work required to make mechanical systems complete and include this work in the tender sum.
- .7 Review structural plans for limitations of penetrations or inclusions of electrical equipment. In the tender sum, allow for avoiding critical areas with electrical equipment.
- .8 Review existing record plans and site conditions for limitations of penetrations or inclusions of electrical equipment. In tender sum, allow for avoiding critical areas with electrical equipment.
- .9 Comply with the requirements of the General Contract, and coordinate the installation with all other trades on site.
- .10 Distributor Net Pricing has been secured for all products specified and is used in the preparation of preliminary opinions of probable cost. A record of specific unit costs has been shared confidentially with the Owner to assist him in analysis of bid submittals.
- .11 Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied by other trades.

1.3 WORK INCLUDED

- .1 This work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by owner.
- .2 Items obviously necessary, or reasonably implied, to complete the work, to be included as if shown on drawings and noted in the specifications.
- .3 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of the systems described herein shall be furnished. This includes providing lighting and power for own work.
- .4 This contract shall include, but is not confined to, the following scope of work:

- .1 Demolition of existing components including lighting fixtures and wiring, duplex receptacles, communications outlets and cabling, connections to all redundant equipment and all conduit and wiring within the walls being demolished.
- .2 Power connections and outlets
- .3 New panelboards
- .4 Mechanical equipment connections
- .5 Lighting systems and Controls
- .6 Data/Communications system components
- .7 CCTV system components
- .8 Security System components
- .5 Complete all electrical connections to equipment and accessories pertaining to this contract and leave all in operating condition to the Departmental Representative's satisfaction.
- .6 Remove all existing electrical equipment and material made redundant by this contract or in conflict with work to be carried out. Reroute, reinstall or replace existing electrical material that becomes necessary due to work carried out by this contract so a complete working electrical system will be retained in all areas affected by this installation.

#### 1.4 WORK EXCLUDED

- .1 This contract shall not include, but is not confined to, the following scope of work:
- .2 Low voltage mechanical systems control wiring where indicated in electrical and mechanical specifications to be done by controls contractor shall be excluded from the electrical contractor's scope of work as noted.

#### 1.5 DRAWINGS AND SPECIFICATIONS

- .1 The drawings and specifications compliment each other and what is called for by one is binding as if called for by both. If there is any doubt as to meaning or true intent due to a discrepancy between the electrical drawings and specifications, and all other contract documents, obtain written ruling from Departmental Representative prior to tender closing. **Failing this, the most expensive alternative is to be allowed for.**
- .2 The plans show the approximate location of outlets and apparatus but the right is reserved to make such changes in location as may be necessary to meet the emergencies of construction in any way. No extra will be allowed for such changes to any piece of electrical equipment unless the distance exceeds 3 metres, or if the relocation is required after initial installation is complete.
- .3 It is imperative that the contractor visit the site and completely familiarize himself as to the work to be undertaken.

#### 1.6 CODES AND STANDARDS

- .1 Do complete installation in accordance with CSA C22.1 (Canadian Electrical Code) latest edition, except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 latest edition, except where specified otherwise.

#### 1.7 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.

- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.8 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235 latest edition.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.9 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
- .5 Furnish Certificates of Acceptance from Electrical Inspection Department, HRSDC or the authorities having jurisdiction on completion of work to Departmental Representative and copy the Consultant.
- .6 All electrical work shall be carried out in accordance with the latest edition of the Canadian Electrical Code as amended, and adapted by the Province of British Columbia, City of Vancouver and to the satisfaction of the Electrical Inspection Authority having jurisdiction.
- .7 All work shall be carried out in accordance with the National Building Code current edition (including all local amendments) to the satisfaction of local building inspector authority having jurisdiction.
- .8 Any electrical material and/or equipment supplied by any contractor or sub-contractor for installation on this project must bear evidence of CSA approval or special CSA certification acceptable to the Chief Electrical Inspector for the Province of British Columbia.
- .9 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain electrical permit and pay associated fees.
- .10 Fees will cover all routine inspections by the District Electrical Inspector. Any fees for follow-up inspections found to be necessary by the District Electrical Inspectors as a result of incorrect work shall be borne by this contractor without any cost to the owner.
- .11 Furnish to Departmental Representative on completion of work Certificates of Acceptance from Electrical Inspection Department.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with the Construction Waste Management Plan as established by the Construction Manager.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

- .3 Collect and separate for disposal: paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

#### 1.11 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes. Install outlets back to back in different stud spaces.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm. and information is given before installation.
- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.
- .4 Provide 120 volt power to all Direct Digital Control (DDC) panels indicated on Mechanical Drawings and Specifications, whether shown or not on Electrical Drawings. Provide voice data outlet for connection of DDC panel to LAN.

#### 1.12 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. In existing areas match height of existing devices already installed in the space.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1400 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Telephone and interphone outlets: 300 mm.
  - .5 Pay Telephone Outlets: 1194mm
  - .6 Wall mounted telephone and interphone outlets: 1500 mm.
  - .7 Television outlets: 300 mm.
  - .8 Wall mounted speakers: 2100 mm.
  - .9 Clocks: 2100 mm.
  - .10 Door bell pushbuttons: 1500 mm.

#### 1.13 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.

#### 1.14 EXTRA WORK

- .1 Any extra work ordered to be done shall be governed by the specification of this contract unless specific instructions or clauses are contained in a Change Order. In such cases, these instructions or clauses shall supersede those of the specification for this particular application only.

#### 1.15 FIELD QUALITY CONTROL

- .1 All electrical work shall be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division shall be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being conducted in.
- .3 Conduct and pay for following tests:
  - .1 Circuits originating from branch distribution panels.
  - .2 Lighting and its control.
  - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing.
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.
- .6 Carry out tests in presence of Departmental Representative.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .8 Submit test results for Departmental Representative's review.

#### 1.16 CO-ORDINATION OF TRADES

- .1 Consult with the General Contractor and all other subtrades involved to confirm the location of the various outlets and equipment, and cooperate fully to ensure that no conflict arises during the installation.
- .2 Special care shall be taken that equipment, outlets, junction boxes or pullboxes will not be obstructed by other structure, equipment, pipes or ducts installed under this general contract by other trades.
- .3 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Departmental Representative's written approval.
- .4 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All



electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

- .5 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

#### 1.17 SUBSTITUTIONS

- .1 Unless otherwise noted on the plans or specifications, substitutions may be approved by the Departmental Representative if requested by the contractor or by equipment suppliers, for items specified by the manufacturer's catalogue number.
- .2 Requests for approval of such substitutions shall be submitted at least five (5) working days prior to the tender closing date.
- .3 Complete description and data sheets of the proposed substitution shall accompany the application and supplier must be prepared to submit samples for approval on short notice.
- .4 Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the specified item shall apply for comparison if no other clause of this specification applies. The decision of the Departmental Representative to accept or reject shall be final.
- .5 Off-the-shelf items such as standard boxes and EMT conduit, which are specified by description only or indicated on the drawings, without any manufacturer, model, type or catalogue number, do not require approval prior to the tender closing date.
- .6 Submit list of all equipment being used including alternates, within one week after acceptance of tender.

#### 1.18 PROTECTION OF EQUIPMENT

- .1 This contractor shall provide and ensure maximum protection of electrical equipment on the site. Electrical equipment, including existing electrical equipment, shall be kept clean and dry at all times and caution shall be taken to ensure no mechanical damage is done to the equipment. Equipment shall not be delivered to the site until it can be stored safely or placed in final position and the space is clean.

#### 1.19 DAMAGES

- .1 If the finish of electrical equipment is damaged either when received or during installation, have such equipment completely refinished and restored to its original condition at no cost to the owner.
- .2 Irreparably damaged equipment shall be replaced at no cost to the owner.

#### 1.20 SHOP DRAWINGS

- .1 Submit shop drawings, product data and samples in accordance with Division 01 and as required within these specifications.
- .2 Shop drawings and product data shall indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other sections.
- .5 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the General Contractor.

- .6 Shop drawings must be received by the Departmental Representative at a date early enough to permit reasonable study prior to acceptance and manufacture, or to permit alterations where necessary. Late submissions of shop drawings will be sufficient reason for a stoppage of construction pending approval, or removal and replacement of any unsatisfactory item at the contractor's expense.
- .7 Shop drawings/product data content:
  - .1 Shop drawings submitted title sheet.
  - .2 Data shall be specific and technical.
  - .3 Identify each piece of equipment.
  - .4 Information shall include all schedule data.
  - .5 Advertising literature will be rejected.
  - .6 The project and equipment designations shall be identified on each document.
  - .7 The shop drawings/product data shall include:
    - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
    - .2 Mounting arrangements.
    - .3 Control explanation and internal wiring diagrams for packaged equipment.
    - .4 A written description of control sequences relating to the schematic diagrams.

#### 1.21 CUTTING AND PATCHING

- .1 This contractor is responsible for all cutting or blocking out required to install electrical equipment.
- .2 If this contractor makes excessive cuts or does not coordinate work so that finished work requires cutting or patching, then this contractor shall pay for all patching to original condition.
- .3 Any dispute resulting from this shall be referred to the Departmental Representative for decision.
- .4 Prior to any major cutting of walls or floor, review the proposed location, size and method with the Departmental Representative. This includes notification when cutting or coring into any fire rated construction.

#### 1.22 FIRE STOPPING

- .1 Seal all openings for conduit or sleeve penetrations in fire rated and smoke rated separations using approved materials.
- .2 All block outs and access slots to be sealed using approved fire stopping assembly. Provide full details for all fire stopping applications as they relate to each application.
- .3 Provide shop drawings for all fire stopping products, including assembly details as it relates to each application. Products shall be ULC approved as an assembly.
- .4 Retain the services of a Professional Engineer registered in the Province of British Columbia to inspect each and every fire stopping installation and to provide a report on all installations.
- .5 Allow for the destructive testing of 10% of fire stopping applications. Should installations not conform to manufacturer's details, an additional 25% of installation will be destructively tested and should there be more failures, the contractor will be responsible to remove all fire stopping products and reinstall products correctly, at no additional cost to the owner.
- .6 Refer to Architectural section 07 84 00 regarding Fire Stopping.

1.23 PROTECTION OF EXPOSED LIVE EQUIPMENT

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.24 INSPECTIONS AND TESTS

- .1 Notify the Departmental Representative and authorities having jurisdiction at least five (5) working days in advance when the installations will be ready for inspection or testing.
- .2 Test reports, signed by all attending authorities, shall be submitted to the Departmental Representative through the General Contractor after successful completion of an inspection or test.
- .3 Conduct all tests in a thorough and complete manner to the satisfaction of the Departmental Representative and pay for any fees incurred to complete tests.
- .4 Furnish the Departmental Representative with a copy of Certificate of Inspection from B.C. Electrical Safety Branch indicating that all work has been satisfactorily completed and issued prior to final connection.

1.25 CLEAN UP

- .1 Vacuum clean all new raceways, panelboards, and any electrical equipment. Ensure that no debris or spare parts are left in any electrical equipment.
- .2 Any scrap material shall be removed from the site and disposed of by the Contractor.
- .3 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

1.26 SURPLUS MATERIALS

- .1 All material removed from existing site and not being reused in this contract shall be the property of the owner and delivered as directed by the owner's representative. Material as it becomes surplus shall be reviewed by the owner or owner's representative and that part considered of value to the owner shall be classed as surplus material, all other becomes scrap material, and shall be disposed of by the contractor.

1.27 SPARE PARTS

- .1 This contract calls for spare parts or material. These are to be provided new in unopened cartons to the owner at the time of substantial completion of the contract.
- .2 Provide owner with spare lamps in unopened cartons. Quantity to be 10% of total project amount of each lamp source type. Provide a minimum of one lamp of each type installed under this contract.
- .3 Obtain a signed receipt from the owner's representative for all these parts or materials and include a copy in the front of the maintenance manual. Without this receipt these items will be treated as a deficiency and the cost withheld at twice the estimated value by the Departmental Representative.

1.28 AS-BUILT DRAWINGS

- .1 Obtain two (2) sets of white prints for the sole purpose of recording changes in installation as they occur. One (1) set is to be used in the field for day-to-day recording, and one (1) set for submittal after completion.

- .2 These plans shall be kept up-to-date as changes occur and shall be available to be inspected by the Departmental Representative.
- .3 Arrange and pay for the incorporation of any "as-built" changes to reproducible Mylar plans and AutoCAD disks. These changes shall be of similar quality of presentation as the original plans. NOTE: All plans, whether requiring as-built changes or not, shall be included in this Mylar set.
- .4 If the contractor requires the Electrical Consultant to prepare the as-built Mylars or CAD disk, the cost will be **\$275.00** per plan, unless excessive changes have been required. Such excessive changes should be included with the change orders.
- .5 These amended drawings shall be given to the Departmental Representative at time of final inspections.
- .6 "As-built" drawings shall include the location and circuit numbers of junction boxes in ceiling spaces, and all conduit placed in or under poured concrete. Note normal depth of conduits below top of concrete slab.

#### 1.29 OPERATING AND MAINTENANCE MANUALS

- .1 Submit **four sets** of operating and maintenance manuals for equipment or as requested by the general section of the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, electrical inspection authority certificate and contract guarantee.
- .2 Submit documentation in **green colored** heavy duty three ring binders, with lettering on spine identifying: "OPERATING AND MAINTENANCE MANUAL", project title and system names.
- .3 Submit one copy for approval by Departmental Representative prior to assembly of final sets.

#### 1.30 SINGLE LINE DIAGRAM

- .1 Electrical Contractor shall update the Buildings Single Line Diagram showing the new panels and any relocated panels. Deleted panels shall be removed from the Single Line Diagram. Coordinate with the Landlord's Representative.

#### 1.31 DEMONSTRATION OF SYSTEMS

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

#### 1.32 GUARANTEE

- .1 Within a period of one year from the date of final acceptance of work, replace or repair at own expense any defect in workmanship or material. Reused material shall be operating satisfactorily at the time of final acceptance but subsequent failures are not the responsibility of this contractor.
- .2 Warranties for equipment having more than one year guarantee shall be made out to owner, and copies shall be provided in the maintenance manuals.
- .3 Maintenance from manufacturer and contractor of all equipment shall be included for first year, including all lamps except incandescent.

**1.33 PAINTING**

- .1 Arrange and pay for the painting of the devices noted in these specifications, in particular:
  - .1 exposed conduits and conduit fittings.
- .2 Painting shall be to match colour and finish of adjacent walls, with at least two coats of sprayed enamel paint to the satisfaction of the Departmental Representative.

**1.34 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Provide a coordination/protective study and short circuit study of all equipment specified herein and submit for review.
- .2 Include the following:
  - .1 120/208V panelboards, MCCs, and switchgear, connecting feeder cables
  - .2 Locked rotor currents, acceleration times and damage curves for motors 75 kW and larger
  - .3 Any additional data necessary for successful completion of the coordination and short circuit study
- .3 Data shall clearly state the operating time in cycles of each breaker and indicate whether the time current curves for relays are inclusive of breaker tripping time or otherwise.
- .4 Prepare a summation chart showing all ratings and settings with easy reference to the appropriate curve.
- .5 Symmetrical and asymmetrical fault current calculations shall be submitted to verify the correct choice of the protective elements of the system.
- .6 Prepare a systems single line diagram on which the resultant short circuit values, device numbers and equipment ratings are shown.
- .7 Include a list of recommended settings for each relay.
- .8 Prepare an arc fault analysis including all labelling for equipment.
- .9 Qualifications
  - .1 This study shall be provided by the supplier of the main switchboard.
  - .2 This study shall be performed by and bear the stamp of a Professional Engineer registered in the Province of British Columbia.
  - .3 Relay style, CT ratios and fuse sizes have been selected on a preliminary basis for design purposes. Final selection shall be based on the results of this study and shall be included at no extra cost.
- .10 Submittals
  - .1 Submit the complete study for review prior to carrying out calibration and verification.
  - .2 Submit typed results of coordination and short circuit study in maintenance manuals.

**1.35 COST BREAKDOWNS**

- .1 Refer to Section 01 11 55 1.7 for required cost Breakdowns. Provide a Cost breakdown of the electrical contract price as detailed in 1.7.1.
- .2 For funding allocations, provide a separate cost breakdown dividing the electrical contract price between Base Building and Tenant Fit-up.
- .3 Cost breakdown must be provided after the tender is closed. Obtain direction from Design Manager.
- .4 Fit-Up work will consist of the remaining work not included in the Base Building work. Refer to specification section 01 11 00 1.7.

- .4 The contractor after the award of contract must provide the breakdown for drawings related to Passport Office. The base building and tenant scope must be separated and price breakdown for Passport Office portion of the work must be submitted separately.

#### 1.36 BUILDING MANAGEMENT SYSTEM INTERFACE

- .1 Provide power to all BMS/DDC panels and provide voice and data outlets as indicated on drawings and on the mechanical equipment schedule.

#### 2.0 PRODUCTS

##### 2.1 SUSTAINABLE REQUIREMENTS

- .1 Refer to Section 01 35 18 of the General Requirements.

##### 2.2 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

##### 2.3 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Factory assemble control panels and component assemblies.

##### 2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .2 Control wiring and conduit is specified in Divisions 26, 27, 28, 33, 34 and 48 except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Specifications and shown on mechanical drawings.

##### 2.5 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

##### 2.6 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

##### 2.7 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

## 2.8 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and/or labels as follows:
- .2 Nameplates:
- .1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws. Confirm with Landlord where "orange" faced labels with white lettering are required.
- NAMEPLATE SIZES:
- |        |             |         |                    |
|--------|-------------|---------|--------------------|
| Size 1 | 10 x 50 mm  | 1 line  | 3 mm high letters  |
| Size 2 | 12 x 70 mm  | 1 line  | 5 mm high letters  |
| Size 3 | 12 x 70 mm  | 2 lines | 3 mm high letters  |
| Size 4 | 20 x 90 mm  | 1 line  | 8 mm high letters  |
| Size 5 | 20 x 90 mm  | 2 lines | 5 mm high letters  |
| Size 6 | 25 x 100 mm | 1 line  | 12 mm high letters |
| Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters  |
- .3 Labels:
- .1 Embossed plastic labels with 6 mm high letters unless specified otherwise.
- .4 Wording on nameplates and labels shall be approved by Departmental Representative prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate and label.
- .6 Identification shall be English and French.
- .7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .8 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. X". Number as and if directed by Departmental Representative.
- .9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .10 Terminal cabinets and pull boxes: indicate system and voltage.

## 2.9 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1 latest edition.
- .4 Use colour coded wires in communication cables, matched throughout system.

## 2.10 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
- |             |        |           |
|-------------|--------|-----------|
|             | Prime  | Auxiliary |
| up to 250 V | Yellow |           |
| up to 600 V | Yellow | Green     |
| up to 5 kV  | Yellow | Blue      |
| up to 15 kV | Yellow | Red       |

Telephone	Prime	Auxiliary
Other Communication Systems	Green	
Fire Alarm	Green	Blue
Emergency Voice	Red	
Other Security Systems	Red	Blue
		Yellow

3.0 EXECUTION3.1 NOT USED

.1 Not Used.

END OF SECTION 260500



1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies materials and installation for seismic restraint systems for electrical installations.

1.2 REGULATORY REQUIREMENTS

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

1.3 SCOPE

- .1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.
- .3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.
- .4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor shall allow for coordination, provision of seismic restraints, as well as all costs associated with the services of the Seismic Restraint Engineer. This Engineer, herein referred to as the Seismic Engineer, will provide normal engineering functions as they pertain to seismic restraint of electrical installations. Engineer shall submit schedules B and C-B at the completion of project.
- .5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.
- .6 The Seismic Engineer shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings shall be included in the final project manual.
- .7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.
- .8 The Seismic Engineer shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.
- .9 Include all costs associated with the Seismic installation and certification in the base tender.

#### 1.4 SHOP DRAWINGS & SUBMITTALS

- .1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic Engineer.
- .2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Engineer.

#### 2.0 PRODUCTS

##### 2.1 SLACK CABLE SYSTEMS

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

#### 3.0 EXECUTION

##### 3.1 GENERAL

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

##### 3.2 CONDUITS

- .1 Provide restraint installation information and details on conduit and equipment as indicated below:
- .2 Vertical Conduit:
  - .1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.
  - .2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m o.c.
  - .3 Riser joints shall be braced or stabilized between floors.
- .3 Horizontal Conduits:
  - .1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
  - .2 EMT tubing - tubing shall be supported at approximately 1.2 m intervals for tubing.
- .4 Provide transverse bracing at 12.2 m intervals maximum unless otherwise noted. Provide bracing at all 90° bend assemblies, and pull box locations.

- .5 Provide longitudinal bracing at 24.4 m intervals maximum unless otherwise noted.
- .6 Do not brace conduit runs against each other. Use separate support and restraint system.
- .7 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.
- .8 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.
- .9 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
- .10 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .11 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic Engineer and submit shop drawings to Departmental Representatives for their reference.

### 3.3 FLOOR MOUNTED EQUIPMENT

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

### 3.4 LIGHT FIXTURES

- .1 Fluorescent fixtures in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two seismic cables which are connected to the fixture at diagonal points. Provide three support cables on any light fixtures installed below 2400mm.
- .2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by seismic cables.
- .3 Fixtures which are hung independently of ceiling systems shall have minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.
- .4 Cables shall be corrosion resistant and approved for the application.
- .5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

END OF SECTION 260501

1.0 GENERAL

1.1 SCOPE OF WORK

- .1 Remove all redundant or abandoned electrical equipment, devices, wiring, cabling, raceways, wireways, and luminaires in those portions of the existing building or site that are being renovated or demolished. This shall include all electrical equipment outside the area of actual renovation or demolition that serves the renovated area, except breakers that become surplus in existing panels shall be labelled as spares, unless specifically stated to be reused.
- .2 The Electrical Division to take note that the demolition and renovation will be done in an occupied building that is normally occupied during the day. Maintain electrical and communication systems as required to minimize services disruption.
- .3 The Electrical Division to also take note of the dust containment requirements as outlined in the architectural and front end specification.
- .4 Electrical tender documents do not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and system circuits affected in party wall partitions to be reactivated immediately on a temporary or permanent basis as site conditions dictate.
- .5 Any discrepancies appearing on the drawings or in this specification are to be brought to the attention of the Departmental Representative who will provide instruction.
- .6 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain.
- .7 All existing branch circuits for existing panelboards designated "existing circuit" as noted in Panelboard Schedules in specifications are to be tested and traced to source/termination point to confirm circuit is currently in use and in operation. All existing unused redundant branch circuits wiring to be completely removed and the related breakers labelled as "spare". Provide upgraded typed panel directories to the satisfaction of the Departmental Representative.
- .8 All existing branch circuits re-connected to new panelboards designated "Reconnected Exist. Re-Used Circuit", as noted in panelboard schedules in specifications, are to be tested and traced to source/termination point to confirm circuit is currently in use and in operation. All existing unused redundant or abandoned branch circuits wiring, outlets, and devices to be completely removed, and the associated breakers are to be re-labelled as "spares".
- .9 All surplus electrical equipment, devices, and luminaires shall be considered Owner's property. Determine from the Departmental Representative which materials are required to be retained, and transport and store such items at a location as directed by the Departmental Representative. All other surplus materials such as conduit, wiring, devices, etc. shall be removed from the site. Request a signed receipt for surplus material turned over to the Owner and provide a copy of same to Departmental Representative.
- .10 Identify each individual ballast that contains PCB's in luminaires made redundant by renovations. Label each ballast as per Worker's Compensation Board requirements. Place ballasts in storage drums and transport to storage area as directed by Departmental Representative.
- .11 Continuity of power and communication shall be maintained or restored promptly where services to other portions of a site are affected by renovation or demolition that is outlined on the architectural, structural, mechanical or electrical plans or specifications.
- .12 Remove and reinstall electrical equipment that becomes necessary due to renovation of architectural finishes or resurfacing. Include for extension rings, new junction boxes or outlet boxes, etc. to accommodate such changes.

- .13 Where new receptacles, switches, or outlets are added to existing areas, replace the remainder of receptacles, switches, and outlets in that area to match new.
- .14 Test all concrete slabs requiring cutting or coring by x-ray testing and opening a small sample area to obtain the depth of conduit runs. Avoid excessive cutting of slabs to depths that may interfere with existing conduits that are to be retained. Repair all damaged conduits and wiring that are to be retained. Allow for such repair in tender sum. The Departmental Representative may consider an extra if an unexpected large number of conduits are unavoidably damaged.
- .15 When any cutting of walls, ceiling, or floor in electrical rooms is part of the contract all electrical equipment shall be sealed from dust. At completion of work the room and all electrical components shall be fully vacuumed out, except primary voltage gear (exceeding 750 volts). Primary gear shall be cleaned out if the project requires that the gear be de-energized. At time of cleaning, a visual check shall be made of all terminations, and any discolouring brought to the attention of the Departmental Representative.
- .16 Wash and wipe clean all existing luminaires, reflectors, and lenses in areas adjacent to new renovation work.
- .17 Include in contract sum for complete removal of all existing redundant or abandoned data and telephone cabling and related equipment and devices located in existing T-bar ceiling space in area of renovations to the satisfaction of the Departmental Representative.

## 1.2 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Sustainable Requirements: Construction.
- .2 Do verification requirements in accordance with Sustainable Requirements: Contractor's Verification.

## 1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 specification.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

## 1.4 PRODUCTS

- .1 Some electrical equipment and devices are to be retained or relocated and reused where indicated on plans. Provide for cleaning and refurbishing this equipment to the satisfaction of the Departmental Representative. For luminaires, refurbishment means provide complete new lamps, replace existing lenses if broken and replace non-functioning ballasts. For wiring devices, refurbish means replace existing device and faceplate with new.

## 1.5 COMPLETENESS

- .1 The electrical installation and reinstallation shall be to present codes and to at least as good a workmanship level as the original.
- .2 Test the completed installation to ensure all aspects are fully functional. Unless noted in writing to the Departmental Representative before the work is commenced, all systems are assumed to function fully and correctly and must be so at completion of contract.
- .3 All existing branch circuits made redundant by removals of branch circuit wiring as a result of renovation work are to be identified at the respective panelboards with the redundant breakers being labelled as "spares".
- .4 Install and connect luminaire disconnects on existing 347 volt luminaires.

1.6 ASBESTOS

- .1 Refer to specification Division 01 for procedures, removal and disposal of asbestos.
- .2 If during renovations / demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease and the General Contractor advised. The General Contractor shall take appropriate action without delay to verify presence of friable asbestos and be responsible for the removal of all friable asbestos.
- .3 This division will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

1.7 PCB (POLYCHLORINATED BIPHENYLS)

- .1 Carefully remove any electrical items containing PCB's (eg light fixture ballasts) from equipment or fixtures to be renovated or demolished. Removed items (containing PCB's) to be catalogued and stored on site in approved labelled storage containers in accordance with regulations.

2.0 PRODUCTS

2.1 STANDARDS

- .1 Refer to applicable material standards in other specification sections and/or as detailed on drawings.

3.0 EXECUTION

3.1 DEMOLITION

- .1 Demolition to be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the National Building Code of Canada current edition.
- .2 All redundant electrical components in the areas of demolition excluding those specifically identified in the following clauses shall become the property of the Electrical Division and shall be removed from site.
- .3 The following existing electrical components to be disconnected by the Electrical Contractor, cleaned and suitably packaged where applicable, and turned over to the Departmental Representative at designated location established on site. If the Departmental Representative refuses these items they become property of the Electrical Contractor and are to be removed from site
  - .1 All fluorescent luminaires complete with lamps and ballasts.
  - .2 Fire alarm components.
  - .3 Call system and components.
  - .4 Security devices.
  - .5 Speakers.

3.2 DISRUPTION TO OPERATIONS

- .1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before startup.
- .2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

**3.3 INTERRUPTION TO EXISTING SERVICES**

- .1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, to be made good immediately. The Electrical Contractor to identify these circuits to the Departmental Representative. Specific tasks involving the demolition of essential circuits will require that the contractor to obtain permission from the Departmental Representative before proceeding.
- .2 Circuits disrupted by floor cutting or drilling (ie. buried cables) to be brought to the attention of the Departmental Representative. Obvious systems disturbed because due care and attention was not followed, shall be repaired immediately at no additional cost to owner.

**3.4 ABANDONED SERVICES**

- .1 All abandoned conduit and wire to be removed and disposed of by the Electrical Contractor.
- .2 Remove all accessible (eg. Surface) wiring and cables back to source.
- .3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse i.e. not at standard heights for switches or outlets.
- .4 All remaining circuits to be rerouted as required and suitably secured to the building structure.
- .5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

**3.5 FIRE ALARM SYSTEM**

- .1 Construction/demolition activities in existing building may require that select fire alarm devices are protected from construction dust, damage etc. Coordinate with the Departmental Representative as required to protect components of the fire alarm system to prevent nuisance operation and alarms.
- .2 Provide, install and test temporary heat detectors in the area of construction where the construction area is not protected by an active supervised fire protection sprinkler system. The "construction" detectors to be removed and discarded at the end of the project.
- .3 Provide temporary replacement of smoke detectors with heat detectors including interim programming and testing and final re-verification where deemed necessary to minimize false alarms and to ensure other occupants of the building are protected.
- .4 Maintain existing fire alarm system in areas under construction where practical. Relocate, rewire and provide interim connections as required while installing the new system to replace the existing. Provide temporary fire alarm devices and audible signals to suit any temporary exiting provisions.
- .5 Contractor to check in with the Departmental Representative at the start and end of each working day to confirm the fire alarm status in the area of work. Arrange for the related fire alarm zone card or area to be deactivated either to suit the progress of the work and/or where dust will be present on a day to day basis. Bag and protect fire detectors in dusty areas during construction. Remove any bagging at the end of the work day. Any existing detectors subject to construction dust to be immediately vacuumed and marked to be replaced at the end of the project. Any fire alarm devices subject to moisture to be replaced immediately.
- .6 The fire alarm system is to be fully functional in the area of construction when the Contractor is neither on site nor after the Contractors normal work hours. (ie overnight, holidays, weekends).
- .7 Where project phasing requires multiple fire verification, the Electrical Contractor shall include this in the contract bid amount.

- .8      Coordinate with Departmental Representative for actual procedures for specific requirements/restrictions for fire alarm panel relocation and associated down time.

END OF SECTION 260515



## 1.0 GENERAL

### 1.1 SECTION INCLUDES

- .1 This section specifies the materials and installation for wire and box connectors, rated to 1000V.

### 1.2 REFERENCES

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

## 2.0 PRODUCTS

### 2.1 MATERIALS

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

## 3.0 EXECUTION

### 3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer as required. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  - .2 Install fixture type connectors and tighten. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

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PROJECT # R.041365.001

SINCLAIR CENTER REVITALIZATION

VANCOUVER, BC

ELECTRICAL

**WIRE AND BOX CONNECTORS 0-1000V**

SECTION 26 05 20

24/04/2013

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END OF SECTION 260520

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies copper, ACM alloy and aluminum conductors rated 0-1000 Volts and the most common electrical insulation and covering materials.
- .2 This section does not include fire rated building wire to ULC S139 and CSA C83, marine, hazardous, mining, instrumentation, communication and fire alarm wiring.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

1.3 GENERAL REQUIREMENTS

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.
- .2 Aluminium conductors only permitted where indicated on drawings and then typically only for feeder conductors larger than #3/0 AWG. All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.
- .3 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts shall be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-6 flame spread rating.
- .4 Flexible AC90 armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations. AC90 may be used for fishing into existing walls or above existing ceilings.
- .5 Cabling indicated to be 2-Hour Fire-Rated shall be compliant to CAN/ULC-S139 and CSA 38-95 (Draka Lifeline, Raychem RHW, or Shawflex). Cabling shall be low smoke halogen free. Conduit to be sized and installed as per manufacturers' requirements for these specialized cables and assemblies regardless of the size indicated on drawings.
- .6 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .7 Refer to Equipment Schedule(s) for detailed responsibilities.
- .8 Non-metallic sheathed wiring (NMD90) is not to be used on this project.

2.0 PRODUCTS

2.1 WIRE AND CABLE GENERAL

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.
- .3 Use RWU90XLPE for underground installations.
- .4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1 latest edition.
- .5 Main feeders shall be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

- .6 Armoured AC90 (BX) cable may be utilized for recessed tee bar luminaire drops from ceiling mounted outlet boxes and fishing into existing walls. "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Use anti-short connectors. Cable from luminaire to luminaire is discouraged. Allow nominally 900mm [3'] extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.
- .7 Conductors shall be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors shall not be painted.

## 2.2 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated (minimum #12).
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel or aluminum strip.

## 2.3 CONTROL CABLES

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.
- .2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with TWH over each conductor and overall covering of PVC jacket.
- .3 600 V type: stranded copper conductors, sizes as indicated with R90 (X-link) ethylene-propylene rubber insulation type over each conductor and overall covering of PVC jacket.

## 3.0 EXECUTION

### 3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34.
  - .2 In underground ducts in accordance with Section 26 05 34.
  - .3 In surface and lighting fixture raceways in accordance with Section 26 05 35.
  - .4 In wireways and auxiliary gutters in accordance with Section 26 05 37.
  - .5 All wires are to be pulled in together in a common raceway, using liberal amounts of Compound 77 lubricant.
  - .6 All power circuits connected to isolated ground type receptacles are to have individual separate neutral c/w insulated bonding conductor.
  - .7 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.
  - .8 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.
  - .9 All dimmer circuits are to have individual neutral conductors for each circuit.

### 3.2 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.

- .2 Lay cable in cable trays for electrical systems in accordance with Section 26 05 36.
- .3 Cables may be fished into existing walls or in inaccessible ceiling spaces wherever possible.
- .4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

### 3.3 INSTALLATION OF CONTROL CABLES

- .1 Control cable and conduit will be supplied and installed by Mechanical Contractor. Controls wiring must be installed in conformance with Electrical Specifications Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION 260521

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section includes materials and installation for connectors and terminations.

1.2 REFERENCES

- .1 CSA C22.2 No.41- Grounding and Bonding Equipment.

1.3 CERTIFICATES

- .1 Obtain inspection certificate of compliance covering high voltage stress coning from Inspection Authority and include it with maintenance manuals.

2.0 PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 Joint boxes in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION 260522

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies the materials and installation for grounding electrical systems rated 750V or less.

1.2 REFERENCES

- .1 ANSI/IEEE 837- 2004 – Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 CSA C22.2 No. 41 - 2007 – Grounding and Bonding Equipment.

2.0 PRODUCTS

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, type PVC.
- .3 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.

3.0 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including conductors, connectors and accessories. Where EMT or PVC conduit is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: frames of motors, motor control centres, starters, control panels, distribution panels.

3.3 COMMUNICATION SYSTEMS

- .1 Ensure existing communication systems are grounded. New components added to the system shall be grounded to the system.

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 Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION 260528



**1.0     GENERAL****1.1     SECTION INCLUDES**

- .1       This section specifies U shape support channels either surface mounted. Suspended or set in poured concrete walls or ceilings.

**2.0     PRODUCTS****2.1     SUPPORT CHANNELS**

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

**3.0     EXECUTION****3.1     INSTALLATION**

- .1       Secure equipment to surfaces with lead anchors or nylon shields as required.
- .2       Secure equipment to poured concrete with expandable inserts.
- .3       Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4       Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5       Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6       Fasten exposed conduit or cables to building construction or support system using straps.
  - .1       One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2       Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3       Beam clamps to secure conduit to exposed steel work.
- .7       Suspended support systems.
  - .1       Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2       Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8       For surface mounting of two or more conduits use channels at 1.5m 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 Departmental Representative.
- .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 260529

## 1.0 GENERAL

### 1.1 SECTION INCLUDES

- .1 This section specifies materials and installation for splitters, junction boxes, pull boxes and cabinets.

### 1.2 PRODUCT DATA

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.
- .3 Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

## 2.0 PRODUCTS

### 2.1 JUNCTION AND PULL BOXES

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

### 2.2 CABINETS

- .1 Sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (if required) for surface or flush mounting as required.
- .2 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

## 3.0 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 2 m above finished floor.
- .3 Install terminal blocks as required.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

### 3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 20 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

END OF SECTION 260531

## 1.0 GENERAL

### 1.1 SECTION INCLUDES

- .1 This section specifies rigid and flexible fasteners, fittings and installation.

## 2.0 PRODUCTS

### 2.1 OUTLET AND CONDUIT BOXES - GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 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 76 x 50 x 38 mm or as indicated. Larger 102 mm square x 54mm deep outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.
- .2 For larger boxes use GSB solid type as required.
- .3 Boxes for surface mounted switches, receptacles, communications, telephone shall be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.
- .4 Lighting fixture outlets: 102 mm square outlet boxes (No 52151, 52171 or 72171) or octagonal outlet boxes (No 54151 or 54171).
- .5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

### 2.3 SURFACE CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

### 2.4 FITTINGS – GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## 3.0 EXECUTION

### 3.1 INSTALLATION

- .1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.
- .2 Support boxes independently of connecting conduits.

- .3 Ceiling outlet boxes shall be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.
- .4 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .6 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.
- .7 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .8 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .9 No sectional or handy boxes to be installed.
- .10 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .11 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.
- .12 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.
- .14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

END OF SECTION 260532

**1.0 GENERAL****1.1 SECTION INCLUDES**

- .1 This section specifies rigid and flexible conduits, fasteners, fittings and installation.

**1.2 REFERENCES**

- .1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.
- .2 Rigid metal conduit (RMC): to CSA C22.2 No. 45.
- .3 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .4 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.
- .5 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .6 PVC (DB2) conduit: to CSA #C22.1 211-1.
- .7 Flexible metal conduit (FMC): to CSA C22.2 No. 56.
- .8 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

**1.3 BASIC WIRING METHODS**

- .1 Partition walls and ceilings:
  - .1 All wiring shall be run in EMT conduit for:
    - .1 Branch circuits.
    - .2 Low voltage systems.
    - .3 Distribution feeders and sub-feeders.
    - .4 Surface wiring in electrical and mechanical rooms.

In existing walls that are not being opened, AC90 may be utilized for fishing into the walls. Use of "easy" boxes is permitted.
- .2 T-bar ceilings:
  - .1 EMT to junction box with flexible armoured cable drops for individual luminaires. No feed through wiring to luminaires allowed, except for where luminaires butted together. Allow adequate cable to relocate luminaire one T-bar space in any direction.
- .3 Motors, transformers and all vibrating equipment:
  - .1 Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.
- .4 Surface raceways - interior:
  - .1 All surface raceways shall be EMT, except in finished areas where a "wiremold" type raceway system shall be used. If more than one system is installed in the raceway system, provide approved barriers. Acceptable standard is Wiremold DS4000 series. Surface conduit, if located without protection in areas susceptible to damage, shall be rigid steel conduit.
- .5 Surface raceways - exterior:
  - .1 All surface raceways shall be Schedule 40 RPVC conduit, protected from damage and excessive heating to the Departmental Representative's satisfaction.

#### 1.4 LOCATION

- .1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor shall provide conduit, wire, cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.
- .2 Outlet positions shown on architectural drawings (plans and elevations) to take precedence over locations and mounting heights indicated on electrical plans or in specifications.
- .3 Locate electrical devices on walls with regard given for convenience of operation and conservation of wall space. Switches, receptacles, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.
- .4 Review the exact location criteria of each electrical outlet and device with the Departmental Representative prior to rough-in. Relocate any item installed without architectural confirmation as required by the Departmental Representative at no cost to the owner as long as the relocation is within 3m of the location originally shown on the electrical drawings.
- .5 Do not install outlets back-to-back in party walls; allow a minimum of one stud space horizontal clearance between boxes. Install behind all outlets in party walls a Lowry Acoustic backing pad.
- .6 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.
- .7 All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.
- .8 Wherever possible, all raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.
- .9 All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted unless indicated otherwise.
- .10 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Departmental Representative for any and all junction boxes that, due to the building design or existing conditions, cannot be concealed.
- .11 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

#### 2.0 PRODUCTS

##### 2.1 RIGID PVC RACEWAY SYSTEM

- .1 Rigid PVC fittings shall be of the same manufacturer as the conduit.
- .2 PVC boxes and covers shall be Sceptre "F" Series or equivalent complete with all components and adaptors.
- .3 PVC junction boxes exceeding the size of "F" Series shall be Sceptre "JB" Series boxes and be complete with junction box adaptors.
- .4 All fittings with removable covers shall be complete with VC gaskets and brass securing screws and inserts. All metal components shall be brass or stainless steel.

##### 2.2 PVC DUCT RACEWAY

- .1 PVC duct fittings shall be of the same manufacturer as duct.
- .2 PVC duct shall be colour coded white for communications, grey for power.

**2.3 EMT RACEWAY**

- .1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.
- .2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

**2.4 PVC JACKETED FLEXIBLE CONDUIT**

- .1 PVC jacketed flexible conduit (liquid tight) shall be interlocking spiral aluminum conduit with continuous extruded PVC jacket.
- .2 Conduit fittings shall be steel liquid tight type that fit over PVC jacket and seal uniformly all round.

**2.5 FLEXIBLE ELECTRONIC NON-METALLIC (ENT) TUBING**

- .1 Flexible electrical non-metallic tubing (ENT) shall not be used on this project.

**2.6 OUTLET BOXES AND JUNCTION BOXES**

- .1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.
- .2 Outlet boxes to be galvanized steel.
- .3 Junction boxes to be galvanized steel or aluminum.

**2.7 ACCESS HATCHES**

- .1 Provide and install access hatches in drywall ceilings to access junction boxes. Coordinate with other trades and check locations with Departmental Representative before installing.
- .2 Access hatches shall have the following specifications:
  - .1 Door: aluminum frame with gypsum board inlay.
  - .2 Frame: Recessed aluminum
  - .3 Finish: to receive the same finish and paint as the surrounding surfaces.
  - .4 Hinge: concealed, non-corroding.
  - .5 Latch: flush screwdriver cam latch.
- .3 Access hatches to be of a size to suit but not less than 305mm square.

**2.8 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500mm oc.
- .4 Threaded rods, 6 mm diameter to support suspended channels.

**2.9 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

**2.10**    EXPANSION FITTINGS FOR RIGID CONDUIT

- .1      Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.
- .2      Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3      Weatherproof expansion fittings for linear expansion at entry to panel.

**2.11**    FISH CORD

- .1      Polypropylene minimum 12mm..

**3.0**      EXECUTION**3.1**      INSTALLATION

- .1      Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2      Conceal conduits wherever possible except in mechanical and electrical service rooms and in unfinished areas.
- .3      Use rigid galvanized steel threaded conduit except where specified otherwise.
- .4      Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.
- .5      Use rigid pvc conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.
- .6      Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and for fishing into existing walls and partitions.
- .7      Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8      Minimum conduit size for lighting and power circuits: 19mm.
- .9      Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10     Mechanically bend steel conduit over 19 mm dia.
- .11     Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12     Install fish cord in empty conduits.
- .13     Remove and replace blocked conduit sections.
- .14     Do not use liquids to clean out conduits.
- .15     Dry conduits out before installing wire.
- .16     Conduits shall be installed mechanically continuous from outlet to outlet and shall be without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet box to outlet box be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.
- .17     Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.
- .18     On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made



- at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.
- .19 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).
  - .20 Where more than three conduits are run parallel in ceiling cavity, they shall be installed on cantruss type channel, complete with all manufacturers fittings to secure channel to structure and to conduit.

### 3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### 3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

### 3.4 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 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

### 3.5 FIRE STOPPING

- .1 Apply ULC approved fire stopping assembly to all conduit penetrations passing through fire rated walls and floors.
- .2 Provide shop drawings showing details for each type of application on the project. Shop drawings shall include catalogue data and installation details.

END OF SECTION 260534

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies wireways, auxiliary gutters and associated fittings and installation.

1.2 REFERENCES

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

1.3 PRODUCT DATA

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

2.0 PRODUCTS

2.1 WIREWAYS

- .1 Wireways and fittings: to CSA C22No.26.
- .2 Sheet steel with hinged cover to give uninterrupted access.
- .3 Finish: baked grey enamel.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.
- .5 Surface mounted wireways in finished areas shall be Wiremold DS4000 series.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install wireways and auxiliary gutters.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter for full length of equipment.
- .6 Install receptacles and communication outlets in surface wireway in locations shown on the drawings. Devices used shall be acceptable to manufacturer of raceway. Provide cover plates to suit raceway system.

END OF SECTION 260537

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies materials and installation for low voltage control systems for lighting equipment.

1.2 SCOPE OF WORK

- .1 Provide a low voltage lighting control system as shown on the drawings and as specified herein, complete with all hardware and software required for a complete and fully operating system.

1.3 SYSTEM DESCRIPTION

- .1 System shall utilize proven networking technology and shall be able to operate as a stand-alone entity.
- .2 Low voltage control system designed to provide remote switching of lighting loads by use of:
  - .1 Lighting control panels and controllers
  - .2 Dimming and relay modules
  - .3 Occupancy sensors
  - .4 Daylight sensors
  - .5 Wireless transceivers

1.4 PRODUCT DATA

- .1 Submittal package: Submit shop drawings and product data as specified below in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide a composite wiring and/or schematic diagram of the complete lighting control system complete with all components, indicating relay panels, master switches, local switches, occupancy sensors and daylight sensors. Indicate the building location reference for all components.
- .3 Provide manufacturers catalogue sheets, specifications and installation instructions for all system components.

2.0 PRODUCTS

2.1 RACK ENCLOSURES

- .1 Mechanical
  - .1 The Rack Enclosure shall be a surface mounted, deadfront switchboard, constructed of 18-gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.
    - .1 Filter shall be removable for easy cleaning.
    - .2 The enclosure shall support one control processor and one station power module plus accessories
    - .3 The enclosure door shall have an opening to allow limited access to the control module face panel.
  - .2 All rack components shall be properly treated and finished.

- .1 Exterior surfaces shall be finished in fine textured, scratch-resistant, epoxy paint.
- .3 The fully digital rack enclosure shall be available with six or twelve dimmer module spaces, one processor and a single station power supply, Rack dimensions and weights (without modules) shall not exceed:
  - .1 DRd6 556mm H x 432mm W x 244mm D 17.25 kg.
  - .2 DRd12 787mm H x 432mm W x 244mm D 24.25 kg.
- .4 A single low-noise fan shall be located at the top of each rack. The fan shall draw all intake air through the integral electrostatic air filter, over the surfaces of the module housing and out the top of the rack.
  - .1 The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the dimmer room does not exceed 40°C.
  - .2 In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down. A red indicator LED will flash and an error message shall appear on the Control Processor.
- .5 Rack Enclosures shall be designed to allow easy insertion and removal of dimmer and control modules without the use of tools. (230 volt racks with CE certification shall require a screwdriver.)
  - .1 Supports shall be provided for precise alignment of modules into power and signal connector blocks.
  - .2 With modules removed, racks shall provide clear front access to all load, neutral and control wire terminations.
- .6 Rack Enclosures shall support use of any combination of rack option cards designed to provide additional rack features. Rack option cards shall include:
  - .1 FLO - The Fluorescent Option Board shall provide termination for 4 wire low voltage electronic fluorescent dimming ballasts. FLO shall provide 24, 0-10Vdc outputs.
  - .2 DALI - The DALI Option Board shall provide termination for DALI fluorescent dimming ballasts. DRd shall provide 24, DALI outputs for up to 63 ballasts each in a broadcast mode.
  - .3 Optional floor mounting pedestal shall be available for the 12-module rack.
  - .4 Racks enclosures shall be designed for use with AX series auxiliary racks for Main Circuit Breaker, Main Lug, and cross bussing applications.
  - .5 Accessories
    - .1 RideThru Option (RTO)
      - .1 The Rack Enclosure shall support an optional, short-term back-up power source for the control electronics.
      - .2 The short-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
      - .3 The short-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
      - .4 The short-term back-up power source shall support the control electronics for at least 10 seconds.

.2 BatteryPack Option (BPO)

- .1 The Rack Enclosure shall support an optional, long-term back-up power source for the control electronics.
- .2 The long-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
- .3 The long-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
- .4 A test switch/indicator shall be available without opening the rack door or removal of any modules/components.
- .5 The long-term back-up power source shall supply power to the control electronics for at least 90 minutes.

.2 Electrical

- .1 Rack enclosures shall be available in 100, 120, 230, 240 and 277 volt, three-phase, main lug configurations.
  - .1 120 volt rack enclosures shall be field configurable for single phase operation without the need for additional components
- .2 Rack enclosures shall be completely pre-wired by the manufacturer. The contractor shall provide input feed, load, and control wiring.
- .3 Standard Short Circuit Current Ratings (SCCR) shall be 22,000 at 100-277 Volt
  - .1 Higher SCCR ratings, up to 100,000 amps SCCR at 120V, shall be possible when used with an AX series Auxiliary Rack Enclosure.
  - .2 Higher SCCR ratings, up to 65,000 amps SCCR at 240V and 277V, shall be possible when used with an AX series Auxiliary Rack Enclosure.
- .4 All control wire connections shall be terminated via factory provided connectors.
- .5 Rack enclosures shall support dimming for incandescent, fluorescent, neon, cold cathode, electronic low voltage and magnetic low voltage transformer load types.
- .6 The rack enclosure shall support 16-bit DMX input
- .7 The rack enclosure shall support 65,000 steps of dimming.
- .8 The rack enclosure dimming engine shall support multiple dimmer curves including modified square law, linear, switched, fluorescent, pre-heat and electronic low voltage.
- .9 The rack enclosure shall support voltage regulation including, minimum and maximum scale voltages with offsets
- .10 Rack enclosure shall support a UL924 listed contact input for emergency lighting control bypass.
  - .1 Emergency lighting input shall support load shedding
- .11 Rack enclosures shall be designed to support the following wire terminations:

- .1 AC
- .2 Echelon link power (Belden 8471 or equivalent)
- .3 24Vdc (2- 16AWG Wire)
- .4 DMX512A Port A (In or Out) (Belden 9729 or equivalent)
- .5 DMX512A Port B (Out) (Belden 9729 or equivalent)
- .6 RS232 Serial In/Out (Belden 9729 or equivalent)
- .7 Unshielded Twisted Pair (UTP) Category 5/5e Ethernet
- .8 Contact Closure In (14AWG to 26AWG Wire)
- .9 Contact Closure Out (14AWG to 26AWG Wire)
  - .1 Contact Closure Out shall provide 1A @ 30vDC
- .12 Station Power Modules
  - .1 Station power modules shall provide LinkPower for up to 32 stations and 1.5A@24VDC of Auxiliary (AUX) power.
  - .2 Station power repeater modules shall provide LinkPower for 30 stations and 1.5A@24VDC of Auxiliary (AUX) power.
  - .3 Station power module shall support over-current/short protection for LinkPower and Auxiliary (AUX) power. LinkPower shall support fault detection on each leg of the balanced data bus.
- .13 All control wire connections shall be terminated via factory provided connectors.
- .14 Main feed lugs shall accept a maximum of 350 MCM wire.
- .15 Load terminals shall accept a maximum of #6 AWG wire.
- .3 Thermal
  - .1 Ambient room temperature: 0-40°C / 32-104°F
  - .2 Ambient humidity: 10-90% non-condensing

## 2.2 PORTABLE PLUG-IN STATIONS

- .1 Mechanical
  - .1 Connector stations shall provide an interface to portable stations.
  - .2 All connector stations shall be available with white, cream, ivory, gray or black faceplates.
  - .3 Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
  - .4 All faceplates shall be designed for flush or surface mounting.
  - .5 Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
  - .6 Station faceplates shall be indelibly marked with station function.
  - .7 The manufacturer shall supply back boxes for all surface mounted stations.
- .2 Electrical
  - .1 Unison control station wiring shall be an Echelon® Link power network.

- .1 Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
- .2 Portable plug-in stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
- .3 Network wiring may be bus, loop, home run, star or any combination of these.
- .4 Wiring termination connectors shall be provided with all stations.
- .2 Portable Plug-in Stations shall offer the following Regular markings
  - .1 UL and cUL LISTED
  - .2 CE Market
  - .3 RHoS and WEE Compliant

## 2.3 CONTACT INTERFACE STATION

- .1 General
  - .1 Contact Interface shall provide direct interface (in and out) to external devices via contact closure. Interface enclosure shall consist of 8 input connections and 8 output connections
- .2 Mechanical
  - .1 Contact Interface Stations shall be available in enclosures built for:
    - .1 Wall-mount
    - .2 Rack-mount
  - .2 Wall-mount Interfaces shall be:
    - .1 Designed for surface mount installation
    - .2 Shall be constructed of 16- gauge (.08) steel and are finished in black fine-texture powder coat paint.
    - .3 The enclosure shall be 356mm W x 267mm H x 76mm D.
    - .4 Conduit access points shall be provided on the top and bottom of the enclosure.
  - .3 Rack-mount Interfaces shall be:
    - .1 Designed of use in 19" rack-mount enclosures
    - .2 Rack tray shall be constructed of 12-gauge aluminum.
    - .3 Cover shall be constructed of 14- gauge (.08) steel.
    - .4 Rack-mount interfaces shall be finished in black fine-texture powder coat paint.
    - .5 The enclosure shall be 356mm W x 267mm H x 76mm D.
  - .4 The assembly shall consist of up to 16 connections; 8 inputs functionally coupled with 8 normally open relay contact outputs. Inputs and outputs may be configured as either maintained or momentary.
- .3 Electrical
  - .1 Control station wiring shall be an Echelon® Link power network.

- .1 Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
- .2 Contact Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
- .3 Network wiring may be bus, loop, home run, star or any combination of these.
- .4 Wiring termination connectors shall be provided with all stations.
- .2 Ratings:
  - .1 The Input Rating shall be 5V@10mA (unit requires dry contact closure)
  - .2 Dry contact outputs shall consist of:
    - .1 Normally-Open 2-pole contact closure outputs;
      - .1 1A@30Vdc.
      - .2 [.5A@120V](#)
- .3 Contact Interface Stations shall offer the following Regular markings
  - .1 UL and cUL LISTED
  - .2 CE Market
  - .3 RHoS and WEE Compliant

#### 2.4 FADER INTERFACE STATION

- .1 General
  - .1 Fader Interface shall provide direct interface for low voltage analog inputs to external devices. Interface enclosure shall consist of 8 input connections.
- .2 Mechanical
  - .1 The surface mount enclosure and cover shall be constructed of 16- gauge (.08) steel and finished in black fine-texture powder coat paint.
  - .2 The enclosure shall be 356mm W x 267mm H x 76mm D.
  - .3 Conduit access points shall be provided on the top and bottom of the unit.
  - .4 The assembly shall consist of up to 8 analog connections functionally coupled to 8 Lamp driver outputs
- .3 Electrical
  - .1 Control station wiring shall be an Echelon® Link power network.
    - .1 Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
    - .2 Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
    - .3 Network wiring may be bus, loop, home run, star or any combination of these.
    - .4 Wiring termination connectors shall be provided with all stations.
- .2 Ratings:



- .1 The Input Rating shall be 0-3.3 VDC
- .2 Lamp driver outputs shall be individually rated for 100mA @ 24 VDC
- .3 Connections between fader inputs and lamp outputs shall support distances up to 300 meters using standard 16-gauge wire.
- .3 Fader Interface Stations shall offer the following Regular markings
  - .1 UL and cUL LISTED
  - .2 CE Market
  - .3 RHoS and WEE Compliant

## 2.5 CONTROL PROCESSOR MODULES

- .1 Mechanical
  - .1 The Architectural Control Processor (ACP) shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.
  - .2 ACP module electronics shall be contained in a plug-in assembly.
    - .1 The module shall be housed in a formed steel body and contain no discrete wire connections.
      - .1 No tools shall be required for module removal or insertion.
  - .3 The ACP shall be convection cooled.
  - .4 User Interface
    - .1 The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.
    - .2 The ACP shall provide an alpha-numeric keypad for data entry and navigation.
    - .3 The ACP shall provide a touch-sensitive control wheel for navigation.
    - .4 The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
    - .5 The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions.
      - .1 The backlight shall have a user selectable time out, including no time out.
  - .5 The ACP shall provide a front-panel RJ45 jack for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.
    - .1 The Ethernet port shall be secured behind the locking door.
  - .6 The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.
    - .1 The SD slot shall be secured behind the locking door.
  - .7 The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
    - .1 The USB port shall be secured behind the locking door.
  - .8 Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.

- .1 The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
- .2 The CF Card is stored in the back of the ACP, and can be accessed only by removing the ACP.
- .3 The ACP data can be exchanged by inserting the CF card into another ACP.
- .2 Electrical
  - .1 The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
  - .2 The ACP shall require low-voltage power supplied by the Dimming or Control enclosure.
  - .3 The ACP shall be hot-swap capable.
  - .4 The ACP shall support Echelon LinkPower communications with remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.
    - .1 The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require (2) #16 AWG wires.
    - .2 The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
    - .3 Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m).
    - .4 Link power wiring between stations shall not exceed 1313 ft. (400m).
  - .5 The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.
  - .6 The ACP shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
  - .7 The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports.\*
    - .1 \*When used in a Dimming Enclosure, the second port is always an output port.
  - .8 The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.
  - .9 The ACP shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.
- .3 Functional
  - .1 Capacity
    - .1 Shall support 1024 channels of control
    - .2 Shall support 2 physical DMX ports, each of which may be configured as an input or output
  - .2 System

- .1 Runtime application shall utilize support Net3 system interoperability
- .2 System shall support the use of Network Time Protocol for real time clock synchronization
- .3 System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
- .4 System shall support local firmware upload from removable media (SD Card, USB Flash Drive)
- .3 Diagnostics
  - .1 Shall output an Event log
  - .2 Standard log shall store a fixed-length history of recent activity
  - .3 Separate critical log shall only store important messages (such as boot-up settings)
- .4 Configuration Data
  - .1 Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application
  - .2 Configuration Data can be retrieved from another Paradigm Processor
  - .3 A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism
  - .4 Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units
  - .5 Configuration Data may be loaded to and from removable media access provided on front panel
  - .6 Configuration Data for the entire System shall be available for download from any single Processor
  - .7 Shall store configuration data for Dimming enclosure processors and shall make available for download
- .5 Scalability
  - .1 Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum System size
  - .2 The maximum number of Processors configured as a System shall be at least 12.
  - .3 Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information
  - .4 Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made
  - .5 Failure of a single Processor shall not prohibit continuing operation of the remaining Processors
  - .6 It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems
- .6 Local User Interface

- .1 Shall provide access to Processor setup (IP address)
- .2 Shall provide access to Processor status and diagnostics
- .3 Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics
- .4 Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.
- .5 Shall provide functionality to schedule astronomical and real time events (add/edit/delete)
- .6 Shall allow for display of local DMX information
- .7 Shall allow for transfer of log files to local removable media
- .8 Shall allow to perform firmware upgrades for connected Dimming enclosures
- .9 Shall allow for transfer of configuration to and from Dimming enclosures using removable media
- .10 Shall allow for transfer of configuration to and from LCD Stations using removable media
- .11 Shall allow for binding of Stations
- .7 Access Controls
  - .1 There shall be 2 user accounts - Administrator, and User with separate password protection
  - .2 Account and password settings shall be local to each Processor
  - .3 Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface
- .8 Web User Interface
  - .1 Shall be an internal web server accessible via Ethernet port
  - .2 Shall support common web browsers on Windows and Mac platforms
  - .3 Shall provide functionality to Activate and Deactivate Presets
  - .4 Shall provide functionality to schedule timed events (add/delete)
  - .5 Shall display status information
  - .6 Shall display log files
  - .7 Shall allow for configuration of Processor settings (date, time)
  - .8 Shall allow for upload and download of configuration data
  - .9 There shall be links to other web-enabled devices in the System, including other Paradigm Processors
- .9 Stations
  - .1 Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet
  - .2 Station discovery and binding shall be accomplished from the Local User Interface or Light Designer
- .10 Net3 and ACN Devices

- .1 Net3 Devices shall be connected to and controlled from Paradigm Processors via Ethernet
- .2 Paradigm Processors shall provide DMX-Net3 gateway functionality
- .3 It shall be possible to send and receive Macro triggers defined within the System configuration via Net3
- .4 There shall be support for Streaming ACN on up to 24 universes per Processor
- .11 Operation
  - .1 When contained in an dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot
  - .2 DMX output refresh rate shall be configurable
  - .3 There shall be support for 16-bit DMX Attributes
  - .4 DMX inputs may be patched to DMX and Streaming ACN outputs as external sources
  - .5 Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources
  - .6 Where there are multiple external sources then priority and HTP shall be used to perform arbitration
  - .7 External and internal sources shall be arbitrated based on user-selection of standard or custom rules
  - .8 On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output
  - .9 The total output may be the combination of many different Presets running concurrently
  - .10 There shall be no hard limit on number of concurrent cross fades
  - .11 Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence(LTP) or Highest Takes Precedence (HTP)
  - .12 LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP
  - .13 Settings due to LTP Presets may be automatically discarded from operation when overridden
  - .14 It shall be possible to specify that a Preset or Attribute Control will persist when overridden
  - .15 A Preset may be designated as an HTP Override and shall cause HTP values to be discarded
  - .16 It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System
  - .17 Each Preset shall have a status that can be Activated, Deactivated or Altered
  - .18 Preset status may be set based on matching levels in the current output as an option
  - .19 On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day
- .12 Serial Input/Output

- .1 RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits
- .2 RS232 shall support baud rates from 4800 to 115,200 bps
- .3 Serial input and output messages are fully customizable
- .4 Serial output messages can be generated by any Control or Event

## 2.6 PHOTO SENSORS

### .1 Mechanical

- .1 All sensors shall be constructed of ABS plastic and available in pure white or black
  - .1 Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
- .2 Light Sensors shall consist of two parts that may be mounted together or separately. These parts shall be:
  - .1 Light Sensor Controller
  - .2 Light Sensor Head
- .3 The Light Sensor Controller shall support local and remote mounting of the Light Sensor Head.
  - .1 Local mounting shall allow the Sensor Head to be mounted within the Light Sensor Controller.
  - .2 A color matched filler shall be included for the Controller when the Sensor head is remotely mounted
- .4 Light Sensor Heads shall support mounting to ½" or ¾" standard conduit knockouts for remote mounting
- .5 Light Sensor Heads shall support indoor or outdoor mounting when used with an appropriately rated backbox.
  - .1 Light Heads shall be IP65 rated
- .6 Sensor Controllers shall provide configuration buttons for:
  - .1 Linking of station to lighting control system
  - .2 Recording target light level value
- .7 Sensors shall have no visible means of attachment
- .8 Sensors Controllers shall include an adjustable mounting base that supports the following mounting options:
  - .1 Mounting to any standard ceiling box
  - .2 Mounting to any standard junction box
  - .3 Mounting to single gang RACO box
  - .4 Mounting to drywall or soft ceiling tiles using an included wire form adapter
- .9 Sensors controllers shall include all necessary mounting hardware, wiring connectors, and instructions.

### .2 Electrical

- .1 Sensor wiring shall be low-voltage Class 2 wiring
- .2 Sensor Controllers shall use Unison LinkConnect control wiring
- .3 Wiring shall be an Echelon® Link power network.
- .4 Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
- .5 Network wiring may be bus, loop, home run, star or any combination of these.

- .6 Termination connectors shall be provided with all sensors
- .7 Sensor Light Heads shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent
- .8 Sensors shall be designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.
- .9 Sensors shall be UL and cUL LISTED and CE marked
- .3 Functional
  - .1 The control system shall support Lighting Photo Sensors for automated control of electric lighting levels based on measured light levels
  - .2 Photo Sensors shall use a Light Sensor Controller and up to two Light Sensors for readings
    - .1 When using multiple light sensors with a single controller, the controller shall automatically average the light readings
  - .3 The control system shall support Open and Closed Loop daylight harvesting
  - .4 The control system shall support Switched and Dimmed daylight harvesting
  - .5 Sensors shall meet ASHRE 90.1 and CA Title 24
  - .6 Sensor functions shall be programmed using Light Designer configuration software
    - .1 Dimming daylighting systems shall support
      - .1 Configurable time delay, fade time and dead band
      - .2 Configurable Change amount
      - .3 Software configurable minimum level
      - .4 Control of channel/zone, group and space control
      - .5 Overrides
    - .2 Switched daylighting systems shall support:
      - .1 Dim and Bright thresholds
      - .2 Configurable delay time
  - .7 Sensor controllers support recording target light level readings using an onboard configuration button

## 2.7 WIRELESS TRANSCEIVER

- .1 General
  - .1 The Transceiver shall be a microprocessor-based unit specifically designed to broadcast DMX512/RDM data to compatible receivers, or receive DMX512/RDM data from compatible transmitters, via a wireless 2.4GHz Frequency Hopping Spread Spectrum Radio Broadcast.
  - .2 The Transceiver shall be fully enabled as a PLASA/ANSI E-1.20 Remote Device Management (RDM) responder, and as a fully enabled PLASA/ANSI E-1.20 RDM Proxy system when implemented in a SHoW DMX Neo network with additional Vero Transceivers. Both Responder and Proxy functions shall be compatible with any PLASA/ANSI E-1.20 compliant RDM Controller. Units that do not provide PLASA/ANSI E-1.20 RDM Responder and Proxy functions shall not be acceptable. Units that are not

compatible with any PLASA/ANSI E-1.20 compliant RDM Controller shall not be acceptable.

- .3 The Transceiver shall have a DIP switch and BCD Switch array for configuration. System configuration and RF configuration shall be user configurable using the local DIP and BCD Switch interface or RDM commands. The Transceiver shall have a Data Present LED visible from the exterior of the enclosure to indicate the presence of valid DMX signal. Units that do not indicate valid DMX data shall not be allowed.
- .4 The Transceiver shall be tested to CE and FCC standards and shall be NRTL Listed, and shall be marked with appropriate certification symbols.
- .5 The Transceiver shall be provided with a NEMA 4 / IP 66 enclosure and shall be suitable for permanent outdoor or indoor installation.

.2 DMX512 Input/Outputs

- .1 Each Transceiver shall incorporate one wired and one wireless DMX512 Input/Output port. The wired DMX512 Input/Output port shall consist of one 3 position two part screw terminal block, and a DMX termination switch for end of line termination when required. The wireless DMX512 Input/Output port shall consist of an internal The Radio Module and an external N antenna connector for connection of approved antennas, including the provided 4.5dBi omni-directional antenna.
- .2 The wired DMX512 Input/Output port shall comply with the requirements of the PLASA ANSI E-1.11 USITT DMX512/512A standard.
- .3 The wired DMX512 Input/Output port shall be fully isolated from the unit's other electronics.
- .4 The wireless DMX512 Input/Output port shall operate either as a Wireless DMX Transmitter or Wireless DMX Receiver depending on configuration.
- .5 Maximum wireless DMX transmission delay time in standard Low Latency mode from transmitter input to receiver output shall not be greater than one packet time (approximately 30 ms), and average delay time shall be no greater than 7ms.

.3 Power

- .1 Power for the Vero Transceiver shall be 100-240VAC 50/60Hz 3W via a 3 position two part screw terminal block

.4 Environmental

- .1 The ambient operating temperature shall be -20° to 40°C.
- .2 The storage temperature shall be -40° to 70°C.



.5 Physical

.1 Transceiver

- .1 The Transceiver will be fabricated of 0.060 aluminum and finished in RAL 7036 powder coat, and provided with a gray finish Kydex decorative cover panel.
- .2 The dimensions shall be 152mm W x 165mm H x 102mm D
- .3 The weight shall be 0.77 kg

.6 Accessories

- .1 4.5dBi Omni Antenna
- .2 8dBi Panel Antenna

2.8 WIRELESS SENSOR

.1 Occupancy Sensor

.1 Mechanical

- .1 The Sensor shall mount to a ceiling using screws or peel-and-stick attachment
  - .2 The Sensor shall support optional mounting to an electrical box or low voltage trim
- The Sensor shall be available in white
- Manufacturer's standard colors shall conform to the RAL CLASSIC Standard
- .3 The Sensor shall use a frosted cover over multiple photovoltaic panels
  - .4 The Sensor shall have a button for linking the sensor to a wireless controller
    - .1 The button shall be accessible when the Sensor is mounted
  - .5 The Sensor shall have a red LED indicator located behind a lens to show that IR functionality is present
  - .6 The Sensor shall be constructed of ABS injection molded plastic that fully encloses all components
  - .7 The Sensor shall be 122mm W x 111mm H x 36 mm D

.2 Electrical

- .1 The Sensor shall utilize photovoltaic energy harvesting for power. Sensors that require low voltage power or batteries shall not be acceptable
  - .1 The Sensor shall provide normal operation without light for at least ninety hours

- .2 The Sensor shall store harvested energy to provide at least 90 hours of reserve power in complete darkness
  - .3 The Sensor shall use EnOcean battery free wireless radios
  - .4 The Sensor shall utilize 315 MHz UHF RF radios. Systems that use other frequencies radios shall not be acceptable
  - .5 The Sensor shall have a range of at least 50 feet through walls up to 300 feet in open space
  - .6 Auxiliary signal repeaters shall be available to increase range
  - .7 The Sensor shall comply with FCC Part 15.231 and IC RSS-210
- .3 Functional
- .1 The Sensor shall wirelessly send occupancy status to compatible Lighting Controllers
  - .2 The Sensor shall support SimpleTap configuration. Sensors that require software for configuration shall not be acceptable

## 2.9 WIRELESS STATIONS

### .1 Switch Stations

#### .1 Mechanical

- .1 Switch Stations shall be decorator style plastic switches
- .2 Switch Stations shall be available in single and dual switch configurations
- .3 It shall be possible to attach multiple switch stations together using surface mounting plates available from the manufacturer or standard electrical gang boxes
- .4 Mounting Plates shall be available from the manufacturer for surface mounting using screws or peel-and-stick attachment
- .5 All Switch Stations shall be available with white, cream, ivory, black, light almond and brown switches
  - .1 Manufacturer's standard colors shall conform to the RAL CLASSIC Standard
- .6 All faceplates shall be designed for flush or surface mounting
- .7 Switch Station faceplates shall be constructed of ABS plastic and be available with or without visible means of attachment
- .8 Switch Stations shall have a fully enclosed electronics assembly
- .9 The SmartClick Switch Station shall be 70mm W x 115mm H x 19mm D

#### .2 Electrical

- .1 Switch Stations shall use EnOcean battery free wireless radios

- .2 Switch Stations shall utilize 315 MHz UHF RF radios. Systems that use other frequencies radios shall not be acceptable
- .3 Switch Stations shall utilize kinetic energy harvesting that does not require any batteries or external power input
- .4 Switch Stations shall have a range of at least 50 feet through walls up to 300 feet in open space
  - .1 Auxiliary signal repeaters shall be available to increase range

The Switch Station shall comply with FCC Part 15.231 and IC RSS-210

.3 Functional

- .1 Switch Stations shall be able to switch relay loads on and off when used with compatible relay controller loads on and off
- .2 Switch Stations shall be able to dim loads up and down when used with compatible power controllers
- .3 Switch Stations shall support DMX scene recall when used with compatible DMX Scene Controllers. Systems that do not support DMX Scene Controllers shall not be acceptable
- .4 Up to 20 Switch Stations shall be supported with a single power controller. Systems that do not support at least 20 stations shall not be acceptable
- .5 Switch Stations shall provide SmartClick programming for configuration of connected power controllers directly from the Switch Station. Control systems that only provide default functions, that or require software for configuration shall not be acceptable

2.10 WIRELESS INTERFACE

.1 Occupancy Sensor Interface

.1 Mechanical

The Sensor Interface shall mount to a ½" electrical junction box knock out using a thread nipple and retaining nut

- .1 The Sensor Interface shall be constructed of 94-V-0 plastic that fully encloses all high voltage components
- .2 The Controller shall have buttons to manually learns station and to enable/ disable a signal repeater
  - .1 The buttons shall be accessible when the Controller is mounted
- .3 The Controller shall have two LED indicators to display power and linked station status
  - .1 Red LED for power status

- .2 Green LED for repeater status
- .4 The Controller shall provide the following wiring connections:
  - .1 Three stranded #18 AWG wires for power input
    - .1 White for Neutral Power input
    - .2 Black for 120VAC Power Input
    - .3 Brown for 277VAC Input or Yellow for 347VAC Input
  - .2 Two stranded #22 AWG wires for 24V DC power output
    - .1 Red for 24VDC Positive
    - .2 Black for 24VDC common
  - .3 One stranded #22 AWG wire with yellow jacket for occupancy sensor input
- .5 The Controller shall be 91mm W x 50mm H x 50mm D
- .2 Electrical
  - .1 The Sensor Interface shall be available in 120/277VAC and 120/347VAC configurations
  - .2 The Sensor Interface shall support wired occupancy sensor connections
    - .1 The Sensor Interface shall supply 35mA of 24VDC power for wired occupancy sensor power
    - .2 The Sensor Interface shall support dry contact input for wired occupancy sensor status
  - .3 The Controller shall use EnOcean battery free wireless radios
  - .4 The internal radio shall utilize 315 MHz UHF RF. Systems that use other frequencies radios shall not be acceptable
    - .1 The internal radio shall have a range of at least 50 feet through walls up to 300 feet in open space
    - .2 The internal radio shall provide UHF signal repeater functionality. Systems that do not provide UHF signal repeating shall not be acceptable
  - .5 The Sensor Interface shall be ETL and cETL listed and conform to UL 508 and UL 2043 standards
  - .6 The Sensor Interface shall comply with FCC Part 15.231 and IC RSS-210
- .3 Functional
  - .1 The Sensor Interface shall wirelessly send the connected occupancy sensor status to wireless Lighting Controllers
  - .2 The Sensor Interface shall provide connection for a 24V wired occupancy sensor
    - .1 The Sensor Interface shall support sharing wired sensor status wirelessly to other Sensor Interfaces

- .3 The Sensor Interface shall support commissioning without the use of software. Controllers that require software for configuration shall not be acceptable

## 2.11 WIRELESS CONTROLLER

### .1 Relay Controller

#### .1 Mechanical

- .1 The Controller shall mount to a ½" electrical junction box knock out using a thread nipple and retaining nut
- .2 The Controller shall be constructed of 94-V-0 plastic that fully encloses all high voltage components
- .3 The Controller shall have learn and clear buttons for manual linking of stations and sensors
  - .1 The buttons shall be accessible when the Controller is mounted
- .4 The Controller shall have two LED indicators to display power and linked station status
  - .1 Red LED for power status
  - .2 Green LED for station and sensor configuration status
- .5 The Controller shall provide the following wiring connections:  
The Controller shall provide the following wiring connections:
  - Three stranded #18 AWG wires for power input
    - White for Neutral Power input
    - Black for 120VAC Power Input
    - Brown for 277VAC Input or Yellow for 347VAC Input
  - Two stranded #14 AWG wires with red jackets for relay input and output
- .6 The Controller shall be 91mm W x 50mm H x 50mm D

#### .2 Electrical

- .1 The Controller shall be available in 120/277VAC and 120/347VAC configurations
- .2 The Controller shall provide a single normally open relay fully rated for:
  - .1 20 Amps at 120 and 277VAC, or
  - .2 15 Amps at 347VAC
- .3 The Controller shall use EnOcean battery free wireless radios
- .4 The internal radio shall utilize 315 MHz UHF RF. Systems that use other frequencies radios shall not be acceptable

- .1 The internal radio shall have a range of at least 50 feet through walls up to 300 feet in open space
- .2 The internal radio shall provide UHF signal repeater functionality. Systems that do not provide UHF signal repeating shall not be acceptable
- .5 The Controller shall support at least 20 wireless devices in any combination of SmartClick stations and SimpleTap Sensors. Systems that do not support at least 20 stations or sensors shall not be acceptable
- .6 The Controller shall be ETL and cETL listed and conform to UL 508 and UL 2043 standards
- .7 The Controller shall comply with FCC Part 15.231 and IC RSS-210
- .3 Functional
  - .1 The Controller shall provide switching control for an individual fixture zone, or load
  - .2 The Controller shall support SmartClick stations and SimpleTap Sensors for relay control
  - .3 The Controller shall provide wireless signal repeating to other Controllers and stations
  - .4 The Controller shall support commissioning without the use of software. Controllers that require software for configuration shall not be acceptable

### 3.0 INSTALLATION

- .1 Install system and components in accordance with manufacturer's instructions.

### 4.0 FIELD QUALITY CONTROL

- .1 On completion of installation, manufacturer representative shall be notified to carry out site inspection and report any inconsistencies to the Consultant. Corrections are to be implemented to comply with manufacturer's report.

END OF SECTION 260943

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This Section specifies standard and custom panelboards and their installation.

1.2 SCOPE OF WORK

- .1 Provide and install new breakers in the existing panelboards as indicated on the drawings, panel schedules and these specifications.
- .2 Types of panelboards include lighting and appliance panelboards

1.3 PRODUCT INFORMATION

- .1 Submit shop drawings in accordance with Section 01 33 00 – submittal procedures.
- .2 Shop drawings to include electrical detail of branch breaker type, quantity, ampacity and enclosure dimension.

2.0 PRODUCTS

2.1 PANELBOARDS, DOORS AND TRIMS

- .1 Some Panelboards are existing. Provide new panelboards to match existing in manufacture and design.:
- .2 Breakers rated for:
  - .1 Lighting and Appliance Panelboards: 10KA symmetrical, minimum, interrupting capacity or as indicated.

2.2 BREAKERS

- .1 All breakers shall be:
  - .1 For Lighting and Appliance Panelboards: Bolt on type molded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard.
- .3 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules or the Single Line Diagram.
- .4 Provide GFI type breakers as indicated.
- .5 Provide Lock-on devices as indicated for Security Equipment circuits, Exit sign circuits and Emergency Battery Equipment circuits.

2.3 PANELBOARD IDENTIFICATION

- .1 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

3.0     EXECUTION

3.1     INSTALLATION

- .1       Install new panelboards where shown on the drawings.
- .2       Install new breakers in existing panelboards as indicated on drawings.
- .3       Connect loads to circuits as indicated.
- .4       Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION 262416



1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This Section specifies switches, receptacles, wiring devices, cover plates and describes their installation.

1.2 PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 330 00 – Submittal Procedures.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2 CSA-C22.2 No.42.1, Cover Plates for Flush Mounted Wiring Devices.
  - .3 CSA-C22.2 No.55, Special Use Switches.
  - .4 CSA-C22.2 No.111, General Use Snap Switches.

2.0 PRODUCTS

2.1 SWITCHES

- .1 Heavy duty specification grade.
- .2 20 Amp, 120 V single pole, double pole, three-way, four-way switches as indicated.
- .3 Manually-operated general purpose AC switches as indicated and with following features:
  - .1 Terminal holes approved for No.10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine molding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
  - .5 Ivory toggle (red toggle for emergency power circuits).
- .4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rating capacity of motor loads.
- .5 Switches of one manufacturer throughout project.
- .6 Standard of acceptance:
  - .1 Hubbell HBL.1221 20A series
  - .2 Leviton 1221-20A 120V series – 18221 347V
  - .3 Pass & Seymour PS20AC1 120V series – PS37201(3)0 347V

2.2 DIMMER SWITCHES

- .1 Provide and install wall mounted dimmer switches that are suitable for dimming compact fluorescent fixtures supplied with dimming electronic 120 volt ballasts.
- .2 Dimmer switches shall be rated a minimum of 600 watts. Increase rating as required for groups of fixtures controlled by the same dimmer switch.

2.3 OCCUPANCY SENSORS

- .1 Provide and install wall mounted occupancy sensors to control the 120 volt fluorescent fixtures in rooms as shown on the drawings. Occupancy sensors shall have an "on/Off switch and shall have adjustable timers from 60 seconds to 30 minutes.

2.4 RECEPTACLES - GENERAL

- .1 Heavy duty specification grade.
- .2 Duplex receptacles, CSA type L5-15 R, 125 V, 15 A, U ground, with following features:
  - .1 Ivory nylon molded housing (red for emergency power circuits)
  - .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 non riveted grounding contacts.
- .3 Receptacles of one manufacturer throughout project.
- .4 Standard of acceptance:
  - .1 Hubbell 5252 heavy duty, construction series
  - .2 Leviton 5262 series
  - .3 Pass & Seymour 5262 series

2.5 RECEPTACLES – PARTICULAR APPLICATION

- .1 Isolated Ground type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, orange face, parallel blade, U ground, impact resistant nylon face. Standard of acceptance equal to:
  - .1 Hubbell IG8262A series
  - .2 Leviton 8200IG series
  - .3 Pass & Seymour IG26262 series (Décor)
- .2 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button. Standard of acceptance equal to:
  - .1 Hubbell GF8200A series
  - .2 Leviton 7599HG series
  - .3 Pass & Seymour HG1595 series (Décor)
- .3 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

2.6 COVER PLATES

- .1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. For general interior flush mounted wiring devices and surface type FS or FD type boxes.
- .2 Steel: sheet steel hot dip galvanized with rolled edges for surface mounted utility boxes.
- .3 Wall plates shall be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.

- .4 All plates to be beveled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.
- .5 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Cover plates shall fasten to box by four screws.
- .7 Gaskets: resilient rubber or close cell foam urethane.
- .8 Cover plates for all wiring devices to be from one manufacturer throughout project.

### 3.0 EXECUTION

#### 3.1 INSTALLATION GENERAL

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

#### 3.2 INSTALLATION PARTICULAR

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Dimmer Switches
  - 1, Install dimmer switches in rooms as shown on the drawings.
  - 2. Provide appropriate cover plates to match the switch and receptacle cover plates.
- .3 Occupancy Sensors
  - 1. Install occupancy sensors in rooms as shown on the drawings.
  - 2. Set the adjustable timers as directed by the Departmental Representative.
- .4 Receptacles:
  - .1 Install all receptacles in the vertical plane unless otherwise noted.
  - .2 Generally install the L5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.
  - .3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.
  - .4 Where split receptacles has one portion switched, mount vertically and switch the upper portion.
  - .5 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.
- .5 Cover plates:
  - .1 Protect 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 262726

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies the materials and installation for the luminaires for the entire project including exterior lighting fixtures if required.
- .2 Refer to the Appendix A for Luminaire Schedule and to drawings for additional details prepared by Lighting Consultant. This applies to Sinclair Centre Atrium and public space lighting upgrades only.
- .3 Refer to Luminaire Schedule on Drawing E14 for Passport Canada fit-out lighting fixtures.

1.2 REFERENCES

- .1 CAN/CSA C22.1-09, Canadian Electrical Code, Part I.
- .2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

1.3 STANDARD OF ACCEPTANCE

- .1 Products listed in Appendix 1 Luminaire Schedule, details, sketches and Passport Canada Luminaire Schedule on drawings establish the minimum quality and performance and are not intended to be the sole source.

1.4 PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.
- .3 Photometric data shall include VCP Table and spacing criterion.

1.5 SAMPLE LUMINAIRES AND LAMPS

- .1 Submit sample luminaires for review prior to manufacturing when requested by the Departmental Representative.
- .2 Sample luminaires shall be operable and complete with lamps, accessories and a plug-in power cord if requested by the Departmental Representative.
- .3 Deliver samples to the Departmental Representative's office or to another location as directed. Collect the sample(s) at the conclusion of the review.

1.6 INTENT

- .1 Provide lighting fixtures and accessories for all outlets as listed in the Luminaire Schedule and as shown on drawings.
- .2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.
- .3 Ground all lighting equipment to grounding system.
- .4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.

2.0 PRODUCTS

2.1 BALLASTS

- .1 All ballasts shall be supplied with a rated voltage matching the supply voltage indicated on the drawings. Ballast output current and voltage shall match the current and voltage ratings of the lamp or lamps they are designed to operate. All ballasts shall be built to CSA Standard C22.2 No.74.
- .2 Ballasts shall comply with FCC and NEMA limits covering EMI and RFI and shall not interfere with operation of other normal electrical equipment.
- .3 Minimum requirements for electronic ballasts:
  - .1 Sound rating of 'A'.
  - .2 High frequency operation (25 KHz or higher).
  - .3 Total harmonic distortion to be less than 10%.
  - .4 Current crest factor to be less than 1.7.
  - .5 Rated lamp life shall be maintained.
  - .6 High power factor of 90% or higher.
  - .7 High efficiency programmed start ballasts for linear fluorescent lamps.
  - .8 120 Volt input, or otherwise indicated on the Luminaire Schedule.
  - .9 Ballast shall operate no more than two linear fluorescent lamps.
  - .10 Ballasts used in exterior luminaires to have minimum starting temperature of at least - 18°C.

2.2 LAMPS

- .1 Provide and install lamps in all fixtures in the project.
- .2 Install fluorescent lamps with the same Watt rating as indicated. Utilize lamps with 3500°K colour temperature and 95% CRI rating in all fixtures unless otherwise indicated on the Luminaire Schedule. Refer to the Luminaire Schedule for number of lamps used in each fixture type. Also refer to 1.7 regarding the lamps sample mockup.
- .3 Incandescent fixtures shall be complete with 2500 hour 130 V extended service inside frosted lamps. Where noted in the Fixture Schedule, clear lamps, reflector lamps, silver bowl lamps or special lamps as called for shall be used.
- .4 High Pressure Sodium lamps to be coated. Metal Halide lamps to be coated unless otherwise noted.
- .5 Compact fluorescent lamps shall be 3000°K colour temperature and have an 85% CRI rating.

2.3 SOCKETS

- .1 Sockets for incandescent fixtures shall be standard medium base.
- .2 Sockets for fluorescent fixtures shall be standard medium bi-pin unless otherwise noted.

2.4 FIXTURES

- .1 Accessories and components shall comply with relevant CSA Standards.
- .2 Recessed downlight fixtures shall be of the approved prewired type with junction box forming an integral part of the fixture assembly and so located in relation to the fixture that the junction box is CSA approved for 60 degree C wire. The electrical trade shall supply and install all necessary plaster rings, supports, etc., required for complete and proper installation.
- .3 Except where otherwise noted in the Luminaire Schedule, depth of recessed fluorescent fixtures shall not exceed 150 mm, including mounting yokes, or bridges and the distance from the back

face of the diffuser or lens to the centre of the lamp shall be not less than 75 mm. Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of lamp lines.

- .4 Fluorescent fixtures shall be constructed of not less than code gauge steel. All metal parts shall be thoroughly cleaned and finished in high reflectance baked white enamel over corrosion-resistant primer. Reflecting surfaces and exposed surface shall have not less than two coats of baked white enamel with reflectance of not less than 85%.
- .5 All fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools for cleaning.
- .6 Fixtures shall incorporate adequate gasketing, stops and barriers to form light traps and prevent light leaks.
- .7 Fixtures shall be designed for adequate dissipation of ballast and lamp heat to avoid short ballast life, nuisance thermal tripping and decreased lamp output. Heat test reports by independent laboratories shall be provided where required by the Consultant.
- .8 Construction of all fixtures shall be such as to provide a rigid well aligned fixture. Formed or ribbed backplates, end plates, reinforcing channel, heavy gauge sockets, straps, etc., shall be used where required to accomplish this.
- .9 The construction and performance of all fluorescent fixtures shall be subject to the acceptance of the Departmental Representative. Full photometric data from independent testing laboratory shall be provided when requested by the Electrical Consultant.

### 3.0 EXECUTION

#### 3.1 INSTALLATION AND SUPPORTS

- .1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.
- .2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
- .3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.
- .4 Self aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.
- .5 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Luminaire Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.
- .6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.
- .7 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts

- or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.
- .8 Wiring from outlet boxes to fluorescent fixtures and wiring through fluorescent fixture channels shall be rated for 90 degrees C.
  - .9 Connection to incandescent fixtures shall be by means of approved fixture type wiring.
  - .10 All recessed fixtures to be installed so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible conduit and approved fixture wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.
  - .11 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.




END OF SECTION 265000







APPENDIX A




## General




- All lighting fixtures shall meet the general requirements as specified in Section 26 50 00.
- All attachments to the building shall meet heritage buildings requirements.
- Luminaire performance corresponding to specified manufacturer's catalogue numbers indicate a minimum acceptable standard for this type of luminaire
- Manufacturers catalogue numbers must be verified with the luminaire description and confirmed with the vendor.
- See General, Product and Execution sections of lighting specifications for terms of submittals, warranties, quality assurance, fabrication, components, product performance, delivery and all other related information.
- All finishes are subject to approval by the architect
- All electrical components are subject to approval by electrical engineer.
- Unless otherwise noted, all T5HO Lamps should be 4-foot 54w Osram Sylvania Octron 830XP XP XL Ecologic 3, extended performance, rated not less than 4450 initial /4140 mean lumens at 25° C, rated 60,000 hours life on 12 hrs start, 96% lumen maintenance, with 3000K CCT, 85 CRI FP54/830/HO/XP/XL/ECO3 or approved equal.
- Unless otherwise noted, all fluorescent ballast should 120v, dimming 0-10V Osram Sylvania Powersense, Advance MarkVII Or Lutron Ecologic or approved equal. Use multiple lamp ballast wherever practical to reduce overall quantities of ballast on the project.
- All Dimensions are in millimetres, unless specified otherwise.

RECESSED DOWNLIGHT			
Type	Description	Light source CCT3000, unless noted	Detail
A1	<p>Recessed, semi specular reflector LED 150mm (6") aperture downlight. Luminaire should have remote phosphor mixing chamber for consistent performance and glare control and have 45 degree cut-off to source and source image and spacing ratio be not less than 1.0</p> <p>LED system should have 0-10v dimmable driver, produce 940 lumens, have CCT of 3000 and life to be rated not less than 50,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Luminaire housing depth should be 200mm (8") or less.</p> <p>Minimum acceptable standard Lithonia ALED-30/10-6-AR LD-120</p>	LED 24 w	
A2	<p>Recessed, semi specular reflector LED 150mm (6") aperture downlight. Luminaire should have remote phosphor mixing chamber for consistent performance and glare control and have 45 degree cut-off to source and source image and spacing ratio be not less than 1.0</p> <p>LED system should have 0-10v dimmable driver, produce 1800 lumens, have CCT of 3000 and life to be rated not less than 50,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Luminaire housing depth should be 200mm (8") or less.</p> <p>Minimum acceptable standard Lithonia ALED-30/18-6-AR LD-120</p>	LED 38w	
A3	<p>Recessed in the ceiling in front of heritage elevator doors LED directional light. 4.6" square faceplate without visible fasteners. Short distribution, integral 0-10v dimmable driver, HO LED with CCT of 2700 and life to be rated not less than 50,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty. Rated for dry location.</p> <p>Luminaire is mounted to 2.125" deep 4" octagonal box. Natural metal, polished brass faceplate (to be verified by architect)</p> <p>Minimum acceptable standard Winona LED STEP 12 SQU 27K/HO DM120 -PB(TBC)</p>	LED 6W 2700/HO	





**APPENDIX A - LUMINAIRE SCHEDULE**

Type	Description	Light Source	Detail
A4	<p>Recessed in the wall of the arches LED uplight light. 15" x 5.5" rectangular faceplate without visible fasteners. Long distribution, integral 0-10v dimmable driver, HO LED with CCT of 3000 and life to be rated not less than 50,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty. Rated for dry location.</p> <p>Luminaire is mounted to standard multigang switch box, Steel City H4BD or equal. Primed faceplate to be painted on site (to be verified by architect)</p> <p>Minimum acceptable standard Winona LED STEP 13 12 30K/HO DM120 -PRM(TBC)-STD</p>	LED 18W	
A5	<p>Recessed, semi specular reflector LED 150mm (6") aperture wallwasher. Luminaire should have remote phosphor mixing chamber for consistent performance and glare control and have 45 degree cut-off to source and source image and spacing ratio be not less than 1.0</p> <p>LED system should have 0-10v dimmable driver, produce 1800 lumens, have CCT of 3000 and life to be rated not less than 50,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Luminaire housing depth should be 200mm (8") or less.</p> <p>Minimum acceptable standard Lithonia ALED-30/18-6-AR LD-120</p>	LED 38w	
A6	<p>Recessed, shallow LED aperture downlight; 1201mm (4 3/4") aperture, 64 mm(2.52") deep. LED system should have 0-10v dimmable driver, produce 380 lumens/W, have CCT of 3000 and life to be rated not less than 50,000 hours at 70% output. White trim Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard Magic Lite Thin Line LVLDL-04-3000K-WH</p>	LED, 9w	
A7	<p>Recessed, flat LED panel/ downlight; 12" x12" square, 3500K, 0-10v dimming, complete with recessed junction box/housing 7.25"x6.9"x3" deep</p> <p>Minimum acceptable standard Beghelli Planex LED -1-WT35-120/277-RCM-DM</p>	LED	

SURFACE LUMINAIRES			
Type	Description	Light source	Detail
B1	Unassigned		
B2	Unassigned		
B3	Wall mounted in the atrium above elevators square shallow square with square glass lens and side lites – replacement of existing wallpacks.  Minimum acceptable standard Bega 2652P 10-7/8" x 10 7/8" x 5" White	8.7W LED	
C1 Exterior uplight	Surface mounted adjustable 645mm long x 89 mm high x 59 mm wide (24" x 3 1/2" x 2 5/16") extruded aluminum luminaire with machined aluminum end caps, stainless steel hardware and radial louver for glare control. Luminaire should have 10 degree x 60 degree optics, high output LEDs. Luminaire wiring should be 5 conductor and include data. Cable entry to suit electrical engineer. Silver Sand Textured finish.  LEDs should have CCT of 3000 and life to be rated not less than 120,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty. Rated for wet location. Controlled by photocell and automated time device.  Minimum acceptable standard Lumenpulse LOGP HO-120V- 24-30K- 10x10 – UMAS-SI-DIM – LOGRD 2'	LED, 31w total	
C1A Exterior uplight	Stem mounted over existing recessed junction box adjustable 645mm long x 89 mm high x 59 mm wide (24" x 3 1/2" x 2 5/16") extruded aluminum luminaire with machined aluminum end caps, stainless steel hardware and radial louver for glare control. Luminaire should have 30 degree x 60 degree optics, high output LEDs. Luminaire wiring should be 5 conductor and include data. Cable entry through the back. Luminaire shall be mounted over existing jb on the round column with 5" round canopy, yoke and supporting aircraft cables to suit engineer. Silver Sand Textured finish.  LEDs should have CCT of 3000 and life to be rated not less than 120,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty. Rated for wet location. Controlled by photocell and automated time device.  Minimum acceptable standard Lumenpulse LOGP HO-120V- 24-30K- 10x10 --SI-DIM – Stem 4 -MOD MOUNTING	LED, 31w total	

Type	Description	Light source	Detail
C2 Exterior uplight	<p>Surface mounted adjustable 12' long and consisting of three sections connected by 6" standard jumper cables. Each section 1254long x 89 mm high x 59 mm wide (48" x 3 1/2" x 2 5/16") extruded aluminum luminaire with machined aluminum end caps, stainless steel hardware and radial louver for glare control. Luminaire should have 10 degree x 60 degree optics, high output LEDs. Luminaire wiring should be 5 conductor and include data. Cable entry to suit electrical engineer. Silver Sand Textured finish.</p> <p>Dimensions to be confirmed on site prior to ordering.</p> <p>LEDs should have CCT of 3000 and life to be rated not less than 120,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty. Rated for wet location.</p> <p>Controlled by photocell and automated time device.</p> <p>Minimum acceptable standard Lumenpulse LOGP HO-120V- 24-30K- 10x10 – UMAS-SI-DIM – LOGRD 12'</p>	LED, 180w total	
C2A Exterior uplight	<p>Cantilever mounted on 305mm adjustable brackets at 2100AFF and centered on 1650mm long exterior sign (sign type A), adjustable 1254 mm long x 89 mm high x 59 mm wide (24" x 3 1/2" x 2 5/16") extruded aluminum luminaire with machined aluminum end caps, stainless steel hardware and radial louver for glare control. Luminaire should have 10 degree x 60 degree optics, high output LEDs. Luminaire wiring should be 5 conductor and include data. 4' long stem, length to be confirmed on site.</p> <p>Cable entry through the back. Provide 5" round canopy. Silver Sand Textured finish.</p> <p>LEDs should have CCT of 3000 and life to be rated not less than 120,000 hours at 70% output. Luminaire should have 5 years manufacturer's limited warranty. Rated for wet location.</p> <p>Controlled by photocell and automated time device.</p> <p>Minimum acceptable standard Lumenpulse LOGP HO-120V- 48-30K- 30x60 – WAM12--SI-DIM</p>	LED, 62w total	
C3	<p>Surface mounted in the recess at the atrium arch LED uplight complete with an integral driver and lightly frosted lens. Luminaires should be mounted over 75mm (3") octagonal box. Luminaire and canopy powder coated dark grey paint. Fixture dimensions h 80mm x w 80mm x 100mm projection</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards Ligan U31591 -02-F</p>	LED, 2w, 4w total	



APPENDIX A - LUMINAIRE SCHEDULE



Type	Description	Light source	Detail
C4	<p>Wall mounted over utility room door (Granville St South Entrance, low level) die cast aluminum, 120v, exterior rated LED downlight complete with an integral driver and lightly frosted lens. Luminaire is mounted over horizontally mounted single gang JB. Luminaire and canopy powder coated dark grey paint. Fixture dimensions h 80mm x w 206mm x 100mm projection</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards Ligman U31611 -02-F</p>	LED, 10w total	
C5	<p>Wall mounted, die cast aluminum, lightly frosted lens, 120v, exterior rated LED up and downlight complete with an integral driver. Luminaires should be mounted over 75mm (3") octagonal box. Luminaire and canopy powder coated matt silver color paint. Fixture dimensions h 80mm x w 80mm x Type D47100mm projection</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards Ligman U31581 -02-F</p>	LED, (2x2w) x2, 8w total	
C6	<p>Mounted in the niches in Hasting street (Passport Office) elevator lobbies on upper and lower levels, lensed, span mounted inside niche, high output, 0-10v dimmable, LED wallwasher. C6 shall be mounted directly below A4 uplight, with lobby side edges of both fixtures vertically aligned. Luminaire shall be approximately 8' long, wallwash. and 2 3/4" high x 2" high profile. If intermediate supports are required, they shall be two cantilevers mounted on the back wall of the niche. and located 24" from either end, Painted finish, same color as paint inside the niche, to be confirmed by Architect.</p> <p>Minimum acceptable standards Alight Arris, B4 – M8—LH30, 120 (1-10V)-Lenticular lens-J-O(TBC)-D 0-10v</p>	LED, 80w	
C7	<p>Assembly of two 243.8cm luminaires with a total length of 4.87 m, 56mm hifg x 34mm wide adjustable mount, wet location rated LED light mounted in front of entrance and exit sign. 3000K, 162lm/w, non dimming, 24v VDCC remote transformer, adjustable mount, anodized aluminum, frosted acrylic lens</p> <p>Complete with LW-series A dimming 0-10v power supply and dimming box to suit.</p> <p>Minimum acceptable standards Lightwild – LW-PLIN-W-96"-AM complete with LW Series A-PS01-NE –Dimming power supply and dimming box.</p>		



DECORATIVE AND SPECIALTY		
	<p>All existing decorative luminaires D1, D2, D3, D4 and D9 shall be cleaned, refurbished and repaired as necessary to be fully functional and relamped as described below.</p> <p>Provide 2 separate prices for types D2 and D4 with more expensive option included in the contract and less expensive shown as a credit.</p> <p>Option 1 – Relamp all fixtures with decorative candle, medium screw (E26) base, clear, rated 12,000 hrs life lamps GE Lighting 76454-LED2CAM/C/TP.</p> <p>Option 2 – Relamp all fixtures with long life (2250 hours) decorative blunt tip halogen medium screw (E26) base lamp. GE 16760-25BM/H/CD2. Include in the price supply and install of one incandescent dimmer for each type and mount dimmers near the panel. Dimmers to be controlled by astronomic time clock.</p> <p>Confirm base type on site and obtain one set of each; LED and halogen, lamps for D2 and D3 and organize a mock up on site for review of each option for Owner review and selection. Mock up to be done after dark.</p> <p>Number of lamps in each luminaire as shown below</p> <p>Type D3 – some of the existing fixtures have 2x175w metal halide and 250w quartz restrike and some have 3 incandescent lamps. For fixtures with only incandescent lamps provide 2 prices are described above. For MH with quartz restrike provide same two prices that also include removing metal halide socket and 347v wiring and replacing sockets with incandescent medium screw (E26) all wired to one circuit and recertified these fixtures.</p>	








**APPENDIX A - LUMINAIRE SCHEDULE**

Type	Description	Light source	Detail
D1	Existing decorative tiered square pendant located at Granville St North Upper level entrance. Existing lamps to be replaced with new.  Lamp quantities, types and bases to be verified by contractor. Replacement lamps will be specified when existing lamps are known.		
D2	Existing decorative long pendant, same as one located at Hastings Post Office/Passport entrance. Replace eight existing lamps with new halogen, 25w decorative B10 clear lamps. Fixtures shall be dimmed approximately between 20% and 80% according to time of day. Dimming settings to be determined on site during commissioning. Base of the lamp to be verified by contractor prior to ordering.	8-25w decorative halogen B10 clear	


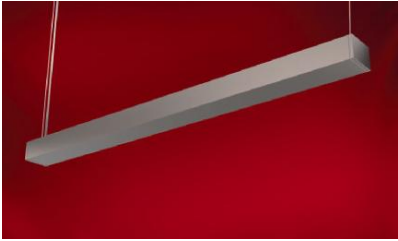


Type	Description	Light source	Detail
D3	<p>Existing decorative bowl pendant, same as one located at Granville St North Lower level entrance.</p> <p>Existing lamps are Type D3 A- 2-175wMH + 1-250W quartz, Type D3B-3-150W Incandescent.</p> <p>Replace existing lamps with new halogen, 25w decorative B10 clear lamps. Fixtures shall be dimmed approximately between 20% and 80% according to time of day. Dimming settings to be determined on site during commissioning. Base of the lamp to be verified by contractor prior to ordering.</p> <p>Type D3A (MH) fixtures shall be retrofitted and on-site recertified.</p>	3-25w decorative halogen B10 clear	
D4	<p>Existing decorative wall sconce, same as one located at Hastings Post Office/Passport entrance</p> <p>Replace existing lamps with new halogen, 25w decorative B10 clear lamps. Fixtures shall be dimmed approximately between 20% and 80% according to time of day. Dimming settings to be determined on site during commissioning. Base of the lamp to be verified by contractor prior to ordering.</p>	4-25w decorative halogen B10 clear	




Type	Description	Light source	Detail
D5A	<p>2' long adjustable High Output LED luminaire 2700K, frosted lens, small profile aluminum housing</p> <p>Mounted on concrete bulkhead, see mounting detail.</p> <p>Luminaire wiring should be 5 conductor and include data. Cable entry to suit electrical engineer. Painted Silver Sand Textured finish to match type C1</p> <p>Minimum acceptable standards Lumenpulse –LCS HO-120V – 48-27K-FR-feed to be specified by the electrical engineer- Silver Sand Textured finish to match type C1-DIM 0-10 Complete with blade louver</p>	LED 2700K, CRI80+	
D5B	<p>8' long adjustable High Output LED luminaire 2700K, frosted lens, small profile aluminum housing</p> <p>Mounted on concrete bulkhead, see mounting detail.</p> <p>Luminaire wiring should be 5 conductor and include data. Cable entry to suit electrical engineer. Painted Silver Sand Textured finish to match type C1</p> <p>Minimum acceptable standards Lumenpulse –LCS HO-120V – 96-27K-FR-feed to be specified by the electrical engineer- Silver Sand Textured finish to match type C1-DIM 0-10 Complete with blade louver</p>	LED 2700K, CRI80+	
D6	Not Used		

Type	Description	Light source	Detail
D7	<p>Typical for all steel columns in the atrium, two per column: Replace all existing semi sphere uplights mounted on the columns with a long life 3000K LED, 120mm x 120mm base x 50mm deep with 85mm protruding opal, impact resistant crystal glass, with integral transformer, luminaire. Fixture should come mounted over existing junction box on a round column. White painted finish</p> <p>Minimum acceptable standards Bega 2432LED 3000K</p>	LED 6W	
D8	<p>Replace existing suspended exterior decorative "coach lamp" with new 380mm (15") diameter, 790mm (31") high with 1.8m (6') long chain and canopy, antique gold finish and amber tinted glass. Non-dimmable.</p> <p>Replaces existing coach lamps. New fixtures to be suspended at same elevation as existing. Confirm suspension length with architect.</p> <p>Minimum acceptable standards – Fine Art Lamps – Gramercy Park 571882ST</p>	4X LED candle, candelabra base, clear, Ushio U-LED	
D9	<p>Existing acorn wall sconces. To be refurbished, internal shields/reflectors removed and retrofitted with 120v medium based LED decorative candle, clear, 2900K lamp. GE 76454-LED2CAM/C/TP</p> <p>Fixtures shall be painted white to suit architect.</p> <p>Non-dimmable.</p>	1-2 w LED 2900K, CRI80+	


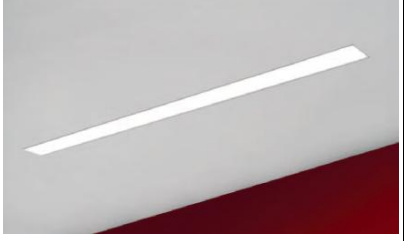
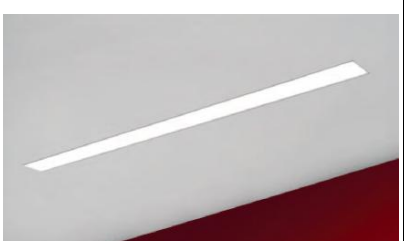

FLUORESCENT			
Type	Description	Light source	Detail
F1	<p>Interior, 120v wall, mounted to C-channel or a mullion with a 1" wall blocks 89mm x 89mm (3 1/2"w x 2 1/2"h) in section, extruded aluminum, continuous uplight with asymmetric distribution. Fixtures mounted to mullions and have glass or other shiny surface behind them require saw tooth baffle to prevent creating reflection of a light source in the glazing. Fixtures mounted on the wall do not require saw tooth baffle. Contractor to identify quantities of each type to obtain accurate pricing. Luminaire should have 1 T5HO lamp in section and have rigid dust cover. Painted finish. Exact length and finish to be confirmed by the architect.</p> <p>In locations where fixtures are mounted on the bottom flange of the C-channel, contractor shall confirm exact method of attachment with structural engineer. Verify clearance between column support and the flange prior to ordering. If this space does not allow for fixture to be mounted under the support, length of each sections to suit space between columns. If space allows for fixture to be mounted under the support, fixture should be ordered continuous, with mitered corners to suit.</p> <p>Minimum acceptable standard A.light D4 -R as shown on drawings- H- 120 DIM OSY Powersense -T-D-H1-O finish to be confirmed by the architect</p>	1-54w T5HO in section	
F1A	<p>Exterior, 120v wall, mounted with a 1" wall blocks above entrance doors at Granville South, Lower level entrance and to a bulkhead opposite the door, 89mm x 89mm (3 1/2"w x 2 1/2"h) in section, extruded aluminum, continuous uplight with asymmetric distribution. Luminaire should have 1 T5HO lamp in section and have lens. <b>Painted finish. Exact length and finish to be confirmed by the architect.</b></p> <p><b>In locations where fixtures are mounted on the bottom flange of the C-channel, contractor shall confirm exact method of attachment with a structural engineer.</b></p> <p>Minimum acceptable standard A.light D4 -6' (exact, site measurement required) H - 120 DIM OSY Powersense N -H-C-T-D7 Q <b>a-lightanium finish to be confirmed by the architect</b></p>	1- 54w T5HO in section	

APPENDIX A - LUMINAIRE SCHEDULE

Type	Description	Light source	Detail
F1B	Interior wall mounted on the square seismic column , 750mm long asymmetric upright. Fixture shall have 5" canopy in the center for mounting to extension ring over existing jb recessed in the column A.light D4 –M750mm- T5HO – 120 DIM OSY Powersense -T- Minimum acceptable standard D-H1-T- <b>a-lighttanium finish to be confirmed by the architect. MOD mounting. Mounting to be reviewed and approved by electrical engineer</b>	1-24W T5HO	
F1C	Interior suspended approximately 5' below lower edge of a barrel vault ceiling asymmetric indirect fixture with dust cover, single aircraft cable seismically rated suspension, dimming ballast.  Minimum acceptable standard A.light D1 –R as shown on drawings- F – 120 DIM OSY Powersense -N-D-S-E  Textured eggshell white paint <b>finish to be confirmed by the architect. MOD mounting</b>	1-24W T5HO	
F1D	Interior bottom surface mounted on the top of bulkheads 8' long symmetric grazing upright complete with saw tooth baffle to prevent creating reflection of a light source in the glazing - Post Office in Elevator Lobby Upper Level. Fixture to be mounted with saw tooth baffle on the side near glazing.  Minimum acceptable standard A.light D4 –8- H–1- 120 DIM OSY Powersense -E-D-H1-T- Textured eggshell white paint, <b>finish to be confirmed by the architect</b>	1-24W T5HO	
F2	Interior, 120v, approximately 24' long cove luminaire with one T5Ho lamp in section, rigid dust cover, dimming ballast Length to be confirmed on site prior to ordering. New cove fixtures F2. Provide mounting surface so that top of the fixture is even with or slightly lower (not exceeding 1/2") than the top of the cove's lip. Luminaire to be mounted tight to front edge of the cove. Inside surfaces of the cove should be finished and painted white.  Minimum acceptable standard Peerless HCM5-1-54T5HO-3x8'(TBC)-120-OSDIM/Powersense –DU	6- 54w T5HO	



Type	Description	Light source	Detail
F3	<p>Continuous, wall mounted cast decorative Glass Reinforced Gypsum (GRG) cove, complete with inside and outside 90 degree corners as shown on the drawings and dimming dimming DIM OSY Powersense ballast. Style A 7-3/4" wide x 5 1/4" high, length as shown. Utilize only 4' lamps and overlap to ensure even light distribution.</p> <p>Minimum acceptable standard ELP -154-T-5CLC-Style A- DIM OSY Powersense</p>	1-54w T5HO in section	
F4	<p>Mounted to columns either side of atrium elevator and wall mounted at the skytrain entrance wall mounted, up/down luminaire should with one 2- T5HO lamp in section, 120v dimming ballast. Grazing optics up and down, regressed HTLO lens top and bottom. Length of luminaire should be exactly to match length of the wall /column that luminaire is mounted on, approximately 6', exact length and finish to be confirmed.</p> <p>Fixtures mounted on atrium elevator shall be 828mm long with 2x24wT5HO. In one fixture lamps shall be at one end and in the second fixture at the opposite end. Fixture is being mounted over existing junction box located behind center of the fixture. Provide power to suit.</p> <p>Minimum acceptable standards</p> <p>Atrium Elevator A.light D2-M828mm- H-H-1 -RH-G-H-R-T Painted Lightanium finish to be confirmed by the architect.</p> <p>Typical fixture - A.light D2-M6'(TBC)-H-H-1 -RH-G-H-H-H1" T5HO – 120 DIM OSY Powersense Painted finish to be confirmed by the architect.</p>	2 x T5HO in section	
F4A	<p>Similar to F4, but span mounted, approximately 6.5m long, symmetric uplight/ a-cirrus lens, symmetric downlight/ a-cirrus lens. Skytrain escalator/stairs</p> <p>Minimum acceptable standard A.light D2-M6'(TBC)-H-1 -RH-G-RH-G-H1" T5HO – 120 DIM OSY Powersense Painted finish to be confirmed by the architect.</p>	2 x T5HO in section	





Type	Description	Light source	Detail
F4B	<p>Similar to F4, but wall mounted, approximately 6' long, damp location rated, asymmetric uplight/ a-cirrus lens, symmetric downlight/ a-cirrus lens. Skytrain escalator/stairs</p> <p>Minimum acceptable standard A.light D2-M6'(TBC)-H-H- 1 -A-T-D-Q- T5HO – 120 DIM OSY Powersense Painted finish to be confirmed by the architect.</p>	2 x T5HO in section	
F5A	<p>Recessed 4' long, 2 ½" wide wallwasher with T5HO lamp mounted 5'-8" on center and centered inside approximately 11'-4" long display case</p> <p>Minimum acceptable standard Alights D5-4'-H-1-A-G-D- DIM OSY Powersense</p>	1x T5HO	
F5B	<p>Recessed, approximately 13' long, 2 ½" wide wallwasher with T5HO lamps and 12' in the center should be illuminated. Wallwasher should be installed as tight to AC diffuser as possible so that South end of the fixture is aligned with South edge of the linear diffuser, (approximately 21" from South wall). Distance from the North end of the fixture to North wall should be equal to distance from South end of the fixture to South wall. Contractor should provide side measurements during shop drawing review.</p> <p>Minimum acceptable standard Alights D5-M13'-H-1-A-G-D- DIM OSY Powersense</p>	3 x T5HO	
F6	<p>Surface mounted on the top of the beam uplight, dust cover, DIM OSY Powersense ballast. Single lamp in section, single circuit. Continuous, approximately 6.5m long, use only 4' lamps</p> <p>Minimum acceptable standard Peerless BRM1-1-54W T5HO-SPR-120-DIM- OSY Powersense SCT-L/LP-F2</p>	54W T5HO	





**APPENDIX A - LUMINAIRE SCHEDULE**



Type	Description	Light source	Detail
F7	<p>Recessed in the underside of the sign/ beam at the top of escalator/stairs to skytrain flangeless continuous, , closest to approximately 6.5m long with using only 4' lamps, downlight with a-cirrus lens. Dimming ballast.</p> <p>Minimum acceptable standards A.light D5-R 6.5m(TBC)-H-1 -A-G- T5HO – D-120 DIM OSY Powersense Painted finish to be confirmed by the architect.</p>	5HO 1T	
F8	<p>Surface ceiling mounted fluorescent grazer with louver . 2 runs approximately 9.5m, two runs approximately 6.5m long</p> <p>Minimum acceptable standard A.light D3 – R(+ - 24'TBC)-H-1-GW-F-Dim OSY Powersense</p>	5HO TT	


EXTERIOR LUMINAIRES			
Type	Description	Light Source	Detail
L1	<p>41 dia x716 long x76 high surface mounted, locking, adjustable Linear LED wallwash with 60x120 optics. 24V Luminaire shall have IP66 rating, anodized aluminum housing with 120V remote dimmable driver.</p> <p>Luminaire assembly supplied by manufacturer shall consist of cover plate to be replace existing fixture and be mounted over existing junction box, 300mm long liquid tight connectors and cable to remote driver, weather proof enclosure with dimmable power supply/driver, 1800mm long liquid tight connectors and cable to luminaires mounted on the balcony floor and centered on the window, approximately 300mm in front of the façade.</p> <p>Refer to drawing notes and sketches for mounting details.</p> <p>Mounted on rooftop, as shown on the drawings and focused on clock tower dome. Provide 10' coiled cable with luminaire. Exact locations of luminaire to be reviewed and approved on site by lighting designer after dark and before luminaires are attached.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards: SPI ECHO ROUND</p> <p>EEG11110-L26.8W/A-24V-AN04-3500K-SMA PSN with CPS10875-PS13-VOLT-PSE-MOD, POWER SUPPLY WET LOCATION RATED.</p>	<p>LED</p> <p>3500K</p> <p>26.8W</p>	
L2	<p>1220L x 76 H x 71W Linear LED up-light, IP67 rating, aluminum housing, brushed stainless steel faceplate, clear tempered glass lens with asymmetric wall wash optics luminaire.</p> <p>Luminaires shall be mounted directly buried/recessed into new concrete curb with horizontal top surface. Curb must have weeping holes and unobstructed water egress. 120V, with integral dimming driver. Luminaire shall be supplied as 4' assembly with single 120v input and connected 2' modules.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards: SPI ECHO EFFECT</p> <p>ERG11489-L40.2WA-120-277V-BSS-3500K-PW-DBB</p> <p>CUSTOM 4' LENGTH</p>	<p>LED</p> <p>3500K</p> <p>40.2W</p>	


**APPENDIX A - LUMINAIRE SCHEDULE**



Type	Description	Light Source	Detail
L3	<p>915 L x 76 H x 71W Linear LED up-light, IP67 rating, aluminum housing, brushed stainless steel faceplate, clear tempered glass lens with asymmetric wall wash optics luminaire. Luminaires shall be mounted directly buried/recessed into new concrete curb with horizontal top surface. Curb must have weeping holes and unobstructed water egress. 120V, with integral dimming driver</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards: SPI ECHO EFFECT            ERG11489-L30.2WA-120-277V-BSS-3500K-PW-DBB</p> <p>CUSTOM 3' LENGTH ARRANGEMENT</p>	<p>LED            3500K</p>	
L4	<p>41 dia x 417Lx76H high surface mounted, locking, adjustable Linear LED wallwash with 60x120 optics. 24V Luminaire shall have IP66 rating, anodized aluminum housing with 120V remote dimmable driver.</p> <p>Luminaire shall be mounted with stone tap screws to the rear side of stone handrails of 6th floor balcony balusters.</p> <p>Luminaire shall be supplied with 20' long flexible liquid tight cable for connection to next luminaire. Three luminaires shall be supplied with second 20' home run to remote driver mounted on in weatherproof enclosure on the roof or inside service room on sixth floor. Cables between luminaires shall be concealed on the ledge tight to the building.</p> <p>Refer to drawing notes and sketches for mounting details.            Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards: SPI ECHO ROUND</p> <p>EEG11109-L13.4WA-24V-AN04-4500K-FT-PSN</p> <p>NOTE: CPS10875-PS13-VOLT-PSE MOD, POWER SUPPLY WET LOCATION RATED.</p>	<p>LED            4500K            13.4W</p>	

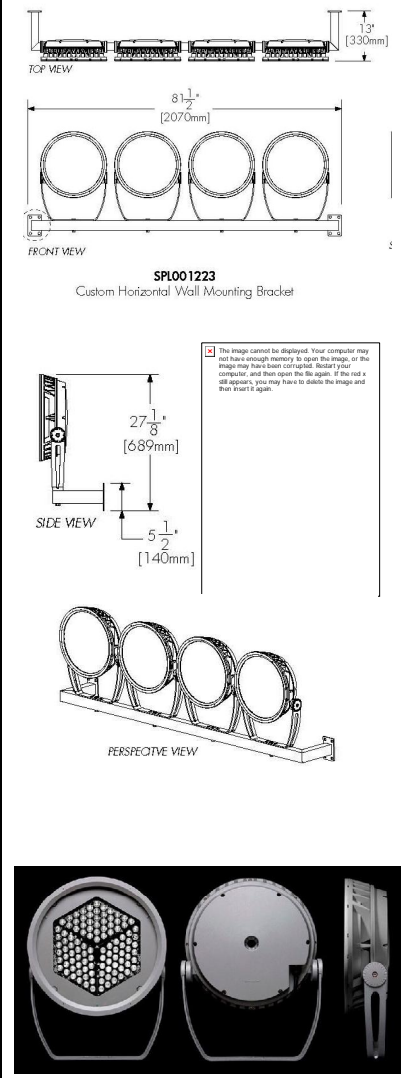
**APPENDIX A - LUMINAIRE SCHEDULE**

Type	Description	Light Source	Detail
L5	<p>41 dia x417Lx76H high surface mounted, locking, adjustable Linear LED wallwash with 60x120 optics. 24V Luminaire shall have IP66 rating, anodized aluminum housing with 120V remote dimmable driver.</p> <p>Mounted within archway on clock tower. All attachments shall meet heritage requirements. Refer to drawing notes and sketches for mounting details.</p> <p>Luminaire shall be supplied with 20' long flexible liquid tight cable for connection to next luminaire. Three luminaires shall be supplied with second 20' home run to remote driver mounted on in weatherproof enclosure on the roof or inside service room on sixth floor. Cables between luminaires shall be concealed on the ledge tight to the building.</p> <p>Refer to drawing notes and sketches for mounting details.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards: SPI ECHO ROUND</p> <p>EEG11110-L26.8W/A-24V-AN04-3500K-SMA-PSN</p> <p>NOTE: CPS10875-PS13-VOLT-PSE MOD, POWER SUPPLY WET LOCATION RATED.</p>	<p>LED</p> <p>3500K</p> <p>13.6W</p>	
L6	<p>200dia x116 deep x268 high including bracket LED 10x10 optics, narrow beam spotlight, IP66 rated with low copper content aluminum housing with silver finish and complete with a corrosion resistant coating and clear tempered glass lens. , and optics are. Surface mounted to rooftop. Complete with 120Vintegral intelwhite dimmable driver.</p> <p>Mounted on rooftop, as shown on the drawings and focused on clock tower dome. Provide 10' coiled cable with luminaire. Exact locations of luminaire to be reviewed and approved on site by lighting designer after dark and before luminaires are attached.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards LUMENPULSE LUMENBEAM, LBM-120-30K-NS--SI-DMX-CRC, AND LBM-SN-SI-BK, 10' LEADER CABLE</p>	<p>LED</p> <p>3000K</p> <p>28w</p>	



Type	Description	Light Source	Detail
L7	<p>Custom assembly of two 41 dia x417Lx76H each locking, adjustable Linear LED luminaires mounted on horizontal, side by side bracket. 24V Luminaire shall have IP66 rating, anodized aluminum housing with 120V dimmable driver mounted next to fixtures within shroud.</p> <p>Each luminaire shall have locking adjustable orientation. Uplight luminaire shall be further away from mounting surface and be high output with FT asymmetric wallwash optics, downlight luminaire shall be nearest to mounting surface and have low output, symmetric SMA optics.</p> <p>Luminaire shall be mounted within 6" w custom shroud /enclosure, height, length and finish of the shroud to be determined by architect.</p> <p>Refer to drawing notes and sketches for mounting details.</p> <p>Custom mounting, see sketches for details.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard: STILE SEWS STYK EXTERIOR LINEAR LED SEWS-051-L53.6WA-35K-FT-24VDC-4'-see below-AN04-PS-PSE-DML</p> <p>SEWS-051-L16.0 6WA-35K-SMA-24VDC-4'- see below-AN04-PS-PSE-DML</p> <p>Custom bracket as described above</p>	<p>LED            3500K            53.6w uplight            16w downlight</p>	



Type	Description	Light Source	Detail
L7A	<p>Similar to L7, but luminaires are stacked vertically. Custom assembly, linear LED luminaires, IP66 rating, aluminum housing, anodized finish, with 60x120 and Forward-Throw optics. Custom mounting, see sketches for details. Locking adjustable orientation, with remote driver. Powered at 120V, with a total of 53.6W of LED lamping. Dimmable. Dimensions of the luminaire are approximately 41x1306x76. Luminaire comes with a five-year warranty.</p> <p>Custom assembly of two 41 dia x417Lx76H each locking, adjustable Linear LED luminaires mounted on horizontal, side by side bracket. 24V Luminaire shall have IP66 rating, anodized aluminum housing with 120V dimmable driver mounted next to fixtures within shroud.</p> <p>Each luminaire shall have locking adjustable orientation. top luminaire shall be high output with FT asymmetric wallwash optics, lower luminaire shall be low output, symmetric SMA optics.</p> <p>Luminaire shall be mounted to structural support within 4" w custom shroud /enclosure, height, length and finish of the shroud to be determined by architect.</p> <p>Refer to drawing notes and sketches for mounting details.</p> <p>Custom mounting, see sketches for details.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard: STILE SEWS STYK EXTERIOR LINEAR LED SEWS-051-L53.6WA-35K-FT-24VDC-4'-see below-AN04-PS-PSE-DML</p> <p>SEWS-051-L16.0 6WA-35K-SMA-24VDC-4'- see below-AN04-PS-PSE-DML</p> <p>Custom bracket as described above</p>	<p>LED            3500K            53.6w uplight            16w downlight</p>	



Type	Description	Light Source	Detail
L8	<p>57 dia, 190 high 18x18 optics adjustable surface base mounted LED spotlight. IP66 rated, copper-free aluminum housing in painted bronze finish. Complete with clear tempered glass soft focus lens, 45 degree cap and wall mount 5" diameter canopy. Fixture shall be mounted over weatherproof jb, mounted between columns on the second floor balcony. Complete with dimming transformer to suit. Transformer shall be mounted in a weatherproof enclosure next to each grouping of fixtures. Transformers, jb and weatherproof enclosure by contractor.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard BK LIGHTING ARTISTAR, -AR-LED-RM-E22-SP-A9-BZW-SFL--A-WM</p>	<p>LED            3100K            8.4W</p>	
L9	<p>57 dia, 190 high 36X36 optics adjustable surface base mounted LED spotlight. IP66 rated, copper-free aluminum housing in painted bronze finish. Complete with clear tempered glass soft focus lens, 45 degree cap and wall mount 5" diameter canopy. Fixture shall be mounted over surface jb onto vertical surface of service landing and backlighting clock faces. Complete with dimming transformer to suit. Transformer shall be mounted in a weatherproof enclosure next to fixtures. Transformers, jb and enclosure by contractor.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard BK LIGHTING ARTISTAR, -AR-LED-RM-E22-WFL-A9-BZW-12-C- WM</p>	<p>LED            4100K</p>	



Type	Description	Light Source	Detail
L10	<p>587dia x146 deep x587 high including bracket, LED FLOOD, IP66 Rating, low copper content aluminum housing, silver finish complete with a corrosion resistant coating. Lensing is clear tempered glass, and optics are 6X6, complete with elongator lensing. Wall mounted on wall bracket to exterior West wall of Birks building mechanical room. 120V Fully Dimmable</p> <p>Mounted on the west wall of a service room located on the top of Birks building.</p> <p>Three luminaires require a horizontal spread lens, and are focused on the building from the lower roof down, and one luminaire requires a vertical spread lens, and is to be focused on the clock tower.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard LUMENPULSE LUMENBEAM, LBX-120-40K-VN--SI-DMX1FX-CRC, 10' LEADER CABLE, FOUR UNITS TOTAL, THREE UNITS WITH LSLH, ONE UNIT WITH LSLV</p>	<p>LED                      4000K                      140W</p>	 <p>TOP VIEW</p> <p>FRONT VIEW</p> <p>SIDE VIEW</p> <p>PERSPECTIVE VIEW</p> <p>SPL001223              Custom Horizontal Wall Mounting Bracket</p> <p>This image cannot be displayed. Your computer may not have enough memory to open this image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.</p>



TRACK MOUNTED			
<p>All tracks shall be provided with connectors, feeds, transformers (if required) and all mounting hardware for complete installation. Length of track as shown on the drawings.</p> <p>All track and fixtures for T1 and T2 shall be white unless noted otherwise.</p> <p>All track and fixtures for T3, T4, T5 and T6 shall be silver unless noted otherwise.</p>			
Type	Description	Light source	Detail
T1	<p>Track mounted on the underside of steel beam – atrium. Track mounted LED downlight, dimmable, with snoot, spot, elliptical. Dimensions are approximately 260x124x165.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard Intense MB3-52w (3000lm)- 30 (3000K 82CRI)-W- SP19 with elongator PLF98-2 lens-LH1W accessory holder- PS White</p>	LED 3000K	
T2	<p>Track mounted on the top of bulkhead under the glazing– atrium.</p> <p>Track mounted LED wallwash/façade lighting, dimmable, wallwash or elliptical flood.</p> <p>Dimensions are approximately 218x472x78.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standard Intense MBWH2-54w (3000lm)-27K-DIM (ELV)-White</p>	LED 2700K	

Type	Description	Light source	Detail
T3	<p>Track mounted LED Downlight</p> <p>Dimensions are approximately 150x190x290.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards Radii Radii 0-07-3K-50-2cct track-Silver-CN-2- dim NFL</p>	LED 2700K	
T4	<p>Track mounted LED Downlight</p> <p>Dimensions are approximately 150x190x290.</p> <p>Luminaire should have 5 years manufacturer's limited warranty.</p> <p>Minimum acceptable standards Radii Radii 0-07-3K-50-2cct track-Silver-CN-2- dim SP</p>	LED 2700K	

Type	Description	Light source	Detail
T5	<p>Track mounted LED Downlight</p> <p>Dimensions are approximately 150x190x290.</p> <p>Minimum acceptable standards Radii Radii 0-07-3K-50-2cct track-Silver-CN-2- dim BELL</p>	LED 2700K	
T6	<p>Track mounted under glass block, atrium</p> <p>Mounted on the track underneath North-South atrium between column lines B and J at gridline 14 LED wallwash/façade lighting stone façade below glass block, dimmable. Silver (to be confirmed by the architect.6</p> <p>Dimensions are approximately 271x137x57.</p> <p>Minimum acceptable standards Lightolier Lightspan Alcyon LED LL27AL+LLFBD barn doors</p>	LED 2700K	

LIFE SAFETY			
Type	Description	Light source	Detail
X	Extruded aluminum edge lit Running Man exit sign. Self powered with 120 minute battery backup. Universal wall or ceiling mounting. Minimum acceptable standards Beghelli OT-RM SP L WC 1 0 120SP	LED	
BU	Dual head emergency battery unit with 120 minute battery backup, 12V, 200W, (2) 4W LED heads Minimum acceptable standards Thomas & Betts LDX12-200-2-LD7	LED	

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .3 Section 26 05 21 - Wires and Cables (0-1000 V).
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-[M1985(R1999)], Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition 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 packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Dispose of unused batteries at official hazardous material collections site approved by Departmental Representative.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 WARRANTY

- .1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

2.0 PRODUCTS

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, ac.
- .3 Output voltage: 12 V dc.
- .4 Operating time: 120 min.
- .5 Battery: sealed, maintenance free.

- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON'.
- .10 Lamp heads: integral on unit remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: tungsten halogen 12 W.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: White.
- .13 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.
  - .5 Battery disconnect device.
  - .6 AC input and DC output terminal blocks inside cabinet.
  - .7 Shelf.
  - .8 Cord and plug connection for AC.
  - .9 RFI suppressors.

## 2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EM 1, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: #10 minimum type in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations.

## 3.0 EXECUTION

### 3.1 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads illuminate the paths of egress.
- .3 Connect exit lights to unit equipment.

END OF SECTION 265201

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies empty telecommunications raceway systems with conduit raceway system.

1.2 SYSTEM DESCRIPTION

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, , pull boxes, sleeves and caps, cable tray, and fish wires,  
.2 Overhead distribution system.

2.0 PRODUCTS

2.1 MATERIAL

- .1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.  
.2 Junction boxes, cabinets Type E: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.  
.3 Outlet boxes recessed type, conduit boxes 104 x 104 size, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.  
.4 Fish wire: polypropylene type.  
.5 Provide and install suspended 300mm wide by 100mm deep basket type Cable Tray in the Data Room as shown on the drawings. Provide seismic bracing as directed by Seismic Engineer.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install empty raceway system, including overhead distribution system, fish wire, outlet boxes, pull boxes, cover plates, conduit, sleeves, cable tray and caps, miscellaneous and positioning material to constitute complete system.

END OF SECTION 270528

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Division 26 – Electrical

1.2 REFERENCES

- .1 Canada Green Building Council (CaGBC) C.1 Version 1.0 (2007)
  - .1 LEED Canada-LEED (Leadership in Energy and Environmental Design): Green Building Rating System and reference Package for Commercial Interiors.

1.3 DESCRIPTION OF WORK

- .1 Supply, install, and commission the specified components to create complete and fully operating Sound Systems within the Sinclair Centre Building Atrium, as indicated on the drawings and in this specification. Note that this specification is complementary to the drawings; work shown in either is deemed to be in both.
- .2 Co-ordinate installation with all other contractors engaged in the project. Resolve any conflicts caused by improper co-ordination at no extra cost to the contract.
- .3 Furnish equipment, materials and workmanship of the highest quality. Workmanship and materials specified in Section 2.0 of this document will, at all times, be subject to acceptance by the Departmental Representative.
- .4 Include everything necessary or incidental to complete the Sound systems herein described.
- .5 Include all conduit, fittings, electrical devices, and wiring to connect systems equipment to AC outlets, panelboards, and dedicated ground points.
- .6 Provide structurally adequate mounting for all loudspeakers. Refer to Section 3.0 Execution, for seismic and safety requirements.
- .7 Provide restraints for all equipment racks, suspended audio equipment, and counter mounted audio equipment, where appropriate. Refer to section 3.0 Execution for seismic and safety requirements.
- .8 Allow for construction requirements such as storage, hoarding, lift equipment and night work.
- .9 Work indicated as N.I.C. demonstrates existing or future equipment interfaces and specific items labelled as N.I.C. are not to be included.

1.4 STANDARDS

- .1 install equipment and materials in accordance with manufacturer's recommendations and accepted trade practice. Comply with following codes, regulations and standards:
  - .1 Electrical standards of the of the Province of British Columbia, and the by-laws of the Municipal Electrical Inspection Department having authority over the area in which the work is being conducted, whichever is the most stringent.
  - .2 The Province of British Columbia Rules and Regulations for installation and maintenance of electrical equipment.
  - .3 Canadian Electrical Code in effect on closing date of tender.
- .2 Obtain any plan approvals required by Inspection Authorities prior to commencing construction.
- .3 Obtain all permits and licenses necessary for the execution of the work, and pay all fees associated here to.
- .4 Deliver Certificate of Approval from the governing body at conclusion of installation, prior to total completion.



- .5 All equipment provided that is powered with line voltage is required to carry harmonized UL/CSA approvals, CSA approvals, or must have equivalent local approvals.

#### 1.5 EXISTING CONDITIONS

- .1 Verify all conditions that pertain to the installation, including the work of other divisions, to ensure that the work as specified can be satisfactorily executed without changes.
- .2 Drawings are generally schematic and are intended to show only major features of the work. Site information given on the drawings is not guaranteed.
- .3 Do not scale the drawings - confirm all dimensions on site prior to installation. Co-ordinate all mounting heights with surrounding features.

#### 1.6 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittals.
- .2 Shop drawings augment but do not alter contract documents. Review of shop drawings does not imply acceptance of the work.
- .3 Submit two (2) prints of the following drawings for review by Departmental Representative.
  - .1 Before proceeding with the work,
    - .1 Manufacturer's specification cuts and quantity schedule for all items furnished under the contract.
- .4 Before proceeding with respective portions of work,
  - .1 Drawings and tables indicating proposed nomenclature, layout arrangements for panels, terminal block configurations, and wiring harnesses.
  - .2 Connection schedules.
  - .3 A list of test points, and a proposed format for test records.
  - .4 Details and descriptions of any other aspect of the Sound system that must differ from the drawings due to field conditions.
- .5 Certify with signature and title that drawings submitted reflect the final issue intended for fabrication.
- .6 Co-ordinate documents of related divisions when joint submissions are required.
- .7 Maintain one copy of reviewed shop drawings on job site at all times.

#### 1.7 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.
  - .1 Protect against dampness and damage during and after delivery.
  - .2 Store in ventilated areas, protected from extreme changes of temperature or humidity.
- .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 Store and protect architectural woodwork from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work
- .5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding,

and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### 1.8 WARRANTY AND MAINTENANCE

- .1 Warrant the completed systems against defects in materials and workmanship, including any required parts and labour, at no cost to the Owner, for a one (1) year period from date of final acceptance or first beneficial use, whichever occurs first. Pass on manufacturer warranties for individual items.
- .2 Visit the installation at least two (2) times during the warranty period to ensure that all equipment is functioning satisfactorily. Perform any maintenance services that may be required. The first visit shall occur approximately six months after commencement of the warranty period, with the last visit just prior to the end of the warranty period. Use only qualified service personnel.
- .3 Perform additional maintenance services requested during the warranty period, at no cost. Maintenance services shall consist of, but not be limited to, operational tests and checks of all cable and equipment.
- .4 Any defect discovered during any maintenance visit shall be repaired or replaced under the terms of the warranty. The Contractor is not liable for equipment damaged by improper use, negligence, or acts of nature.

#### 1.9 INTELLECTUAL PROPERTY

- .1 It is understood that the machine language or high level programming language shall remain the property of the particular audio, video or control system product manufacturer, and the Owner shall have the use and benefit of this hardware/software for as long as they own this equipment.
- .2 The Owner shall become the outright owner of all value-added intellectual property in the form of audio, video or control system programming that is intended to adapt and configure the equipment for the specific functions and performance required by this specification, whether performed by the Sound Contractor or the product manufacturer. Supply four copies for each system of the decompiled source code for all the audio, video and control system value-added programming on CD-Rom compatible disks, complete with a printed copy of the available support documentation.
- .3 The system manuals are to include copies of the compiled and un-compiled source code for all the audio, video and control systems value-added programming on PC compatible CD-ROM media, complete with electronic (on PC compatible CD-ROM media) and printed copies of the available support documentation.
- .4 It is understood that the agreement to turn over the Sound system value-added programming to the Owner as part of this contract will in no way limit or prevent the Sound Contractor from reusing the programming knowledge, techniques, methods, macros, and programming details in other projects for other clients, with the exception of the graphical design supplied which are owned by and for the exclusive use of the owner.
- .5 The Owner will not knowingly resell, or transfer for profit, the value-added Sound system programming to any other Sound vendor or contractor for use on any Sound systems other than the systems described by this specification.

#### 1.10 ASSISTANCE TO OWNER

- .1 After the system has been tested as fully operational; provide eight (8) hours of instruction to designated representatives of the Owner in the features of the systems and the proper methods of operation. This may be provided in one or more sessions to suit the Owner's

timetable. The instructional topics will be mutually agreed on, in advance, by the owner and the contractor.

- .2 Provide operating assistance for the first two (2) major uses of the completed systems. Provide this assistance at the times required by the Owner even if outside the normal working day.

#### 1.11 OPERATION AND MAINTENANCE MANUALS

- .1 Assemble four (4) hard copies of the manual, formatted as follows:
  - .1 Complete list of passwords, IP addresses and Net ID sets for all devices.
  - .2 List of Equipment provided, including owner supplied (excluding pre-existing equipment) to include serial numbers and materials receipts for loose or portable items delivered to the Owner. Provide a schedule of terminations, cross-referenced to test results.
    - .1 Simplified Operating Instructions
    - .2 As-Built and Reviewed Shop Drawings
    - .3 Performance Measurements
    - .4 Service and Adjustment Instructions
- .2 Electronic Media - Submit a draft copy of the manual at completion of testing under Section Testing 3.8 to the Sound Consultant for review.
- .3 Forward the final copies to the Departmental Representative for review.
- .4 Use standard letter size post binders, labelled for project and date. Neatly fold oversized drawings into individual plastic sheet holders properly punched and inserted into the binders. Include specified configuration files and associated software on CD with paper envelope, attached within clear plastic binder-sleeve.
- .5 In each manual set, include one copy of the compiled and uncompiled source code for all the sound system value-added programming on PC compatible DVD-ROM media, complete with electronic (on PC compatible DVD-ROM media) and printed copies of the available support documentation. Label and date DVD-ROM appropriately.
- .6 In each manual set, include electronic (PDF) copies of the List of Equipment Provided including owner-supplied equipment (excluding pre-existing equipment), with serial numbers on PC compatible CD-ROM media. Label and date DVD-ROM appropriately.
- .7 In each manual set, include electronic (PDF and source format such as AutoCAD 2004) copies of the As-Built Shop Drawings on PC compatible DVD-ROM media. Label and date CD-ROM appropriately.
- .8 The manuals shall be complete conforming to all items covered under Section 11.1 without omissions, and be submitted within 30 days of achieving substantial completion.

#### 1.12 SYSTEM OVERVIEW

- .1 This system overview provides a summary description of the sound system features that will be upgraded in the Atrium of the Sinclair Centre. A new stage platform will be added to the Atrium for public speeches and small-scale musical performance. A grand piano will be located at floor level adjacent to the stage and will have a permanent sound pickup added to allow the instrument to easily be reinforced by the sound system.
- .2 Stage
  - .1 The new stage will include a floor box for connecting up to four wired microphones for vocal or musical instrument reinforcement. Two line level outputs connections will allow monitor mixing from the manual mixer for more sophisticated musical performances, to feed future (or rented) stage monitor loudspeakers.

- .1 The piano will be located under the clock/bell column and will have a floor box with two microphone inputs to reinforce the piano (and piano vocal) sound in the atrium. A line level feed from the manual mixer will also be provided from the manual mixer, for use with a (future) stage monitor loudspeaker.
- .3 Microphones
  - .1 Microphones will be provided for a wide range of presentation and performance styles.
  - .2 One wireless beltpack transmitter will provide connections for either a lapel or earset microphone (both provided). One wireless vocal-type microphone will be provided for stand mounting or handheld use.
  - .3 Four wired cardioid microphones, two condensor vocal/instrument microphones and two dynamic vocal microphones will be provided.
  - .4 A passive transformer-based direct box will be supplied to allow the connection of a musical instrument directly to the sound system.
  - .5 The piano will be used alone for musical performances and is anticipated to be near the clock/bell pillar of the Atrium. To allow the piano to be reinforced by the sound system with a minimum of technical effort, a contact microphone be installed in the instrument. This pickup device will be mounted on the piano to minimize visibility and the risk of theft.
  - .6 There will be five round base microphone stands with boom arms provided, along with ten 4m long portable microphone cables.
- .4 Sound Mixers
  - .1 There will be two sound mixers, an automatic mixer for speech reinforcement and a manual mixer for music reinforcement. All the microphones are connected to both mixers using an eight input transformer-isolated splitter.
  - .2 The automatic mixer will adjust the relative levels for the two wireless microphones and six wired microphones (four on stage and two at piano) without requiring an operator. A master volume control on the front panel of the sound equipment rack is the only user adjustment required. The output from the automixer and the master output from the manual mixer will be alternately selected by a toggle switch mounted on the front panel of the equipment rack.
  - .3 The manual mixer will be installed on a slide-out rails in the equipment rack. When extended for use, this mixer will provide eight microphone input channels, for the wired and wireless microphones, along with a two line level channels for connection of music players or other line level audio sources.
  - .4 An XLR-3F mounted on the front panel of the equipment rack will provide for connection of a portable mixer (N.I.C.) for larger events.
  - .5 The auxiliary mixing busses of the manual mixer will be connected to (2) line outputs in the stage floor box and (1) a line output at the piano floor box. This will allow foldback mixes to be created on the manual mixer to feed stage monitor loudspeakers for the performers.
  - .6 A stage monitor system is currently beyond the anticipated routine use of the sound system, so it would be rented for events that require this additional level of support.
- .5 System Processor and Amplifiers
  - .1 A signal processor will follow the auto/manual mixer switch, to provide the signal conditioning suited to the primary loudspeaker arrays, the subwoofer and the listening assistance system. This will include the system equalization, crossovers and limiters set for each loudspeaker. A line input will also be provided to bypass both mixers, for events where an external mixer will be used to operate the event, using only the installed loudspeaker system component of the sound system.
  - .2 The primary loudspeaker arrays are self-powered and fed directly from an output of the signal processor. A cross-over in the processor will feed the subwoofer required to extend the lower octaves of the sound system to support music. Channel One of a rack-mounted dual-channel amplifier will provide 400 Watts to drive this low-frequency loudspeaker from a dedicated output of the system processor. Channel Two of the

amplifier will provide 400 Watts through a 70V transformer to drive the ceiling loudspeakers on the lower level of the Atrium.

- .3 An output with processing to reduce the dynamic range of the sound will be configured and connected to the listening assistance system transmitter.
- .6 Loudspeakers
  - .1 The primary loudspeakers will be a pair of line arrays, a vertical line of drivers in a compact narrow cabinet. These loudspeakers use a combination of bandwidth filters and signal delays for each driver to achieve a very specific dispersion of sound from the device. Using integrated digital signal processing, the active loudspeaker can be configured to provide two distinct lobes of coverage, one for the "main" floor (Lower Level) and one for the "balcony" audience on the Upper Level. This narrowly defined coverage of the Atrium will reduce the unwanted sound that will be reflected from unoccupied areas into the reverberant field (that can reduce in speech intelligibility). The line array is comprised of eight of each type of driver (4", 3" and 1") integrated into tightly packed vertical rows. The signal processing and power amplifiers are integrated into the cabinet immediately behind the drivers. The resulting loudspeaker is (HxWxD) 1483 mm by 171 mm by 150 mm (58" by 7" by 6") and two units are required to cover the width of the Atrium.
  - .2 A subwoofer will be installed to extend the frequency response of the sound for musical reinforcement. This loudspeaker will comprise of two 12" drivers designed specifically for infrasonic applications. A compact design (240 mm x 680 mm x 900 mm) will minimize the footprint of this device when installed below the stairway, off stage right. The device will be mounted close to floor level to gain from the floor reflection and minimize low-frequency spill onto the stage.
  - .3 The loudspeaker system will cover the Lower Level floor area of the Atrium, and the "balcony" areas within view of the stage from the Upper Level. Ceiling loudspeakers (replacing those from the existing sound system) are required to fill-in the sound to areas out of the direct sound from the primary loudspeakers.

## 2.0 PRODUCTS

### 2.1 GENERAL

- .1 Provide only new equipment and material approved for the installation and suitable for continuous operation, except where the owner's equipment is specified for reuse. Where the specifications do not describe a required item, furnish equipment or material consistent with the quality of other specified products, and best suited to the purpose required.
- .2 All audio equipment, with the exception of microphone inputs, loudspeaker outputs, and consumer (IHF) items in approved usage, is intended to operate at a nominal level of -20 dBm to +4 dBm on balanced floating 600 ohm lines. Provide buildouts, terminations, interstage attenuators and decoupling transformers as required.
- .3 Consumer (or music industry) items are nominally intended to operate at 200 mV (or -10 dBV) on unbalanced high-impedance lines. Provide buildouts, terminations, interstage attenuators and decoupling transformers as required.
- .4 Units designated as Optional will be listed separately from the Sound system package price and will include individual unit pricing.

### 2.2 AUDIO EQUIPMENT AND MATERIALS

- .1 Input Devices
  - .1 Wireless Beltpack Microphone Transmitter QTY: ONE
    - .1 Install UHF diversity wireless microphone system; adjustable-frequency transmitters/receivers operating in the 638 to 662 MHz band (L4); carrier

- frequency selectable from a total of 960 RF operating frequencies across a bandwidth of 24 MHz; automatic selection of optimal carrier frequency; audio bandwidth of 45 to 15,000 Hz, +/-2 dB; Gain Adjustment Range transmitter -10 dB to +20 dB; Modulation +/-15 kHz deviation compressor expander system with pre and de-emphasis; RF Power Output 30 mW; Dynamic Range >100 dB, A weighted; and RF Image Rejection 70 dB typical. Receiver and transmitter shall coordinate settings via IR transmission. Transmitter shall include display of RF frequency group; channel; RF frequency; lock status and battery level. Receiver shall include display of audio level; RF frequency group; and channel number.
- .2 Mount the ½ rack-unit receiver in the equipment rack and connect antenna inputs to remotely mounted antennas. Mount antenna on wall above equipment rack, confirm location with sound consultant prior to installation.
- .3 Include with each transmitter two sets of Nickel Metal Hydride (NiMh) "AA" size 1.5 volt rechargeable batteries and a battery charger mounted to a rack panel or shelf in the equipment rack. Battery life >8 hours with a pair of 1.5 "AA" batteries. Select clear frequencies on site based on RF site survey using wireless receiver. Supply with condenser lapel and earset microphones (below), each compatible with the wireless beltpack transmitter. Document handover to owner with signed receipt.
- .2 `Lapel Microphone - QTY: ONE
- .1 Provide electret condenser microphone in an lapel (lavalier) configuration with omni-directional pickup pattern. Nominal sensitivity shall be no less than 13 mV/Pa. Frequency response shall be 50 Hz to 15 kHz and produce an equivalent noise of less than 34 dBA nominal. Provide unit in black finish complete with windscreen, mounting clip and storage case and 2m Kevlar-reinforced portable cable. Cable and microphone shall be RF shielded to prevent noise induced by wireless personal communication devices. Provide with connector compatible with (above) wireless beltpack transmitter.
- .3 Earset Microphone - QTY: ONE
- .1 Provide electret condenser microphone in an earset (head worn) configuration with omni-directional pickup pattern. Unit shall be attached over the ear (one side, not wrap-around mount) with flexible boom arm mount. Short boom arm shall securely position capsule near talker's mouth. Nominal sensitivity shall be no less than 6 mV/Pa and maximum SPL shall be 122 dB SPL for 1% THD. Frequency response shall be 50 Hz to 15 kHz and produce an equivalent noise of less than 34 dBA nominal. Provide unit in black finish complete with windscreen, mounting clip and storage case and 2m portable cable. Cable and microphone shall be RF shielded to prevent noise induced by wireless personal communication devices. Provide with connector compatible with (above) wireless beltpack transmitter. Document handover to owner with signed receipt.
- .4 Wireless Handheld Microphone - QTY: ONE
- .1 Install UHF diversity wireless microphone system; adjustable-frequency transmitters/receivers operating in the 638 to 662 MHz band (L4); carrier frequency selectable from a total of 960 RF operating frequencies across a bandwidth of 24 MHz; automatic selection of optimal carrier frequency; audio bandwidth of 45 to 15,000 Hz, +/-2 dB; Gain Adjustment Range transmitter -10 dB to +20 dB; Modulation +/-15 kHz deviation compressor expander system with pre and de-emphasis; RF Power Output 30 mW; Dynamic Range >100 dB, A weighted; and RF Image Rejection 70 dB typical. Receiver and transmitter shall coordinate settings via IR transmission. Transmitter shall include display of RF frequency group; channel; RF frequency; lock status

- and battery level. Receiver shall include display of audio level; RF frequency group; and channel number.
- .2 The condensor microphone capsule shall have a supercardioid polar pattern with a self-noise level of less than 24 dB A-weighted and 2 mV/Pa sensitivity. Capsule shall match wired handheld condensor microphones (below).
- .3 Mount the ½ rack-unit receiver in the equipment rack and connect antenna inputs to remotely mounted antennas. Mount antenna on wall above equipment rack, confirm location with sound consultant prior to installation.
- .4 Include with each transmitter two sets of Nickel Metal Hydride (NiMH) "AA" size 1.5 volt rechargeable batteries and a battery charger mounted to a rack panel or shelf in the equipment rack. Battery life >8 hours with a pair of 1.5 "AA" batteries. Select clear frequencies on site based on RF site survey using wireless receiver. Supply with condenser cardioid handheld microphone. Document handover of transmitter to owner with signed receipt.
- .5 Handheld Condensor Microphone - QTY: TWO
- .1 Provide rugged handheld condenser microphones with supercardioid pickup pattern and integrated mechanical noise isolation to minimize handling noise. Nominal sensitivity shall be no less than 2 mV/Pa and maximum SPL shall be 117 dB SPL for 1% THD. Frequency response shall be 50 Hz to 20 kHz with a uniform response over the supercardioid pickup pattern. The unit shall produce an equivalent noise of less than 24 dB A-weighted for a signal-to-noise ratio of greater than 70 dB, and phantom powered by 48V at 1.2 mA. Unit shall weight 207 grams with an aluminum body in blue metallic finish with hardened steel capsule grille, integral breath filter and chrome plating. Unit shall have a balanced output with nominal 100 Ohm impedance terminated in XLR-3M connector. Supply each unit with two 7m portable microphone cables and stand-mount clip. Document handover to owner with signed receipt.
- .6 Handheld Dynamic Microphone- QTY: TWO
- .1 Provide rugged handheld dynamic microphones with cardioid pickup pattern and integrated mechanical noise isolation to minimize handling noise. Nominal sensitivity shall be no less than 1.85 mV/Pa. Frequency response shall be 50 Hz to 15 kHz with a uniform response over the supercardioid pickup pattern. Unit shall weight 298 grams with a die-cast metal body in grey enamel finish with steel mesh capsule grille and integral breath filter. Unit shall have a balanced output with 300 Ohm impedance terminated in XLR-3M connector. Supply each unit with two 7m portable microphone cables and stand-mount clip. Document handover to owner with signed receipt.
- .7 Condensor Contact Microphone- -QTY: ONE
- .1 Provide a condenser contact microphone for direct attachment to the owner's grand piano. Unit shall be 200 mm long by 20 mm wide and include adhesive tape for removable mounting to piano. Unit shall have a maximum output voltage of 1.5V at 600 Ohm impedance, dynamic range exceeding 155 dB at less than 0.05% harmonic distortion. Frequency response shall be 25 Hz to 50 kHz and a signal-to-noise ratio of greater than 83 dB A-weighted. The unit shall have a fully balanced output, phantom powered by 48V and terminated in XLR-3M connector. Installation in piano shall be undertaken only under the supervision of the sound consultant. Supply unit with two 7m portable microphone cables. Document handover to owner with signed receipt.
- .8 Direct Instrument Interface - QTY: ONE
- .1 Provide passive transformer-based direct box for connection of electric instruments to the sound system mixer inputs. Unit shall provide an unbalanced ¼" input jack at 140k Ohms impedance connecting to a nickel-laminated audio balancing transformer with dual Faraday shielding, a mu-

metal cover and turns ratio of 12:1. Output shall be 150 Ohm balanced with less than 0.05% harmonic distortion with input levels up to 21 dBu; a dynamic range of 135 dB; bandwidth of 20 Hz to 20 kHz with less than 1 dB variation; and terminate in an XLR-3M connector. Integrated switches shall provide for XLR pin #1 disconnection; 30 dB pad; loudspeaker output filter; polarity switch; and parallel input/merge connection. Unit shall have a highly rugged 14 gauge steel case with baked enamel finish and recessed connectors and switches. Supply unit with two 7m portable microphone cables. Document handover to owner with signed receipt.

.9 Microphone Transformer Splitter - QTY: ONE

- .1 Provide an eight-channel microphone splitter with direct-coupled signal connected to automatic mixer inputs and transformer-isolated output connected to microphone inputs on manual mixer. Unit shall have compression-type connections and will fully isolate the microphone signal and ground reference for each input. The unit's audio performance shall meet or exceed the performance of the audio mixers (above) that receive the signal from this unit. Install in sound equipment rack and dress connecting cables neatly to rack-mounted mixer inputs.

.10 Microphone Stand with Boom Arm - QTY: FIVE

- .1 Provide a round base stand with extending boom arm for mounting handheld microphones. Stand shall include wear-proof clutch for height adjustment from 900 mm to 1600 mm and 250mm diameter round (3.6 kg) weighted base with rubber feet. Tubing shall be made of cold-rolled steel with a black epoxy finish and terminated in 5/8"/27 threads for mic clip attachment. Boom arm shall be adjustable and extend from 483 mm to 940 mm with a 0.2 kg counterweight. Document handover to owner with signed receipt.

.2 Audio Mixers

.1 Manual Music Mixer - QTY: ONE

- .1 Install a rack-mounted manual mixer system with 8 microphone inputs and two dual stereo line level inputs. Each mic input channel shall have a balanced XLR-3F input connection; continuously variable gain trim ranging from 10 dB to 60 dB of gain; six auxiliary sends with a control range of -80 dB to + 6dB and sends #3 and #4 shall be selectable between pre- and post-fader routing; four-band equalization including two frequency adjustable (35 Hz to 1 kHz and 500 Hz to 15 kHz) mid-bands with a Q-value of 1.8; switchable 80 Hz at 12 dB/octave highpass filter; 20 dB input pad switch; 48V phantom power switch; pan control; mute switch; solo switch and 100 mm fader. Each input shall have a ¼" jack insert and ¼" jack direct output connections. The line input channels will be configured as selectable stereo inputs with four-band equalization of +/- 15 dB centred at 80 Hz, 250 Hz, 2.5 kHz and 12 kHz; pan control; mute switch; pre-fader-listen switch and 100 mm fader. Pre-fader listen indicator shall include level annunciation with two-segment LED audio level indication with levels below -12 dB illuminating one segment and the second segment when levels exceed 5 dB below clipping.
- .2 The mixer shall have a frequency response within +/- 0.5dB between 20Hz-20 kHz; signal-to-noise ratio of >80dB; output level of +24dB with less than 0.15%THD.
- .3 The mixer will have a total of 10 line level outputs. The inputs will each have high-pass filters and three-band parametric equalization. The outputs will be fully balanced with XLR-3M or ¼" phone jack connectors.
- .4 A dual-channel digital audio effects unit shall be integrated into the mixer and fed independently from Aux Sends #5 and #6. Feature can be enabled with illuminated switch and two banks of eight preset effects shall be provided.



- Preset effects shall be available for configuration using software on a computer connecting to the MIDI port on the rear panel of mixer. When bypassed, the mixer will allow for the connection of external processing via the effects return input connections.
- .5 Headphone monitoring shall include auxiliary bus selection, master outputs and PFL signals, via switch banks. A rotary level will control the output driving the 1/4" headphone jack. An independent level control will adjust the monitor out send on the connector panel of the mixer. A pair of twelve-segment LED will indicate levels on the bus currently assigned for monitoring. A separate LED will indicate when the PFL/AFL mode has been engaged, as this mode overrides the selected monitor bus.
  - .6 Unit shall be constructed using an all-steel chassis with compact footprint, designed for rack mounting, with a weight of 10 kg and dimensions of 483 mm x 444 mm x 194 mm. Rotate connector module for cable to exit to rear of mixer and provide cable management to allow harness to move with mixer to operating position. Mount unit in Sound Equipment Rack, on slide-out rails that fully expose mixing surface when in extended. Provide cable management to prevent cables binding or pinching when mixer is extended or retracted.
- .3 Automixer and System Processor - QTY: ONE
- .1 Install DSP-based modular and software configurable matrix mixer system with 8 microphone inputs and 2 line level inputs. The processor shall allow signal path to be designed free from pre-defined signal paths. The mixer shall have a frequency response within +/- 0.5dB between 20Hz-20 kHz; signal-to-noise ratio of >80dB; output level of +24dB with less than 0.15%THD using 24 bit A/D and D/A conversion at a 48 kHz sampling rate. The microphone automixer will have NOM level control and the automixed signal shall be assignable to any or all outputs. The mixer will have a total of six line level outputs, assignable through a matrix mix with crosspoint level adjust. The inputs will each have high-pass filters and the outputs will each have 5-band parametric equalization. The outputs will also have filtering, signal delay, and dynamic processing. Unit shall allow for the interconnection of audio and logic expansion units, which will communicate digital audio bus connections, NOM data; configuration and remote control between units. Connect to a logic interface for the Rack Control Panel switches, LED indicators and volume controls. The unit will be configured through computer software via Ethernet but a computer will not be required for operation. Configure unit as indicated in DSP Schematic Drawing SS 1.2. Mount unit in Sound Equipment Rack.
  - .2 Logic Control Interface - QTY: ONE
    - .1 Provide and install input/output control box and connect to the Remote Control Bus of the DSP. Unit shall provide four voltage control ports and four TTL-level logic ports that can be programmed in any combination of inputs/outputs. Connect as required to support the controls on the front of the sound equipment rack. The unit shall be compatible with DSP unit specified above (Section 0).
  - .3 Digital Audio Processor Programming
    - .1 Provide programming of the DSP audio processor.
    - .2 DSP programming to include signal path and signal processing as described in this document and indicated in DSP Schematic Drawing SS 1.2. Include programmed file with shop drawing submission.
  - .4 Signal Processing
    - .1 Line Level Decoupling Transformers - QTY: AS REQUIRED
      - .1 Provide single-channel 1:1 transformer to balance and isolate line level audio signals to and from the floor boxes and rack panel

connection. The minimum bandwidth of the device shall be 50Hz to 20kHz  $\pm 0.1$ dB capable of up to +22 dBu signal levels with less than 0.04% distortion at +4 dBu and CMR ratio exceeding 85 dB. Nominal impedance shall be 600 Ohms and connections terminated in compression fitting block. Unit must be appropriately mounted nearest the unbalanced input connection, clearly labelled and enclosed.

.2 Subwoofer Processor - QTY: AS REQUIRED

- .1 Provide dedicated processor for low-frequency extension of sound system bandwidth. Unit shall provide infrasonic filtering to achieve flat frequency response between 40 Hz and 120Hz, fully optimized for a sealed subwoofer cabinet operating below resonance. Input and output connections shall be balanced XLR-3-type with maximum input and output levels of +16 dBu with unity gain through the unit. Unit shall provide dynamic infrasonic filters with a maximum gain of +10 dB and maximum attenuation of -10 dB. Processing filter dynamic range shall exceed 105 dB with circuit noise levels below -90 dBu. The highpass frequency shall be selectable between 50 Hz and 200 Hz. Adjust infrasonic gain and dynamic filter settings in concert with amplifier gain to achieve reliable and robust operation of subwoofer. Install unit in Sound Equipment Rack with security cover to prevent unauthorized adjustment of front panel controls.

.3 Power Conditioner - QTY: (1)

- .1 Provide and install a power distribution and conditioning unit with eight industrial-grade AC power receptacles on the rear panel. A master switch on the front panel will control six of these outlets. A convenience outlet will be provide on the front panel. Power conditioning shall not include sacrificial devices or pass overages to the output ground bus. Unit shall include a circuit breaker in addition to surge protection circuitry. Surge protection shall limit surge let-through to 0 Volts with surges less than 6000 Volts. Filtering for electromagnetically induced noise and radio frequency interference shall be better than 40 dB at 300 kHz, 30 dB at 1 MHz, 50 dB at 3 MHz and 50 dB at 20 MHz. Unit shall be in a magnetically shielded steel enclosure that is 1 RU in height and has a captive 2.5 m power cable terminated in a U-Ground plug. Install unit in sound equipment rack to power active rack devices.

.4 Power Amplifiers

.1 Subwoofer and Ceiling Loudspeaker Amplifier - QTY: ONE

- .1 Provide and install a dual-channel power amplifier to power the subwoofer and 70V loudspeaker distribution circuit. Unit should have two balanced line-level inputs capable of input levels up to +22 dBu. Unit should be capable of at least 325 W into a four-Ohm load and 400 W into a 70V load with no more than 0.05% THD. Unit should have a bandwidth of 20 Hz to 20 kHz  $\pm 0.2$  dB, damping factor exceeding 500; and A-weighted noise should be over 107 dB below full power. Unit must have minimal radiation of acoustical noise from cooling or power supply transformer. Amplifier shall include full protection from: overload; short circuit; open circuit; ultrasonic oscillation; RF interference and radiation; and thermal overload. Input and output connections shall be compression fitting-type barrier blocks. Provide one 70V

output transformer for connection to ceiling loudspeaker circuit. Transformer shall have a frequency response of 75 Hz to 12 kHz + 0 dB/-3 dB; load regulation to within 1 dB; distortion below 0.05% between 150 and 15 kHz; and a fully isolated secondary winding. Unit shall be 2 RU in height. Install unit in the Sound Equipment Rack.

.5 Loudspeakers

.1 Line Array Loudspeakers - QTY: NINE

.1 Provide line array of drivers with integrated signal processing and power amplifiers with a computer-controllable dispersion pattern. The array shall consist of two cabinets that combine to provide eight 1" drivers, eight 3" drivers and eight 4" drivers in a vertical array. The complete unit shall achieve a maximum output level of 96 dB SPL at 30m. The bandwidth will be 110Hz – 20kHz +/-10dB. Unit shall provide beamwidth control down to 400 Hz and be capable of varying vertical dispersion from 10 to 100 degrees while maintaining a horizontal dispersion of 120 degrees. The integrated digital signal processing shall have an audio sampling rate of 96 kHz and be controlled via RS485. The integrated power amplifiers shall provide individual 100 W RMS outputs for each of the 32 drivers. Configure array coverage of audience area to minimize sound directed at ceiling while providing two distinct vertical lobes of on-axis coverage from each unit: main level and upper level. A/V consultant will provide array configuration details to contractor prior to shop drawing development. Ensure control connectivity is available for commissioning. Cabinet shall be 1483 mm by 171.5 mm by 150 mm and mounted securely in location approved by architect using manufacturer's approved mounting system. Confirm custom colour of finish with architect.

.2 Subwoofer Loudspeaker

.1 Provide and install a dual 12" subwoofer with a: nominal impedance of 4 Ohms, sensitivity of 96 dB at 1W/1m and 400 Watt power handling. Each driver shall have a 64 mm voice coil and 2.2 kg magnet. Cabinet shall be constructed of 11-ply birch plywood and tuned to resonate above the operating band of the drivers in a fully sealed back box. Unit shall require an infrasonic filter specifically to achieve the bandwidth of 8 Hz to 95 Hz +/- 3 dB without over excursion. The cabinet shall be 240 mm in height by 900 mm wide and 680 mm deep and weigh 35 kg. Input shall be five-way binding post or Neutrik Speak on connectors. Unit shall have a black finish with a vinyl coated steel grille. Install under stairway off stage right in location, as approved by Departmental Representative.

.3 Ceiling Loudspeakers - QTY: TWO

.1 Provide and install loudspeakers with 165 mm low-frequency driver connected through an integrated 2 kHz passive crossover to a coaxially-mounted 2.5 mm high frequency driver with a nominal system impedance of eight Ohms. High-frequency driver shall be ferro-fluid cooled neodymium magnet and

titanium diaphragm. Unit shall achieve 91 dB 1W/1m over a bandwidth of 75 Hz to 30 kHz with a nominal coverage angle of 90 degrees conical, directivity Q of 4.7 between 1 kHz and 6 kHz, and power handling of 80 W RMS for a maximum SPL of 110 dB RMS.

Third harmonic distortion at 10% of full power shall be less than 0.32% at 250 Hz, 0.32% at 1 kHz and 0.18% at 10 kHz. Drivers are mounted in a vented, injection moulded ABS front baffle and attach to a blind-mount back box with spring-loaded self-aligning clamps to mount to the GWB or tile ceiling. Unit shall be supplied with an integrated 60W 70V transformer, set to 30W tap at time of installation. Confirm mounting location with architect and sound consultant prior to installation.

- .6 Listening Assistance System
  - .1 FM Transmitter - Quantity (1)
    - .1 Install one FM transmitter with line and microphone level inputs. The unit will operate in designated 72Mhz listening assist bandwidth and capable of tuning to any one of 57 channels in a choice of wide-band or narrow-band channels. Audio bandwidth shall be 50 Hz to 15 kHz +/-3 dB with a signal-to-noise ratio of 80 dB with noise reduction enabled and less than 2% distortion at 80% RF modulation. The unit will have a built-in compressor to protect the user from sudden loud sounds. Unit shall have a 10-segment LED input level indicator. A fully balanced line input shall connect the unit to the designated output of the DSP system. The unit will be ½ rack width and include rack-mount hardware. The antenna will be mounted externally from rack. The unit will be powered from a wall mount power supply with CSA approval. Extend the antenna outside the rack using a ground plane plate. Confirm antenna location with architect and sound consultant. Install in the sound equipment rack.
  - .2 FM Receivers- Quantity (6)
    - .1 Provide a total of (6) six monaural tuneable neck loop receivers with 3.5mm jack for use with headset and induction loop. Receiver shall be capable of receiving on 17 wide-band and narrow-band frequencies. RF receiver shall have a sensitivity of 0.6uV over the range of 72.025 MHz to 75.975 MHz. An LED will provide indication of power, channel lock, low battery and charging status. Audio bandwidth shall be 50 Hz to 15 kHz +/-3 dB with a signal-to-noise ratio of 80 dB with noise reduction enabled and less than 2% distortion at 80% RF modulation. Unit shall be powered by two AA-format rechargeable batteries. Provide complete with headset, induction loop, and Nickel Metal Hydride rechargeable batteries. Provide (6) six with contract, deliver to Departmental Representative, and obtain receipt.
  - .3 Receiver Rechargeable Batteries - Quantity (6)
    - .1 Provide an extra set of Nickel Metal Hydride rechargeable batteries for FM receivers. Provide six (6) extra sets with contract, deliver to Owner, and obtain receipt.
  - .4 Receiver Battery Charger/Case - Quantity (1)

- .1 Provide a battery charger for approved receivers. Unit shall be a storage case that also provides a charging system specifically adapted to the above receivers. Unit shall be able to charge 8 receivers simultaneously. Deliver to Owner and obtain receipt.
- .5 Extra Ear cushions - Quantity (50pr.)
  - .1 Provide 50 pairs of ear cushions for the above specified headsets. Deliver to Owner and obtain receipt.
- .6 Audio Wiring
  - .1 Portable Microphone Cable
    - .1 24 AWG shielded twisted pair, polyethylene insulated, braided or serve-wrap 100% shield coverage, and abrasion resistant rugged jacket.
    - .2 Installed Microphone, Line Level and Foldback
      - .1 22 AWG shielded twisted pair, polyethylene insulated, 100% shield coverage, 22 AWG stranded drain wire, and CMR/FT4 rated insulation and jacket. Pull wiring in conduit and raceway provided.
- .7 Loudspeaker Main Runs
  - .1 Two-conductor 16 AWG stranded with CMR/FT4 rated insulation and jacket. Pull wiring in conduit and raceway provided.
  - .2 70 Volt Speaker Distribution
  - .3 Two-conductor 18 AWG stranded with CMP/FT-6 rated insulation and jacket. Pull wiring in conduit and raceway provided.
- .8 Connectors  
Do not intermix connector brands.
  - .1 XLR3/4M Panel and Cable Connectors
    - .1 3 & 4 pin XLR male connectors, mounted on plates or rack panels.
  - .2 XLR3/4F Panel and Cable Connectors
    - .1 3 & 4 pin XLR female connectors, mounted on plates or rack panels.
  - .3 XLR3F-1/4"TRS Panel Connectors
    - .1 Combined 3 pin XLR and 1/4" TRS panel connectors
  - .4 RCA Panel Connectors
    - .1 Recessed RCA-type bulkhead jacks with solder terminal on rear and chassis ground isolation.
  - .5 3.5 mm Headphone Connectors
    - .1 Connectors shall be fully-moulded or the cable connections encapsulated (termination void filled with silicone) to maximise mechanical integrity of connections.
  - .6 1/4" TRS Panel and Cable Connectors
    - .1 Connectors shall be constructed to maximize electrical contact and mechanical integrity of connections.
  - .7 Screw Terminals

- .1 Polyamide channel mounted modular terminal blocks accepting wire ranges 22 AWG to 8 AWG. Provide ferrules when necessary for the wire size.
- .8 Portable Loudspeaker Connectors
  - .1 Connector shall be specifically designed for professional sound system applications, with four concentric wiping contacts on a latching in-line connector.

## 2.3 HARDWARE & MATERIALS

- .1 Enclosures and Cabinets
  - .1 Equipment Rack - Quantity (1)
    - .1 Provide and install one EIA-compliant 470mm" (19") equipment rack on a castor base. Unit shall have 21 RU spaces available for equipment installation. Provide vent panels as required to serve convection-cooled equipment. Confirm adequate airflow through rack door during initial power-up of installed equipment to maintain a rack ambient air temperature below 28° C during normal operation. Ensure equipment rack meets specified grounding requirements. Permanently attach all items in the rack to panels or shelves. Provide locking, vented rack door suited to securing rack equipment from unauthorized access in a public area.
    - .2 Do not load AC outlets over 80% of capacity. Where power amplifiers are installed in the rack, isolated ground receptacles in standard single-gang boxes may replace the outlet strip. Where external AC power supplies are required, use a horizontally-mounted power bar with outlets facing up. Power bars are to be commercial-quality with metal case.
    - .3 Include blank panels (1U to 3U maximum) to complete front bay of rack. Install rack equipment and panel plates using flat head socket or Allen head machine screws countersunk in plastic cup washers. Install unit in within the GWB recess as provided in the Atrium on castor base to allow the rack to roll out for installation and service work. Confirm location with Departmental Representative prior to installation.
  - .2 470mm" (19") Rack Shelf - QTY: as required
    - .1 Provide the required 470 mm" (19") rack mount shelves to secure mount any none-rack mountable equipment in the equipment rack.
  - .3 Connector Plates & Mounting Boxes
    - .1 Downstage Centre Floor Plate - QTY: ONE
      - .1 Provide a connector plate with: four XLR-3F microphone jacks connecting to the microphone splitter; and two XLR-3M connecting to the manual mixer auxiliary outputs #1 and #2 via a balancing transformer.
  - .4 Piano Floor Plate - QTY: ONE
    - .1 Provide a connector plate with: two XLR-3F microphone jacks connecting to the microphone splitter; and one XLR-3M connecting to the manual mixer auxiliary outputs #3 via a balancing transformer.
  - .5 Rack Mounted Input and Control Plate - QTY: ONE
    - .1 Provide a 1U rack plate with an XLR-3F line input connector, volume control and mode switch. Connect to the system processor and logic interface respectively.

### 3.0 EXECUTION

#### 3.1 INSTALLATION

- .1 Secure all equipment, except portable equipment, in place with a safety factor of at least three. Adequately ventilate all equipment for worst-case power dissipation, including a minimum of 1U spacing between each power amplifier.
- .2 Install all equipment in such a manner as to present no safety hazard to operating personnel. Carry out all installation work in neat and orderly fashion, mounting hardware parallel to, or perpendicular to, building lines. Provide this specification and contract documents on the job site at all times.

#### 3.2 MOUNTING, RIGGING AND SEISMIC RESTRAINT

- .1 All overhead mounting or rigging installations of loudspeakers components, loudspeaker systems and projector brackets must have received the approval of a Professional Structural Engineer at the shop drawing stage prior to installation. Rigging shall not include the use of chain for suspension or restraint. Where the Sound Contractor uses loudspeaker enclosures or systems that are factory equipped with rigging or mounting points, the rigging or mounting hardware and the attachment to the building or support structure must be certified. Component mounting in the enclosures must make use of bolts and threaded inserts or locknuts. Self-threading wood or sheet metal screws are not acceptable for driver mounting to the baffle. Chain is not acceptable for attachment of any loudspeaker component or system. Loudspeaker mounting clamps that grip the edge of the loudspeaker frame, and are put in compression by a through bolt are not acceptable. All loudspeakers must be mounted by bolts through mounting holes in the frame.
- .2 Loudspeaker components such as moulded fibreglass horns, cast or injection moulded plastic speaker enclosures or horns, etc. must never be supported by a system using the drilled or moulded holes through the plastic material. All mounting holes or attachment points must have aluminum or steel reinforcement to prevent breakaway or tear-out of the material surrounding the holes. Ceiling-mounted loudspeakers shall include approved tile-bridge and safety restraint hardware when mounted in tile/grid ceilings.
- .3 All wooden loudspeaker enclosures that are custom manufactured for the project must be built of LEED compliant material, not particle board or medium density fibreboard. All joints between panels (including baffles and backs) must be reinforced with structural steel or aluminium bracing, bolted through the enclosure, using Nyloc nuts, or permanent thread locking compound on the bolts. All rigging or suspension points must pick up these structural members of the enclosure. No glue joint shall be placed in tension when suspending a loudspeaker enclosure. Component mounting in the enclosures must make use of bolts and threaded inserts or locknuts. Self threading wood or sheet metal screws are not acceptable for driver mounting to the baffle. Loudspeaker mounting clamps that grip the edge of the loudspeaker frame, and are put in compression by a through bolt are not acceptable. All loudspeakers must be mounted by bolts through mounting holes in the frame. Especially large or heavy drivers may require the use of an internal safety cable attached to the speaker frame and an internal rigging point.
- .4 Rigid and fixed mounting systems (brackets, tube and clamp, frames etc.) used for any piece of suspended equipment must have a safety cable attached between the suspended device and the superstructure used to support the mounting system. The size and construction of the safety cable, and attachment points must be suitable to support the weight of the equipment being restrained.
- .5 Flexible rigging systems (aircraft cable) must be installed by a Certified Rigger. Flexible mounting systems must have suitable seismic restraint sway bracing provided. Seismic restraint systems (if required by local building code) must be approved by a Professional Engineer.

- .6 All free standing equipment racks, trolley or caster equipped racks intended for permanent locations, free standing or platform mounted loudspeakers, and other equipment of significant mass with freedom of movement must be equipped with a suitable restraint system that can be disconnected for servicing of that equipment.

### 3.1 WIRING

- .1 Route microphone cables in separate conduit or raceways and maintain separation of all other cables in tray system and equipment racks by level and function: microphone circuits, line level circuits, loudspeaker circuits, intercom circuits, control circuits and 120 volt AC power circuits. Neatly arrange cables with plastic cable ties. Avoid tight bundling, and twist cable bundles into a spiral configuration before installing cable ties. Allow a minimum of a 1- metre spiral bound slack service loop when entering racks or panels. Exercise care to avoid damage to wiring or equipment.
- .2 Make all signal connections within systems with rosin-core solder or approved mechanical connectors. Untidy or cold solder joints will be rejected. Use proper crimping tools for mechanical connectors.
- .3 Do not splice cables except with permission of the Sound consultant.
- .4 All connections using shielded pair audio cable shall include cable dressing as follows. The shield, or drain wire shall have a clear Teflon, or green PVC, or heatshrink sleeve covering exposed conductor between the connector, or termination and the cable jacket. A heat shrink boot, or Hellerman sleeve shall be used on any cable that uses a braided shield or spiral wrap shield where the cable is dressed for termination.
- .5 All audio circuits, unless otherwise specified, shall be balanced, floating and shielded two wire circuits with the red or white wire hot (connected to pin 2 of XLR3 connectors and to the Tip of phone connectors) and the black wire cold (connected to pin 3 of XLR3 connectors and to the Ring of phone connectors).
- .6 Make input connections to power amplifiers with XLR3 connectors or with spade lugs on barrier terminal strips. Do not make input connections with ¼-inch phone plugs.

### 3.2 BUILDOUTS AND TERMINATIONS

- .1 All equipment in the audio chains **MUST** be connected to preserve correct signal levels, impedance and polarity throughout the system. Mount all components on Veroboard inside suitable insulating enclosure. Provide block and level diagrams, specific to the equipment being offered, showing all equipment impedances, interstage loss pads, buildouts and terminations proposed to accomplish this. Include in the shop drawing submission. Shop drawings without this detail will be rejected.

### 3.3 GROUNDING AND SHIELDING

- .1 Isolate all racks containing Sound system equipment from the building and electrical grounds. Bond adjacent equipment racks with #6 AWG insulated ground cable. Connect all racks containing Sound system equipment to only the dedicated Sound system ground point. Conduit and tray systems containing audio and control wiring will be permanently connected to the electrical ground.
- .2 Do the utmost to prevent ground loops of any type.
- .3 Isolate the shields of all shielded cables from both the conduit system and any other shielded cables. Provide continuous shield from source to input point, with shields grounded at the output point and lifted at the input connection. Properly serve all unconnected shielding. For microphone cables, provide continuous shield from microphone receptacle to microphone preamp or mixer input and ground only at preamp/mixer. Provide separate shield terminal for



each circuit in multipin connectors - no common shield terminals will be permitted. Pin 1 on XLR type connectors must not be connected to the connector barrel or shell.

### 3.4 MARKING

- .1 Mark all wiring with PVC or neoprene slip-on sleeves, or with tape type markers with a clear heat shrink boot, indicating approved circuit number.
- .2 Record circuit numbers and wire destinations on as-built drawings and schedules. List spare circuits.

### 3.5 NAMEPLATES

- .1 Provide engraved metal or plastic nameplates to identify each and every receptacle. Fill engraving with a contrasting colour as approved on shop drawings. Identify normalled circuits. Dymo labels are not acceptable. Decal type labels (Brother) are not acceptable in high wear applications or areas within public view.
- .2 Identify all racks and panels as specifically noted on the drawings.
- .3 Submit all nomenclature to the Owner and Sound Consultant for approval prior to installation.

### 3.6 FINISHES

- .1 Finish all racks, panels, loudspeakers, baffles, grilles and other hardware exposed to the public with materials as selected by the Owner.
- .2 Provide stainless steel or brushed aluminum covers for individual or ganged outlets unless otherwise directed by the Owner.
- .3 When directed by the Owner, paint outlet covers to match finishes in the area.
- .4 Make good, to the Owner's satisfaction, any finishes damaged during the course of construction.

### 3.7 TESTING

- .1 Conduct tests to demonstrate that the Sound system is properly functional and that the installation does not degrade the performance of the installed equipment:
  - .1 After installation, measure and document the sum of the harmonic distortion, noise floor and gain for a typical path from microphone level input to amplifier output. Include additional measurement data for path through sub-mixer and auxiliary outputs.
  - .2 Measure and document gain structure through the signal path from input to output for each typical signal level. Repeat with sine wave sweep from 50 Hz to 15kHz to record any additional adjustments required by equalization. Repeat with full bandwidth pink noise signal, or swept test signal to record equalizer wide-band gain.
  - .3 Using a time-domain analyzer equalize the loudspeaker systems to conform to the attached Sound System Equalization Curve. Measurements must be windowed to include only the direct arrival from the loudspeaker and 10 ms thereafter. Measurements must include a minimum of three locations in the three paging areas (selected at random by the consultant). Provide copies of the measured response to the Sound system consultant for review.
  - .4 Ensure that system is free of spurious oscillation and RF noise up to 5 MHz.
  - .5 Test polarity of signal equipment and amplifiers. Test polarity of loudspeaker wiring: red = (+), black = (-). Drive all loudspeakers in phase, and absolute polarity. Test absolute polarity of the voice and playback systems, input to output, and ensure that the sum of all signal paths is in polarity. If it is necessary to invert signal polarity at any stage or interconnect point to preserve system polarity, document that polarity change on as-built drawings.

- .6 With musical program, drive each loudspeaker to rated or maximum sound pressure level without amplifier clipping and eliminate buzzes, rattles or other vibration. Repeat with sinewave sweep from 20 Hz to 8000 Hz at 10 dB below rated loudspeaker output.
- .7 Ensure that residual noise and hum at rated output are below NC-25 when measured from the any typical listening position.
- .8 Ensure that audio wiring is free from ground loops. Demonstrate, by removal of jumper, that racks and panels are isolated from the electrical conduit ground.
- .9 Document the impedance of each loudspeaker line, measuring the load of the loudspeaker line and loudspeakers. Measurements shall be made at amplifier output for direct-coupled loads, and after the amplifier output transformer for transformer-coupled configurations. Impedance values shall be submitted for no less than three frequencies (100 Hz, 1000 Hz and 10,000 Hz), although broadband data is preferred.
- .10 Forward to the Sound Consultant a complete report detailing test results obtained above, accompanied by a letter certifying that all audio components meet manufacturer's specifications and that the system is complete and ready for inspection.

### 3.8 TEST EQUIPMENT

- .1 Provide the following audio test equipment on site during check-out:
  - .1 Time domain measurement system for setting of direct sound equalization.
  - .2 Sound level meter with linear response and 1/2 inch free field microphone.
  - .3 Audio test set with low distortion signal generator, true RMS meter, and facility to measure THD.
  - .4 5 MHz oscilloscope.
  - .5 Pink noise generator
  - .6 All cables, connectors and adaptors necessary to interface with the sound system.
- .2 Provide test equipment of professional quality and in good working order. Substandard equipment will be cause for rejection. The Sound Consultant reserves the right to demand proof of equipment accuracy.

### 3.9 ADJUSTMENTS

- .1 After demonstrating satisfactory system operation to the Sound Consultant, provide system equalization with all interior finishes and furnishings in place. Measure uncorrected house response of the sound reinforcement loudspeakers at no less than four (4) positions selected by the Sound Consultant. Adjust equalizer to shape house response for the voice system. Measure and correct prominent ring modes by measuring with the handheld wireless microphone and wireless lavalier microphone on stage. Measured response after equalization shall fall within the limits defined on Figure # 1 at designated measurement locations. With pink noise input, record maximum sound pressure level after equalization.
- .2 Forward to the Sound Consultant a complete report of adjustments.
- .3 Schedule final adjustments to take advantage of essentially quiet conditions.

**3.10 SOUND SYSTEM EQUALIZATION CURVE**

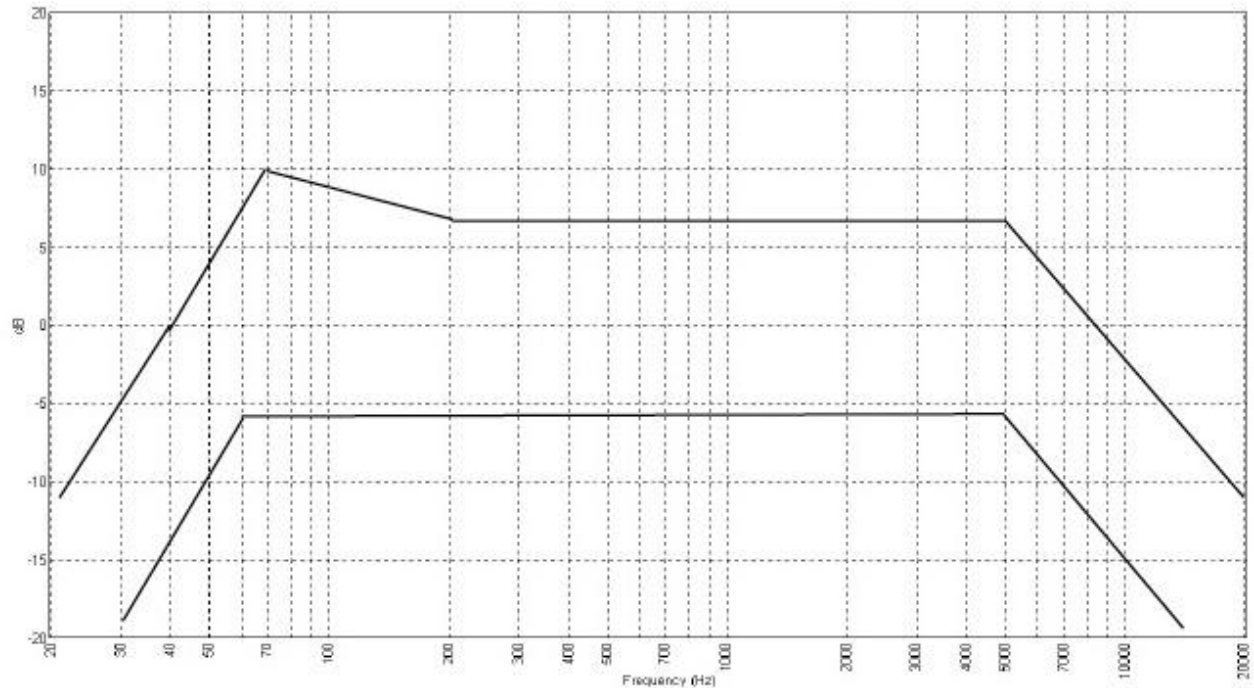


Figure 1: LOUDSPEAKER SYSTEM FREQUENCY RESPONSE LIMITS

**3.11 SYSTEM SCHEMATIC DIAGRAMS AND DRAWINGS**

- .1 The following documents and schematics for the sound system are attached:
  - SS1 SOUND SYSTEM SCHEMATIC
  - SS2 SOUND SYSTEM DSP SCHEMATIC
  - SS3 RACK ELEVATION
- .2 The following drawings provide information on infrastructure and architectural details related to the sound system installation:
  - A19 – BUILDING SECTIONS
  - E10 - ATRIUM NEW POWER & COMMUNICATION - LEVEL B1 LOWER MALL FLOOR PLAN (NE)

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Specifies the materials, master and sub-stations, power supply and installation for a colour video intercom system.

1.2 SCOPE

- .1 Supply and install a audio-video intercom system in locations shown on the drawings.
- .2 Systems to include master stations c/w audio-video monitor, door stations c/w microphone, speaker, video cameras, camera adaptors, door release relays, and power supplies.
- .3 Each system to be complete with all necessary components to provide function required whether or not each and every item is necessarily mentioned.
- .4 Electrical Division to be responsible for supply and installation of all backboards, conduit, pull-boxes and standard trade size junction boxes, device boxes and terminal panels where required to provide a complete system.
- .5 Communication contractor shall supply all specialty junction boxes, device boxes and terminal panels to the Electrical Division for installation.
- .6 Indicated conduit and panel sizes not to be reduced, or the layouts revised, without prior approval of the Consultant.
- .7 Door release function from any master station is not required. Do not enable door release from any master intercom stations.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include riser diagram, talk paths of complete intercom system.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide data for incorporation into maintenance manual specified in Section 01 78 00 - Closeout Submittals
- .2 Include description of system operation.
- .3 Include parts list using component identification numbers, standard to electronics industry.

1.5 DESIGN PERFORMANCE REQUIREMENTS

- .1 The Audio-video entry security intercom system shall support a maximum of 3 color video door stations and a maximum of 5 room stations with monitor with tilt camera control.
- .2 Operation of door station call-in:
  - .1 Press CALL button at a door station.
  - .2 At all room stations, chime tone sounds and image comes on.
  - .3 Move door station camera with TILT control button, if necessary.
  - .4 Lift handset on any room station.
  - .5 When finished, replace handset. Image turns off.
  - .6 Calling Inside with Direct Voice:
    - .1 Momentarily depress CALL button on door station.
    - .2 Speak toward video door station. After chime tone sounds, start speaking.

- .3 Inside room, after chime tone sounds and monitor shows image, outside voice audio is heard.
- .3 Monitoring Door Stations:
  - .1 While in standby, press MONITOR button.
  - .2 Both audio and image of door station 1 turn on for approximately 30 seconds.
  - .3 Move door station camera vertically, pressing either top or bottom edge of TILT control button.
  - .4 Press MONITOR button to view door station
  - .5 Press MONITOR button third time to view door station 3.
  - .6 Press MONITOR button to end monitoring.
  - .7 When Another Room Station Calls-In During Monitoring:
    - .1 View and hear door stations 1 to 3 hands free.
    - .2 Room call-in starts with pre-tone, double tone for selective call or single tone for all call, ending monitoring mode.
    - .3 Lift handset to connect with calling room station.
  - .8 When Another Door Station Calls-In During Monitoring:
    - .1 While one door station is being viewed on monitor, another door station calls in.
    - .2 When door station calls, chime is heard, and image changes to that of calling door station.
    - .3 Lift handset to reply to door station.
- .4 Internal Communication:
  - .1 Calling by Selective Call:
    - .1 Lift handset and press a station selector button. ALL CALL button turns on.
    - .2 Call by voice and communicate when called person replies hands free.
  - .2 Calling by All Call:
    - .1 Lift handset and press ALL CALL button. ALL CALL button flashes red.
    - .2 Call by voice and communicate when called person picks up to reply. ALL CALL button turns on.
  - .3 Answering Selective Call:
    - .1 Double pre-tone sounds and caller's voice is heard. ALL CALL button is steadily lit.
    - .2 Without lifting handset, reply toward station microphone.
    - .3 When conversation is complete, calling station hangs up handset.
- .5 Transferring Door Station Call:
  - .1 Transferring:
    - .1 While communicating with door station, press selector button or ALL CALL button. Call-in LED begins flashing.
    - .2 Call by voice and hear response from other door station. Inside audio cannot be heard at door station.
    - .3 First person hangs up handset after transferring call to second person.
    - .4 Transferred station presses MONITOR button to connect to door station. Door station call-in LED is steadily lit.
  - .2 Receiving Transferred Call:

- .1 Sounds double pre-tone for selective call or single pre-tone for all call sounds and voice comes in.
  - .1 Lift handset and okay to answer door station.
  - .2 Holding handset, press MONITOR button to connect with door station.

1.6 SYSTEM START-UP

- .1 Provide instructions in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.0 PRODUCTS

2.1 MATERIALS

.1 Audio-Video Master Intercom Stations:

- .1 Supports: 3 x colour video door stations, 5 room stations with monitor with tilt camera control.
- .2 Power: 24VDC
- .3 Current: 860mA Max, 220mA Standby
- .4 Multi-tone: 3 separate tones, assignable to separate doors
- .5 Communication: Simultaneous with handset
- .6 Video Monitor: 4-inch direct-view TFT colour LCD. 525 TVL resolution
- .7 Tilt camera control: Yes
- .8 Door release button: Yes
- .9 Door call-in LED's: 3
- .10 Screen Brightness: Adjustable
- .11 Monitor Control: Adjust audio monitor volume of door stations.
- .12 Tone Volume Control: Adjust chime tone and receive volumes
- .13 Housing: ABS plastic
- .14 Colour: White
- .15 Approved Product: Aiphone KB-3MRD Series, Sub masters KB-3MRD Series. Comes with power supplies PS-2420UL.

.2 Colour-Tilt Video Door Intercom Stations:

- .1 Mounting: 1-gang surface mounted
- .2 Power: 22VDC Supplied by master station
- .3 Current: 260mA max
- .4 Communication: Simultaneous in open voice, hands-free
- .5 Microphone: Built-in
- .6 Speaker: Built-in
- .7 Camera: ¼ inch colour CCD.
- .8 Night Viewing: 1ft in front of camera
- .9 Taper-proof cover: Yes
- .10 Environment: Weather resistant
- .11 Housing: ABS plastic
- .12 Colour: Grey

- .13 Operating Temp: -10 C to +60C
- .14 Approved Product: Aiphone KB-DAR Series

.3 Intercom Station Wiring:

- .1 Aiphone: 871802
- .2 West Penn: D990

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install equipment as indicated on drawings, specification and in accordance with manufacturer's instructions.
- .2 Interconnect system components.
- .3 Adjust all audible volume to suit owner. Coordinate with owner.
- .4 Mount intercom door station as per manufacturer recommendations. Typical 5ft AFF.
- .5 All cabling shall be home-run, un-spliced.
- .6 All wiring terminations at the door station shall be weatherproof connectors.
- .7 Install intercom door stations in area that are not in the direct line of rain.

3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Conduct performance test.
- .3 Test all audio channels, video channels, door release functions, tone levels, and microphone levels.
- .4 System tests and adjustments to be conducted by the system installer upon completion installation to determine conformance to the requirements of the specification. Tests to be completed prior to the systems demonstration to the Owner.
- .5 All equipment or wiring provided by system installer which prove to be defective or operating improperly to be corrected or replaced promptly at no additional cost to the Owner.
- .6 The Owner may suspend or discontinue the demonstration at any time if the performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the discretion of the Owner.
- .7 Electrical Division to allow for all the time involvement in coordinating and carrying out of all tests and the Owners demonstration.

3.3 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum two (2) sessions of half (1/2) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the intercom systems.
- .2 Coordinate training schedules with the owner's departmental representative.

END OF SECTION 275123

## 1.0 GENERAL

### 1.1 OVERVIEW

- .1 Supply and Install a card access system as described in the specifications and drawings.
- .2 The Card Access System shall be Lenel OnGuard series.
- .3 The contractor shall provide all required hardware, software, and programming required for the card access and intrusion alarm systems.
- .4 The card access system shall be integrated with the Intrusion Alarm and CCTV systems.
- .5 The contractor shall provide all required components to supply a fully functional card access system as described in the contract documents. The contractor shall provide all required components that are not listed in the specification but are required to supply a fully functional card access system as described in the contract documents.
- .6 Supply and install card access software on a local access control workstation.
- .7 The card access system shall utilize the security systems network switch. Refer to drawings and Section 28 23 00 Video Surveillance.
- .8 Supply and install equipment in the cabinet that will be provided for the CCTV system.
- .9 Provide UPS backup for all active (powered) equipment.
- .10 Electric Strikes and mechanical locking device shall be provided by the door hardware contractor. Coordinate all mechanical locking devices requirements with door hardware contractor. Electric Strike wiring shall be provided by the Security Systems contractor.
- .11 The security systems contractor shall ensure that all mechanical locking devices/hardware will conform to type and function as specified on drawings.
- .12 Provide an Intrusion alarm communications module to report alarms to an alarm monitoring company. Coordinate with owner's departmental representative regarding the connection of the alarm reporting module to the owner's telephone line.
- .13 Provide a GSM auto dialer/back-up for reporting to a central monitoring station in the event of signal loss of main dedicated telephone line.

### 1.2 SUMMARY

- .1 Section Includes:
  - .1 This section of the specification forms part of the contract documents and is to be read, interpreted, and co-ordinated with all other parts.
  - .2 Specifications to supply, install, and operate an integrated security management system.

### 1.3 RELATED SECTIONS

- .1 Section 01 11 00 – Electrical General Provisions
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 26 05 00 – Common Work Results – Electrical
- .5 Section 26 05 01 – Seismic Restraints – Electrical
- .6 Section 26 05 07 – Elevators
- .7 Section 26 05 21 – Wire and Cables
- .8 Section 26 05 34 – Conduit, Conduit Fastenings and Fittings
- .9 Section 27 13 00 – Backbone Cabling



.10 Section 27 15 00 – Communications Cables Inside Buildings

.11 Section 27 05 28 – Pathways for Communications Systems

#### 1.4 REFERENCE STANDARDS

.1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:

.1 Building, fire, electrical and labour codes and standards.

.2 Workmanship shall meet or exceed nationally accepted workmanship standard.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S301 latest edition, Central and Monitoring Station Burglar Alarm Systems

.2 CAN/ULC S302 – latest edition, Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults

.3 CAN/ULC S303 latest edition, Local Burglar Alarm Units and Systems

.4 CAN/ULC S304 – latest edition, Central and Monitoring Station Burglar Alarm Units

.5 ORD C827 – latest edition, Central Stations for Watchman, Fire alarm and Supervisory Services

.6 ORG C1076 – latest edition, Proprietary Burglar Alarm Units and Systems

.7 ORD C488 – latest edition, Remote Burglar Alarm Signalling Centres

.3 Underwriters' Laboratories (UL)

.1 UL 294 latest edition, Standard for Safety for Access Control System Units

.2 UL 365 – latest edition, The Standard for Police Station Connected Burglar alarm Units and Systems

.3 UL 609 1996, The Standard for Local Burglar Alarm Units and Systems

.4 UL 827 1996, Standard for Central Station Alarm Services or (the Standard for Central Station for Watchman, Fire Alarm and Supervisory Services)

.5 UL 1076 1995, Standard for Safety for Proprietary Burglar Alarm Units and Systems

.6 UL 1610 1998, The Standard for Central Station Burglar Alarm Units

.7 UL 1635 1996, The Standard for Digital Alarm Communicator System Units

.8 UL 1981 1994, Standard for Central Station Automation Systems

#### 1.5 SCOPE OF WORK

.1 Supply and installation of a complete and operating system including but not necessarily limited to:

.1 Card readers

.2 Card reader interface modules

.3 Card access system Server and Client software

.4 Card access system accessories

.5 Card access system peripherals

.6 Card access transmission methods

.7 PC workstations

.8 Card access servers

.9 Card access network

.10 Card access equipment cabinets/racks

.11 Intrusion alarm devices

## 1.6 DEFINITIONS

- .1 SMS: Security Management System
- .2 CCTV: Closed Circuit Television System
- .3 CA: Card Access System
- .4 CR: Card Reader
- .5 REX: Request-to-exit sensor
- .6 DPS: Door Position Sensor
- .7 P.S.: Power Supply
- .8 ES: Electric Door Strike
- .9 MT: Mortise Door Lock
- .10 UPS: Uninterrupted Power Supply
- .11 DGP: Data Gathering Panels

## 1.7 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit manufacture's literature for each system component.
  - .3 Submit:
    - .1 Functional description of equipment
    - .2 Technical data for all devices
    - .3 Device location plans and cable lists
    - .4 Devices mounting location detail drawings
    - .5 Typical devices connection detail drawings
    - .6 Programming worksheets
- .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit shop drawings to indicate project layout, including details as follows:
    - .1 Indicate mounting heights and locations.
    - .2 Wiring diagrams.
    - .3 Complete equipment list.
- .3 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 The manufacturers of all hardware and software components employed in the SMS shall be established vendors to the access control/security monitoring industry for no less than five (5) years and shall have successfully implemented at least 5 systems of similar size and complexity.
  - .2 The security system integrator shall have been regularly engaged in the installation and maintenance of integrated access control systems and have a proven track record with similar systems of the same size, scope, and complexity.

- .3 The security system integrator shall supply information attesting to the fact that their firm is an authorized Corporate Dealer.
- .4 The security system integrator shall supply information attesting to the fact that their installation and service technicians are competent factory trained and certified personnel capable of maintaining the system and providing reasonable service time.
- .5 The security system integrator shall provide a minimum of three (3) references whose systems are of similar complexity and have been installed and maintained by the security system integrator in the last five (5) years.
- .6 There shall be a local representative and factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for these systems.
- .7 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .1 Submit ULC/UL/CSA Product Safety Certificates.
  - .2 Submit verification Certificate that Installation/service Company is ULC/UL Listed alarm service Company.
  - .3 Submit verification Certificate that security access system is "Certified Alarm System".
- .8 Instructions: Submit manufacturer's installation instructions.
- .4 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .1 Include:
    - .1 System configuration and equipment physical layout
    - .2 Functional description of equipment
    - .3 Instructions of operation of equipment
    - .4 Illustrations and diagrams to supplement procedures
    - .5 Operation instructions provided by manufacturer.
    - .6 Cleaning instructions
    - .7 All programming worksheets

#### 1.8 CONTRACTOR QUALIFICATIONS

- .1 The Security/Access Control/Intrusion Alarm Control System, shall be installed by a qualified Security Systems Contractor, certified by the respective equipment manufacturer, and having a minimum of five years installation and service experience with similar installations.
- .2 The contractor business, employees, managers and owners must be licensed in the Province of British Columbia under the Private Investigators and Security Agencies Act.
- .3 The business must be licensed and bonded as an Alarm Service and each employee who is installing and servicing security alarm devices and equipment, must be licensed and bonded as an employee of the company and not as a sub-contractor.
- .4 The equipment installers must hold a valid Trade Qualification Certificate issued by the Province of British Columbia. Proof of the Company and Installers Certification shall be requested and reviewed prior to contract award.

#### 1.9 WARRANTY

- .1 For all materials, the 12-month warranty for parts and labour.
- .2 Provide a separate maintenance and service agreements options for the following:

- .1 Extending warranty by 12-months
- .2 Extending warranty by 24-months
- .3 Extending warranty by 36-months
- .4 Additional maintenance and service agreements, with parts to be considered as extra.
- .3 Manufacturer's Warranty: Submit, for Department Representative's Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official.

## 2.0 PRODUCTS

### 2.1 SUPPLY OF SYSTEM COMPONENTS

- .1 Unless otherwise specified in this document, the contractor shall supply all components necessary to complete the system. All materials shall be new and of the latest hardware, software, and firmware versions.

### 2.2 MATERIALS

- .1 Provide only ULC/UL Listed access control and security access systems products.
- .2 Security Systems Software: Lenel OnGuard Series
- .3 Card Access System Server:
  - .1 PC: Dell PowerEdge R710
  - .2 CPU: Intel Xeon E5520, 2.26GHz, 8M Cache, Turbo, HT, 1066MHz
  - .3 Ram: 4GB Memory, 1066MHz dual Ranked UDIMMs
  - .4 Optical Drive: 24 x IDE CD-RW/DVD ROM Drive
  - .5 Hard Drive (OS): 160GB, 7.2K RPM SATA 2.5" Hot Plug
  - .6 Hard Drive (Database): 160GB, 7.2K RPM SATA 2.5" Hot Plug
  - .7 Backup HD: RD1000, Internal SATA Drive Bay for 2.5" Chassis
  - .8 Removable Backup: RD1000, Internal Removable Hard Disk 160GB/320GB
  - .9 Network Ports: 4 x 10/100/1000 Ethernet
  - .10 Serial Ports: 1
  - .11 USB Ports: 6
  - .12 Audio: Speaker output
  - .13 USB Keyboard: Included
  - .14 USB Mouse: Included
  - .15 Surge Suppression Strip: Included
  - .16 Software: Microsoft Windows Server 2008, Microsoft SQL Server 2008, SYSTEM Server Software for Windows 2008
- .4 Intelligent System Controller:
  - .1 Memory Capacity: 250,000 Cards, 50,000 Events
  - .2 Firmware: Flash
  - .3 Host Communications: Built in TCP/IP
  - .4 Field Communication: RS485

- .5 Input Support: 512
- .6 Output Support: 256
- .7 Door Support: 66
- .8 Access Level Support: 32,000
- .9 Intrusion Area Support: 130 partitions
- .10 Card Reader Ports: 2
- .11 Programmable Inputs: 16
- .12 Programmable Outputs: 4
- .13 Main Power Input: 18VAC or 24VDC
- .14 Communication Ports: 10/100Base-T Ethernet high-speed port
- .15 Input Types: 4-state programmable
- .16 Output Types: Wiegand Data1/Data0, Magnetic Clock/Data
- .17 Reader Power: 12VDC
- .18 Dimensions: 160H x 250W x 42mmD
- .19 Approved Product: Lenel NGP-2220 Series
- .5 Alarm Monitoring Station Communications Module:
  - .1 Lenel Worldwide Modem 120-3633L Series
  - .2 Contractor shall arrange for a dedicated telephone line (Non-Centrex) for central monitoring services for the owner.
- .6 GSM dialer/alarm back-up:
  - .1 Provide a GSM dialer/alarm back-up unit that is compatible with Lenel OnGuard security systems.  
Contractor shall arrange all GSM dialer/alarm back-up communication requirements for central monitoring services for the owner.
- .7 Dual Door Interface (DDI):
  - .1 Power Requirements: 12 or 24VDC
  - .2 Power Consumption: 1200mA@12VDC, 49.1 BTU/hr
  - .3 Door Lock Power: 400mA@12VDC
  - .4 Reader Port Compatibility: Wiegand Data1/Data0, Magnetic Clock/Data, F/2F
  - .5 Card reader ports: 2
  - .6 LED Support: Bicolour and 2-wire
  - .7 Audible Support: Yes
  - .8 Card reader cable distance: 500ft using 18AWG stranded cable
  - .9 Outputs: 6 x Form C relays
  - .10 Inputs: 8 x fully supervised circuits
  - .11 Tamper: Yes
  - .12 Communications: RS-485  
Approved Product: Lenel NGP-1320-U
- .8 Control Modules Enclosures:
  - .1 Material: Metal housing
  - .2 Tamper Switch: Yes

	.3	Locking:	Yes, with 2 keys
	.4	Power supply:	LNL-AL400ULX or LNL-AL600ULX-4CB6
	.5	Output power:	4A @ 12VDC OR 6A @ 12VDC
	.6	Backup Battery:	ABT-12 Battery Kit with 12 AH (PS12120)
	.7	Approved Product:	LNL-CTX or LNL-CTX6 Series
.9		Input Control module:	
	.1	Power requirements:	12 or 24VDC
	.2	Power consumption:	300mA @ 12VDC, 12.3 BTU/hr
	.3	Inputs:	16 Selectable fully supervised grade A, B, AA
	.4	Tamper:	Yes
	.5	Output types:	2 x Form C relays
	.6	Communications:	RS-485
		Approved Product:	Lenel NGP-1100-U
.10		Output Control Module:	
	.1	Power requirements:	12 or 24VDC
	.2	Power consumption:	805mA @ 12VDC, 33 BTU/hr
	.3	Outputs:	16 x Form C relays, 5A @ 30VDC
	.4	Tamper:	Yes
	.5	Communications:	RS-485
	.6	Approved Product:	Lenel NGP-1200-U
.11		Electric Strikes:	
	.1	Holding Strength:	2400lbs
	.2	Power:	24VDC
	.3	Configuration:	Fail Secure
	.4	Approvals:	ULC, for fire rated doors and frames.
	.5	Protection:	Flush mounted protective plate (Astragal)
.12		Indala Proximity Reader:	
	.1	Mounting:	Mullions, 1-gang backbox
	.2	Audiovisual Indication:	Red/Green LED, piezo sounder
	.3	Environment:	indoor/outdoor
	.4	Output:	Wiegand, Clock-and-Data
	.5	Formats:	up to 172 bits
	.6	Transmit Frequency:	125kHz
	.7	Read Range:	120mm
	.8	Material:	Polycarbonate UL94
	.9	Power Supply:	4 – 16VDC
	.10	Current Draw:	65mA average
	.11	Operating Temperature:	-35° to 65°C
	.12	Warranty:	Lifetime
	.13	Approved Product:	HID 603 Series
.13		Indala Proximity Keypad Reader:	

- |     |                                  |                              |
|-----|----------------------------------|------------------------------|
| .1  | Mounting:                        | Mullions, 1-gang backbox     |
| .2  | Audiovisual Indication:          | Red/Green LED, piezo sounder |
| .3  | Environment:                     | indoor/outdoor               |
| .4  | Output:                          | Wiegand, Clock-and-Data      |
| .5  | Formats:                         | up to 172 bits               |
| .6  | Transmit Frequency:              | 125kHz                       |
| .7  | Read Range:                      | 100mm                        |
| .8  | Material:                        | Polycarbonate UL94           |
| .9  | Power Supply:                    | 4 – 16VDC                    |
| .10 | Current Draw:                    | 75mA average                 |
| .11 | Operating Temperature:           | -35° to 65°C                 |
| .12 | Warranty:                        | Lifetime                     |
| .13 | Approved Product:                | HID FP5071B Series           |
| .14 | Intrusion Alarm Keypad:          |                              |
| .1  | Intrusion alarm keypads shall be | Lenel NGP LCD Keypad.        |
| .15 | Request-to-Exit Motion Sensor:   |                              |
| .1  | Technology:                      | Passive Infrared             |
| .2  | Range:                           | 3 – 6m (10-20 feet)          |
| .3  | Relay output:                    | 1 x form C rated 1A @ 30VDC  |
| .4  | Relay Latch:                     | adjustable up to 60 seconds  |
| .5  | Operating modes:                 | Fail safe, Fail secure       |
| .6  | Operating voltage:               | 12-28VDC                     |
|     | Approved Product:                | DSC T-REX                    |
| .16 | Door Position Sensor:            |                              |
| .1  | Mounting Type:                   | Recessed 1 inch Diameter     |
| .2  | Gap Distance:                    | 1" in Steel, 2" in Wood      |
| .3  | Colour:                          | Grey                         |
| .4  | Loop Type:                       | Open and Closed              |
| .5  | Electrical Configuration:        | SPDT                         |
| .6  | Form Type:                       | Form C                       |
| .7  | Voltage Rating:                  | 30VDC, 50mA                  |
| .8  | Approved Product:                | GE Sentrol 1076W Series      |
| .17 | Glassbreak Detectors:            |                              |
| .1  | Power:                           | 9-16VDC                      |
| .2  | Current draw:                    | 15 – 25mA                    |
| .3  | Relay Configuration:             | Form C                       |
| .4  | Relay Rating:                    | 16V @ 50mA                   |
| .5  | Detection Range:                 | 3-25 feet, 360 degrees       |
| .6  | Alarm Response:                  | 4 seconds                    |
| .7  | Tamper switch:                   | Yes                          |
| .8  | Dimensions:                      | 21mmH x 102mm diameter       |

- |     |  |                      |                                    |
|-----|--|----------------------|------------------------------------|
| .18 | .9   | Approved Product:    | GE R5815NT                         |
|     | Motion Detectors:                            |                      |                                    |
|     | .1   | Dimensions:          | 71W x 58D x 130mmH                 |
|     | .2   | Colour:              | White                              |
|     | .3   | Detection Range:     | 35ft, 10.7m                        |
|     | .4   | Microwave Frequency: | 5.8GHz                             |
|     | .5   | Mounting Height:     | 2.1-2.7m                           |
|     | .6   | Input Voltage:       | 8.5-18VDC                          |
|     | .7   | Current Consumption: | 27-35mA                            |
|     | .8   | Approved Product:    | GE RCR-C                           |
| .19 | 360 degree Ceiling mounted Motion Detectors: |                      |                                    |
|     | .1   | Coverage Pattern:    | 18 x 30ft curtains                 |
|     | .2   | Input Power:         | 12 or 24VDC                        |
|     | .3   | Current Consumption: | 11-13mA @ 12VDC                    |
|     | .4   | Alarm output:        | Form C relay                       |
|     | .5   | Tamper switch:       | Yes                                |
|     | .6   | Mounting Height:     | 8-16ft                             |
|     | .7   | Approved Product:    | GE AP669                           |
| .20 | Moisture Sensor (Flood Detector):            |                      |                                    |
|     | .1   | Loop Type:           | Closed                             |
|     | .2   | Battery Type:        | Lithium                            |
|     | .3   | Battery Life:        | 10-15 Years                        |
|     | .4   | Alarm Delay:         | 10 seconds, then on as long as wet |
|     | .5   | Test button:         | Yes                                |
|     | .6   | Sensors per control: | 4                                  |
|     | .7   | Approved Product:    | GE 5501 Processor, 5515 Sensor     |
| .21 | Hard Wired Panic Button:                     |                      |                                    |
|     | .1   | Mounting:            | Under Desk                         |
|     | .2   | Switching:           | DPDT, Latching or Momentary        |
|     | .3   | Switch Rating:       | 3A @ 28VDC                         |
|     | .4   | Enclosure:           | ABS Plastic                        |
|     | .5   | Dimensions:          | 51W x 59L x 25mmH                  |
|     | .6   | Ratings:             | UL/ULC Listed                      |
|     | .7   | Environmental:       | Indoor use                         |
|     | .8   | Approved Product:    | Potter HUB-M                       |
| .22 | Strobe Alarm Indicators:                     |                      |                                    |
|     | .1   | Operating Voltage:   | 6 - 14VDC                          |
|     | .2   | Sound Output:        | 105dB @ 12VDC                      |
|     | .3   | Current Draw:        | 180mA @ 12VDC                      |
|     | .4   | Dimensions:          | 2.9"W x 4.8"H x 1.7"D              |
|     | .5   | Colour:              | Ivory body with Blue Strobe        |



- .6 Approved Product: ATW The Doberman - Blue
- .23 PoE Network Switch:
  - .1 Connect to Security systems network switch. Refer to Section 28 23 00 Video Surveillance.
  - .2 Provide all required CAT5E patch cables.
- .24 Wiring:
  - .1 All wiring shall be FT6 rated in accordance with local jurisdiction fire code and the local building codes.
  - .2 All wiring shall be as recommended by the manufacturer of the device/s.

### 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 datasheet.

#### 3.2 INSTALLATION

- .1 Installation shall comply with all other relevant sections.
- .2 Install components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .3 Install components secure to walls, ceilings or other substrates.
- .4 All components shall be housed in metal tampered enclosures.
- .5 All metal enclosures housing data gathering panels shall be mounted on brackets, which will hold the cabinet one (1) inch from the wall surface. Conduit shall be provided from the DGP to the power supplies, junction boxes or wire ways.
- .6 Provide all required power supplies and battery back-up.
- .7 Coordinate with door hardware contractor regarding rough-in wiring and hardware.
- .8 The appropriate cable type Plenum jacket FT6 shall be used in accordance with local jurisdiction fire code and the local building codes.
- .9 All cabling is to be secured to the rack frames at sufficient intervals to prevent the weight of the cable from contributing to fatigue or early failure of the cable or the device and connector to which it is attached.
- .10 All category 5E cables shall utilize Velcro fasteners in place of Ty-wraps.
- .11 All CAT5E cabling methods and distance shall be in conformance with industry best practices and EIA/TIA 568 and NFPA 73.
- .12 All wiring shall be labeled and both ends. Labeling shall match as-built drawings.
- .13 All cabinets shall have tamper switches. Alarms shall report to client workstations and central alarm monitoring company.
- .14 Install required boxes in inconspicuous accessible locations.
- .15 Install request-to-exit motion detectors as indicated drawings.

#### 3.3 PROGRAMMING

- .1 Provide all required software to integrate the card access system, Intrusion alarm system, with the CCTV system.

- .2 Provide all required programming for card access systems servers, client workstations, field hardware, networking switches, Intrusion alarm keypads, and all other components of the card access system.
- .3 Co-ordinate with owner's departmental representative on the exact layout and location of the client workstation (LACW).
- .4 Co-ordinate, with owner's departmental representative, on the exact sequence of events, that should occur during alarms and other daily events. Program card access system to meet the requirements of the owner. Contractor shall make an allowance for custom programming.
- .5 Program the card access system to pop-up CCTV cameras on client workstations and other LCD monitors related to any alarm event. The floor map for the same alarm shall also pop-up.
- .6 Program Blue Strobe Lights to follow panic alarms only.

### 3.4 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum three (3) sessions of four (4) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the security systems.
- .2 The contractor as part of their tendered price shall provide a four (4) hour instruction session 30 days after completion of initial training sessions.
- .3 On completion of training, Certificates must be provided to the office manager, indicating that all training activity has been completed to management's satisfaction. These certificates are to be dated and signed by the owner's departmental representative and the contractors training representative.

### 3.5 VERIFICATION

- .1 Perform verification inspections and tests in the presence of Consultant.
  - .1 Provide all necessary tools, ladders and equipment.
  - .2 Ensure appropriate subcontractors, manufacturer's representatives are present for verification.
- .2 Pretesting Procedure
  - .1 Verify that System is fully operational and meets all System performance requirements of this specification.
  - .2 Measure and record, control carrier levels of every System channel at each of following points in the system:
    - .1 Door located actuating devices.
    - .2 Door control panel functions.
    - .3 Electronic supervisory control units inputs and outputs.
    - .4 Distribution system input and output.
  - .3 Provide and submit to Consultant two copies of recorded system pre-test measurements, along with pre-test certification.
- .3 Performance testing
  - .1 Test procedure: perform test on a "go-no-go" basis.
    - .1 Make only operator adjustments required to show proof of performance.
    - .2 Test to demonstrate and verify that the installed Systems complies with installation and technical requirements of this specification under operating conditions.

- .3 Test results to be evaluated by Consultant as either acceptable or unacceptable using following procedures.
  - .2 Documentation review
    - .1 This review will determine if information provided is sufficient to meet requirements of this specification.
    - .2 Provide for review all System manuals, as installed drawings, pre-test forms, antenna radiation patterns, equipment cabinet pictorials, antenna pictorial, antenna mount pictorial, video and audio equipment details.
  - .3 Mechanical inspection
    - .1 Consultant and Contractor to tour all areas to insure that all Systems and Subsystems are installed in place for proof of performance testing.
    - .2 Take system inventory at this time. Verify following items before beginning proof of performance tests:
      - .1 All electrical power circuits designated for system equipment are properly labelled, wired, phased, protected and grounded.
      - .2 Conductor ends are protected by heat shrink wrap; audio spade lugs, barrier strips and punch blocks are used.
      - .3 Dust, debris, solder splatter, etc. are cleaned and removed from site.
      - .4 All equipment is properly labeled.
      - .5 All equipment identified in System's equipment lists are in place and properly installed.
      - .6 Each system ground is installed in accordance with manufacturer's instructions and this specification.
- .4 Subsystem functional test
  - .1 Conduct operational testing after review of documentation and mechanical inspection completed. Proceed as follows.
    - .1 Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.
  - .2 Control Units
    - .1 Take S/N readings from control unit's input and output in manual and/or automatic mode. Check output of DC/Data converter for S/N. Evaluate entire signal quality at baseband connector output of control unit and remote equipment.
  - .3 Distribution (or Interface) System
    - .1 Check each door utilizing a volt/ohm or signal level meter to confirm each function and to insure that System meets all performance requirements.
    - .2 Test each interconnection point (i.e: Door unit, junction box "cross connection", control unit, etc.) to ensure compliance with this specification.
  - .4 Total system test
    - .1 Proceed with testing when System and Subsystems are functionally tested and accepted. Total System tests to verify that requirements have been met for DC and/or audio, sub carrier, and control signals in accordance with this specification.
  - .5 Safety

- .1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.
  - .5 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
    - .1 Sturdiness of equipment fastening
    - .2 Non-existence of installation related damages
    - .3 Compliance of device locations with reviewed shop drawings
    - .4 Compatibility of equipment installation with physical environment
    - .5 Inclusion of all accessories
    - .6 Device and cabling identification
    - .7 Application and location of ULC approval decals
  - .6 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
    - .1 Validate sensitivity of readers and applicability and application of cards.
    - .2 Connecting joints and equipment fastening
    - .3 Compliance with manufacturer's specification, product literature and installation instructions
  - .7 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
    - .1 Operation of each device individually and within its environment
    - .2 Operation of each device in relation with programmable schedule and or/specific functions
  - .8 Central Station Monitoring testing:
    - .1 All programming shall be tested and certified with the monitoring station company on a zone-by-zone basis for accuracy of transmission.
    - .2 Zone-by-zone testing shall be completed for telephone dialer transmission methods and for GSM auto dialer transmission methods.
    - .3 A signed system verification record shall be provided by the security systems contractor to the client upon completion of the contract and before invoices are submitted.
- 3.6 CLEANING AND ADJUSTING
- .1 Remove protective coverings from accessories and components.
  - .2 Adjust all components for correct function.
  - .3 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
  - .4 Clean all components free from dirt and fingerprints.

END OF SECTION 281300

1.0 GENERAL

1.1 OVERVIEW

- .1 Supply and Install a video surveillance system (CCTV System) as described in the specifications and drawings.
- .2 The contractor shall provide all required components to supply a fully functional video surveillance system as described in the contract documents. The contractor shall provide all required components that are not listed in the specification but are required to supply a fully functional video surveillance system as described in the contract documents.
- .3 Supply and install a local access control workstation (LACW). The LACW shall come with Lenel OnGuard Edit Client Workstation Software and Licence. The workstation shall come complete with a 21 inch LCD monitor, UPS, keyboard and mouse.
- .4 The contractor shall supply and install a new 4-post equipment rack. The rack shall come with a rack mounted LCD monitor, keyboard, mouse, and 8-channel KVM switch.
- .5 All video recordings must be retained for a minimum period of 60 days. Contractor shall assure the video recorder has adequate hard drive space to retain 60 days of video recording.
- .6 Video surveillance cameras shall be IP PoE type and shall use a contractor supplied Ethernet PoE Network switch.
- .7 All security cables shall be YELLOW in colour.
- .8 All patch panel jacks shall be YELLOW in colour.
- .9 The contractor shall supply and install metal hinged covered, lockable terminal cabinets for all power supplies, transformers and power distribution terminal strips. All cabinets must be supplied with tamper switch contacts.
- .10 The contractor shall supply and install a UPS for each security systems component. The UPS shall sustain the operation of the security systems components for a minimum of twenty minutes or until primary or generator power is restored.

1.2 SECTION INCLUDES

- .1 This section of the specification forms part of the contract documents and is to be read, interpreted and co-ordinated with all other parts.
- .2 This section specifies video components configured as a system, which performs functions related to image acquisition, video display and recording images.

1.3 RELATED SECTIONS

- .1 Section 01 11 00 – Electrical General Provisions
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 26 05 00 – Common Work Results – Electrical
- .5 Section 26 05 01 – Seismic Restraints – Electrical
- .6 Section 26 05 07 – Elevators
- .7 Section 26 05 21 – Wire and Cables
- .8 Section 26 05 34 – Conduit, Conduit Fastenings and Fittings
- .9 Section 27 13 00 – Backbone Cabling
- .10 Section 27 15 00 – Communications Cables Inside Buildings
- .11 Section 27 05 28 – Pathways for Communications Systems

#### 1.4 REFERENCE STANDARDS

- .1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:
  - .1 Building, fire, electrical and labour codes and standards.
  - .2 Workmanship shall meet or exceed nationally accepted workmanship standard.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA C22.1- latest edition, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations
  - .2 CAN/CSA-C22.3 No.1- latest edition, Overhead Systems
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 ULC-S317- latest edition, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems

#### 1.5 SCOPE OF WORK

- .1 Supply and installation of a complete and operating system including but not necessarily limited to:
  - .1 Video cameras
  - .2 Video handling
  - .3 Recording devices
  - .4 Transmission methods

#### 1.6 DEFINITIONS

- .1 NVMS: Network Video Management Software
- .2 NVR: Network Video Recorder
- .3 CCTV: Closed Circuit Television
- .4 CCVC: Closed Circuit Video
- .5 CCD: Charge Coupled Device
- .6 FOV: Field of View
- .7 RI: Rough-in conduit only

#### 1.7 DESIGN PERFORMANCE REQUIREMENTS

- .1 Network Video Management Software (NVMS)
  - .1 Enterprise Level software solution that shall be scalable from one client, server and camera to hundreds of clients, servers, and cameras
  - .2 NVMS shall consist of server software applications and client software applications.
  - .3 NVMS shall be a user friendly, PC-based digital video recorder with built-in video motion detection, capable of being networked for remote administration, playback, and export.
  - .4 NVMS shall have alarm-based recording, and relay output controls for silent hours and selected area alarm input.
  - .5 NVMS shall provide for automatically switching the Network Video Recorder NVR from the standby or time-lapse mode to real time recording when an alarm occurs. Real time recording shall continue as long as the alarm condition exists. The NVR shall return to time-lapse or stand-by mode following the removal of the alarm condition.
  - .6 NVMS shall be capable of allowing the user/system administrator to set up recording modes to allow for customizing of weekday, weekend, and special event recording.

- .7 NVMS shall communicate on a stand-alone network dedicated to its purpose and shall not tie into base building or any other external existing networks.

1.8 CONTRACTOR QUALIFICATIONS

- .1 The Video Surveillance System shall be installed by a qualified Security Systems Contractor certified by the respective equipment manufacturer, and having a minimum of three years installation, and service experience with similar installations.
- .2 The contractor business, employees, managers and owners must be licensed in the Province of British Columbia under the Private Investigators and Security Agencies Act.
- .3 The business must be licensed and bonded as an Alarm Service and each employee who is installing and servicing security alarm devices and equipment, must be licensed and bonded as an employee of the company and not as a sub-contractor.
- .4 The equipment installers must hold a valid Trade Qualification Certificate issued by the Province of British Columbia. Proof of the Company and Installers Certification shall be requested and reviewed prior to contract award.

1.9 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and data sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labelling scheme including:
- .1 Functional description of equipment
- .2 Technical data sheets of all devices
- .3 Device location plans and cable lists
- .4 Video camera surveillance chart
- .5 Video interconnection detail drawings
- .6 Programming worksheets
- .3 Samples: Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Submit sample floor plans with device layout that will be used with the NVMS.
- .4 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 – Submittal Procedures.
- .1 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance 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.
- .1 Submit UL/CSA Product safety Certificates.
- .3 Instructions: Submit manufacturer's installation instructions.
- .5 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Include following:
- .1 System configuration and equipment physical layout
- .2 Functional description of equipment
- .3 Instructions on operation, adjustment and cleaning
- .4 Illustrations and diagrams to supplement procedures

- .5 Manufacturer's operation instructions
- .6 All programming worksheets

#### 1.10 WARRANTY

- .1 For all materials, the 24-month warranty for parts and labour.
- .2 Provide a separate maintenance and service agreements options for the following:
  - .1 Extending warranty by 12-months
  - .2 Extending warranty by 24-months
  - .3 Extending warranty by 36-months
  - .4 Additional maintenance and service agreements, with parts to be considered as extra.
- .3 Manufacturer's Warranty: Submit, for Department Representative's Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official.

#### 1.11 SUPPORT SERVICES

- .1 Provide manufacturer/dealer advice, information and support services for 1 year.

#### 1.12 LICENSING

- .1 Contractor shall pay for all software and camera licenses.

#### 2.0 PRODUCTS

##### 2.1 SUPPLY OF SYSTEM COMPONENTS

- .1 Unless otherwise specified in this document, the contractor shall supply all components necessary to complete the system. All materials shall be new and of the latest hardware, software, and firmware versions.

##### 2.2 MATERIALS

- .1 Network Video Management Software (NVMS):
  - .1 Lenel OnGuard Series
- .2 High Definition Network Video Recorder/Server:
  - .1 Software: VideoAppliance Services Application
  - .2 Operating System: Windows Server 2008 R2 (64-bit) preloaded
  - .3 Processor: 2 x Intel Quad-Core Xeon 2.4GHz 5600 Series
  - .4 Memory: 12GB total, 10TB raw, 8TB Usable Capacity
  - .5 Video Drives: 10 x 1TB, 3.5" SATA-II hot-swappable
  - .6 Camera Channels: Up to 66
  - .7 Recording Image Rate: Up to 30 images @ 1920 x 1080
  - .8 OS/VMS Drives: 2 x 500GB, 3.5" SATA-II hot-swappable
  - .9 Recording Storage: Up to 24TB expandable to 72TB RAID6
  - .10 Recording Time Required: Min 60 Days
  - .11 Network Interface: 4 x 1GbE ports
  - .12 Video Outputs: VGA, DVI
  - .13 Form Factor: 2U rack mount chassis
  - .14 Dimensions: 648L x 437W x 89mmH



- .15 Weight: 23.6kg
  - .16 Power Input: 100 to 240VAC, 50/60 Hz
  - .17 Power Supply: Dual-redundant
  - .18 Power Consumption: 5 Amp, 800 Watts, 1024BTU/hr
  - .19 Operating Temperature: 10° C to 35° C
  - .20 Referenced product: Intransa VideoAppliance CVA1022-10TB-1
- .3 Local Access Control Workstations (LACW):
- .1 PC: Dell T3500 Precision Workstation
  - .2 Processor: Intel Quad Core Xeon W3520, 2.66GHz, 8M L3, 4.8GT/s, Turbo
  - .3 Ram: 4GB, 1066MHz, DDR3 SDRAM, NECC (4 DIMMS)
  - .4 Software: Microsoft Windows 7, Microsoft SQL Server 2008 Client License, SYSTEM Client Software for Windows 7
  - .5 Hard Disk Drive: 250GB SATA 3.0Gb/s with NCQ and 8MB DataBurst Cache
  - .6 Network Interface: 10/100/1000 Ethernet Network Port
  - .7 Serial Port: 1
  - .8 USB Ports: 8
  - .9 Graphics Card: Dual 256MB NVIDIA Quadro NVS 295
  - .10 Speakers: Internal Chassis
  - .11 Optical Drive: 16x DVD+/-RW
  - .12 Form Factor: Desktop
  - .13 USB Keyboard: Included
  - .14 USB Mouse: Included
  - .15 Surge Suppression Strip: Included
- .4 LCD (LACW) Workstation Monitors:
- .1 Monitor size: 21 Inch
  - .2 Number of Pixels: 1920 (H) x 1080 (V)
  - .3 Brightness: 400cd/m<sup>2</sup> or better
  - .4 Dynamic Contrast Ratio: 100,000:1
  - .5 Backlight Type: Direct light type
  - .6 Response Time: 7ms or better
  - .7 Panel Aspect Ratio: 16:9
  - .8 Video Formats: 480i/p, 576i/p, 720p, 1080i/p
  - .9 Display colors: 16.7 million
  - .10 VESA Mounting: 100mm x 100mm
  - .11 Video Inputs: VGA, HDMI, DVD-I, Display Port, Component

- .12 Mounting Bracket: Included – Wall/Ceiling Tilt/swivel
- .5 Network Video Recorder/Server Uninterrupted Power Supply (UPS)
- .1 Output Capacity: 2200VA/1600Watts
- .2 Nominal Output Voltage: 120V
- .3 Topology: Double Conversion Online
- .4 Input Connection: NEMA 5-20P
- .5 Output Receptacles: 6 x NEMA 5-15R
- .6 UPS Bypass: Built-in bypass
- .7 Remote Power off (REPO): Yes
- .8 Nominal Input Voltage: 120V
- .9 Power Draw: 16.6A @ 120V
- .10 Frequency: 50/60Hz
- .11 Power Output Factor: 0.9
- .12 Voltage Waveform: Sine Wave
- .13 Serial Port: RS-232
- .14 USB Port: HID Standard
- .15 Mounting: 2U rack mounted
- .16 Dimensions: 85H x 432W x 559mmD
- .17 Weight: 27.5kg
- .18 BTU/hr – Normal: 587
- .19 Referenced Product: APC Smart-UPS Series SURTA2200RMSL2U
- .6 Local Access Control Workstation (LACW) UPS
- .1 Output Capacity: 980Watts/1500VA
- .2 Nominal Output Voltage: 120V
- .3 Output Voltage Distortion: Less than 5% at full load
- .4 Output Frequency: 57-63Hz
- .5 Waveform: Sine wave
- .6 Output Connectors: 8 x Nema 5-15R
- .7 Nominal Input Voltage: 120V
- .8 Input Frequency: 50/60Hz
- .9 Input Connectors: Nema 5-15P
- .10 Cord Length: 1.8 meters
- .11 Battery Type: Maintenance free sealed lead-acid battery with suspended electrolyte. Leakproof.
- .12 Network Options: Included
- .13 Control Panel: Multi-function LCD Status
- .14 Regulatory Approvals: CSA, ULc, UL 1778
- .15 Approved Product: APC Smart-UPS SUA1500

- .7 Poe Network Switch:
- .1 Ports: 48 Ethernet 10/100/1000 PoE+
  - .2 Uplinks: 4 x 1 Gigabit Ethernet SFP ports
  - .3 Available PoE Power: 370 Watts
  - .4 Max Port PoE Power: 48 ports @ 7.7 Watts, 24 ports @ 15.4 Watts
  - .5 Support: IEEE 802.3af, IEEE 802.3at complaint
  - .6 Dimensions: 45H x 445W x 386mmD
  - .7 Weight: 5.7kg
  - .8 Current consumption: 5 – 2A
  - .9 Max Power consumption: 55 Watts @ 100% throughput
  - .10 Referenced Product: Cisco WS-C2960S-48LPS-L Series
- .8 Indoor Fixed Dome Camera:
- .1 Image Sensor: 1/3" progressive scan CMOS
  - .2 Maximum Resolution: 800 x 600
  - .3 Signal-to-Noise Ratio: 50dB
  - .4 Lens: Varifocal 2.8 – 10mm
  - .5 Auto Iris Lens Type: DC drive
  - .6 Electronic shutter Range: 1-1/100,000 sec
  - .7 Wide Dynamic Range: 60dB
  - .8 Sensitivity: Colour 0.5 lux
  - .9 Construction: Cast aluminum and polycarbonate plastic
  - .10 Finish: White
  - .11 Weight: .35kg
  - .12 Network: RJ-45 connector for 100base-TX
  - .13 Cable type: Cat5E or better
  - .14 Power Input: PoE class 2
  - .15 Power Consumption: 6 Watts, 200mA
  - .16 Referenced product: Pelco Sarix IMSOC10-1 Series
- .9 Equipment Cabinet:
- .1 Construction: 4-Post Welded steel
  - .2 Mounting Rails: Front and Rear, threaded #12-24
  - .3 Load Capacity: 2500lb
  - .4 Rack Spaces: 45U
  - .5 Grounding Studs: Provided on body
  - .6 Dimensions: 2134H x 591W X 762mmD
  - .7 Vertical Managers: 2 x 6-inch PatchRunner Series
  - .8 Approved Product: Panduit R4P Series
- .10 Rack Mounted LCD Monitor, Keyboard, Mouse and KVM Switch:

.1	Server Connections:	8
.2	External Mouse Port:	1 x USB Female
.3	KVM Ports:	8 x SPHD-15 Female
.4	Maximum Resolution:	1280 x 1024
.5	Power Consumption:	28 Watts
.6	Weight:	13.8kg
.7	Dimensions:	634L x 480W x 44mmH
.8	Approved Product:	APC 5808 Series

### 2.3 CAMERA CABLING

- .1 Camera cabling shall be CAT5E data cable.

### 2.4 CAMERA JUNCTION BOX

- .1 Metal, sized to handle all system conduit interconnections with appropriate expansion

### 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 datasheet.

#### 3.2 INSTALLATION

- .1 Install video surveillance equipment and components as indicated on drawings and specifications, and in accordance with ULC-S317.
- .2 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.
- .3 Install components secure, properly aligned and in locations shown on reviewed shop drawings.
- .4 Connect cameras to cabling in accordance with installation instructions.
- .5 NVR shall store at minimum 60 days of recorded video.
- .6 Install ULC labels where required.
- .7 Adjust camera video for low light levels such as nighttime or when lights have been turned off. Low light level adjustment shall be done in the evening when the sun has gone down for an hour at least.
- .8 The contractor under this Section is responsible for installing, connecting, programming and testing of all system components.
- .9 Install all video surveillance components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .10 Install all video surveillance components secure to walls, ceilings or other substrates.
- .11 Each cable from component to component shall be continuous without any joint or splice.
- .12 Low voltage cables are not permitted to share the same conduits or ducts with line voltage electrical cables.
- .13 All video communication wiring must be in conduit unless approved otherwise by the departmental representative.
- .14 Install a woven nylon pull string in with cables as cables are pulled into conduits.
- .15 All cables shall be CSA approved. All cables shall be FT6 rated.

### 3.3 PROGRAMMING

- .1 The contractor shall be responsible to program any programmable component related to the video surveillance system, and setup all necessary operating systems.
- .2 The Departmental Representative will inform the contractor of any specific programming requirements. The contractor shall make allowances for custom programming as requested by the Departmental Representative.
- .3 All remote download/upload options shall be enabled co-ordinate with Departmental Representative.

### 3.4 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum three (3) sessions of four (4) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the video surveillance systems.
- .2 The contractor as part of their tendered price shall provide a four (4) hour instruction session 30 days after completion of initial training sessions.

### 3.5 VERIFICATION

- .1 Perform verification inspections and test in the presence of Departmental Representative.
  - .1 Provide all necessary tools, ladders and equipment.
  - .2 Ensure appropriate subcontractors and manufacturer's representatives are present for verification.
- .2 Perform system tests for the following:
  - .1 All camera operations
  - .2 All recording operations
  - .3 All camera labeling
  - .4 All network connections
  - .5 All workstation operations
  - .6 All integrations with other security systems
  - .7 All systems required testing
- .3 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
  - .1 Sturdiness of equipment fastening
  - .2 Non-existence of installation related damages
  - .3 Compliance of device locations with reviewed shop drawings
  - .4 Compatibility of equipment installation with physical environment
  - .5 Inclusion of all accessories
  - .6 Device and cabling identification
  - .7 Application and location of ULC approval decals
- .4 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
  - .1 Measurements of tension and power
  - .2 Connecting joints and equipment fastening
  - .3 Measurements of signals (dB, lux, baud rate, etc)

- .4 Compliance with manufacturer's specification, product literature and installation instructions
- .5 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
  - .1 Operation of each device individually and within its environment
  - .2 Operation of each device in relation with programmable schedule and or/specific functions
  - .3 Operation control of camera lens, pan, tilt and zoom
  - .4 Switching of camera to any monitor
  - .5 Switching of system video recorder to selective monitor
  - .6 Set dwell times.
  - .7 Demonstrate:
    - .1 Sequence viewing of cameras on each monitor
    - .2 Bypass capability.

3.6 CLEANING AND ADJUSTING

- .1 Remove protective coverings from cameras and components.
- .2 Adjust cameras for correct function.
- .3 Clean camera housings, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

END OF SECTION 282300

1.0 GENERAL

1.1 OVERVIEW

- .1 Supply and Install a video surveillance system (CCTV System) as described in the specifications and drawings.
- .2 The contractor shall provide all required components to supply a fully functional video surveillance system as described in the contract documents. The contractor shall provide all required components that are not listed in the specification but are required to supply a fully functional video surveillance system as described in the contract documents.
- .3 Supply and install all required software to integrate with client PC workstations.
- .4 The existing analog CCTV cameras shall be incorporated in the new CCTV system. Digital encoders shall be used to integrate the existing CCTV cameras to the new CCTV system.
- .5 The existing CCTV system shall remain in full operation until the new CCTV system is online, and completely tested. Once the owner has approved the installation and operation of the new CCTV system, the contractor shall disconnect the existing analog CCTV cameras and connect them to the new CCTV system.
- .6 The contractor shall decommission the existing CCTV system after final acceptance of the new CCTV system. The contractor shall remove the existing CCTV system and hand over the equipment to the owner.
- .7 The contractor shall install a new equipment cabinet in the same location as the existing CCTV system.
- .8 All software and camera licenses shall be valid for a minimum of 1-year after award of substantial completion.
- .9 All video recordings must be retained for a minimum of 15 days.
- .10 Video surveillance cameras shall be IP PoE type and shall use a contractor supplied Ethernet PoE Network switch.
- .11 The video surveillance system shall support off-site remote access for authorized personnel. Provide all required hardware and software for this integration.
- .12 The contractor shall provide mobile applications software for smart phones and smart tablets to enable authorized mobile video viewing of all the cameras in the facility.

1.2 SECTION INCLUDES

- .1 This section of the specification forms part of the contract documents and is to be read, interpreted and co-ordinated with all other parts.
- .2 This section specifies video components configured as a system, which performs functions related to image acquisition, video display and recording images.

1.3 RELATED SECTIONS

- .1 Section 01 11 00 – Electrical General Provisions
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 26 05 00 – Common Work Results – Electrical
- .5 Section 26 05 01 – Seismic Restraints – Electrical
- .6 Section 26 05 07 – Elevators
- .7 Section 26 05 21 – Wire and Cables

- .8 Section 26 05 34 – Conduit, Conduit Fastenings and Fittings
- .9 Section 27 13 00 – Backbone Cabling
- .10 Section 27 15 00 – Communications Cables Inside Buildings
- .11 Section 27 05 28 – Pathways for Communications Systems

#### 1.4 REFERENCE STANDARDS

- .1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:
  - .1 Building, fire, electrical and labour codes and standards.
  - .2 Workmanship shall meet or exceed nationally accepted workmanship standard.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA C22.1- latest edition, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations
  - .2 CAN/CSA-C22.3 No.1- latest edition, Overhead Systems
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 ULC-S317- latest edition, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems

#### 1.5 SCOPE OF WORK

- .1 Supply and installation of a complete and operating system including but not necessarily limited to:
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#### 1.6 DEFINITIONS

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#### 1.7 DESIGN PERFORMANCE REQUIREMENTS

- .1 Network Video Management Software (NVMS)
  - .1 Enterprise Level software solution that shall be scalable from one client, server and camera to hundreds of clients, servers, and cameras
  - .2 NVMS shall consist of server software applications and client software applications.
  - .3 NVMS shall include a gateway software application that connects mobile devices to the NVMS.
  - .4 NVMS shall include the following applications:
    - .1 Server Software Applications:



- .1 Control Center Server
- .2 Control Center Admin Tool
- .3 Control Center Gateway
- .2 Client Software Applications:
  - .1 Control Center Client
  - .2 Control Center Web Client
  - .3 Control Center Player
  - .4 Control Center Camera Installation Tool
- .5 NVMS shall permit server and client software applications to be installed and run on both the same computer or on separate computers.
- .6 NVMS shall support edge based storage and processing of video and audio.
- .7 NVMS shall support High Definition Stream Management (HDSM) architecture, which includes:
  - .1 Support for JPEG2000, MJPEG, MPEG-4, AND H.264 compression formats.
  - .2 Support for reducing the required client bandwidth and processing power by only transmitting what is necessary to view the video stream at full quality.
- .8 NVMS shall support recording and management of video and audio sources including:
  - .1 HD IP Dome Cameras: 1 – 5 Megapixels
  - .2 HD IP Dome Panoramic Cameras: 8 Megapixels
  - .3 HD PRO IP Cameras: 2 – 16 Megapixels
  - .4 Composite video from analog cameras, PTZ domes and thermal imagers
- .9 NVMS shall support receiving digital input triggers and triggering digital outputs through an I/O board.
- .10 NVMS shall support recording and monitoring video and audio streams from sources with bandwidth up to 90 Mbit/sec frame rate up to 60 fps, and video resolution up to 16 MP (4872 x 3248).
- .11 NVMS shall require no proprietary recording hardware, no hardware multiplexer or time-division technology for video and audio recording or monitoring.
- .12 NVMS shall not limit the storage capacity and shall allow for upgrades of recording capacity.
- .13 NVMS shall digitally sign recorded video and audio using 256-bit encryption so video can be authenticated for evidentiary purposes.
- .14 NVMS shall securely transmit all command and control data via TCP/IP using cryptographic keys based on SSL to prevent eavesdropping or tampering.
- .15 NVMS shall provide the mechanism by which individual alarm (s) from the card access system can be pre-selected and configured to be monitored and, in turn, trigger event driven video operations.
- .16 NVMS shall support integration with Card Access System.
- .17 NVMS shall be capable of being upgraded from one version to another without having to uninstall the previous version.
- .18 NVMS shall automatically detect if video or audio source firmware is out of date with respect to the current installed software and upgrade it.
- .19 NVMS shall automatically detect if client application software is out of date with respect to the current installed server software and upgrade it.

- .20 NVMS shall run as a service configured to automatically start when the server or workstation is powered on and automatically recover from failure or attempted tampering.
- .21 NVMS shall automatically discover all Control Center Server instances, Control Center Clients, video and audio sources that are connected to the same network.
- .22 NVMS shall provide a search functionality to discover video and audio sources that are connected on a different network segment than the Control Center Server.
- .23 NVMS shall provide the ability to connect a video or audio source to multiple NVRs to achieve redundant recording.
- .24 NVMS shall provide the ability to create a failover connection for a video or audio source. If the NVR that the video or audio source is connected to goes offline then the failover NVR will take over the connection.
- .25 NVMS shall support receiving Simple Network Management Protocol (SNMP) messages from servers and alert the user.
- .26 NVMS shall detect if the video or audio signal is lost and alert the system administrator.
- .27 NVMS shall provide the capability to rename all video and audio sources and NVRs.
- .28 NVMS shall record video and audio streams based on a recording schedule that can be defined individually for each video source. The schedule shall be created with the following parameters:
  - .1 Recording Mode:
    - .1 Continuous
    - .2 Motion
    - .3 Digital Inputs
    - .4 Alarms
    - .5 POS Transactions
    - .6 License Plates
  - .2 Time and Date Settings:
    - .1 Daily
    - .2 Weekly
- .29 NVMS shall provide the ability to manually trigger recording.
- .30 NVMS shall provide a pre-event and post-event recording option.
- .31 NVMS shall perform motion detection on each individual video source with adjustable sensitivity, threshold and detection zones.
- .32 NVMS shall provide the ability to set a maximum recorded video retention time for each video source.
- .33 NVMS shall perform dynamic bandwidth management to ensure that the total bandwidth does not overload the system.
- .34 NVMS shall authenticate users before granting access to the system. Access rights for each user can be defined individually for each user.
- .35 NVMS shall provide the ability to schedule backups of recorded video with associated events to a local folder or mapped network drive.
- .36 NVMS shall provide the ability to email users and system administrators when an event or system health error occurs.
- .37 NVMS shall provide the ability to include camera images in email notifications.

- .38 NVMS shall provide the ability to create customized on-screen messages and email notifications.
- .39 NVMS shall provide a maintenance log and audit trail of all system errors and events.
- .40 NVMS shall provide the ability to receive transaction information from point-of-sale sources and generate events based on point-of-sale transactions.
- .41 NVMS shall provide the ability to define a region of an image where license plate detection is performed. Detected license plates shall be stored along with the video data.
- .42 NVMS shall provide the ability to create a watchlist that will be used to create events when any license plate on the watchlist is detected in the images being analyzed.
- .43 NVMS shall provide the ability to enable and configure PTZ control on the RS-485 interface of a video source.
- .44 NVMS shall provide the ability to change image quality and image rate parameters for a video source without affecting the settings on the other video sources.
- .45 NVMS shall provide the ability to enable a secondary stream for live viewing.
- .46 NVMS shall provide the ability to change the exposure, iris, IR filter, backlight compensation, gain, priority, sharpening, saturation, focus, and white balance settings for a video source.
- .47 NVMS shall provide the ability to change the image dimensions for a video source.
- .48 NVMS shall provide the ability to rotate the image 90°, 180° or 270° for a video source.
- .49 NVMS shall provide the ability to add privacy zones to a video source to block unwanted areas in the image field of view.
- .50 NVMS shall provide the ability to change the input, output, gain and volume for an audio source.
- .51 NVMS shall provide for full-duplex two-way audio communication.
- .52 NVMS shall provide the ability to link any audio source to any video source.
- .53 NVMS shall provide the ability to control the system using a PC keyboard or joystick.
- .54 NVMS shall provide the ability to import and export client settings such as maps, views, and web pages.
- .55 NVMS shall support live or recorded video monitoring of 1 to 36 video streams simultaneously on a single monitor with the following standard layouts:
  - .1 Full Screen
  - .2 2 x 2
  - .3 3 x 3
  - .4 4 x 4
  - .5 5 x 5
  - .6 6 x 6
  - .7 1 + 5
  - .8 1 + 7
  - .9 1 + 12
  - .10 2 + 8
- .56 NVMS shall support live or recorded video monitoring in a customizable video display beyond the standard layouts.
- .57 NVMS shall support the ability to display the following list of image overlays:
  - .1 Camera Name

- .2 Camera Location
- .3 Timestamp
- .4 Record indicator
- .5 PTZ Controls
- .6 Motion Activity
- .7 License Plate
- .58 NVMS shall support an unlimited number of monitors for monitoring video and audio streams.
- .59 NVMS shall support monitoring live and recorded video and audio streams simultaneously on the same monitor.
- .60 NVMS shall support viewing the same live or recorded video stream at different zoom levels.
- .61 NVMS shall support the creation of unlimited views with unique layouts of video streams.
- .62 NVMS shall support the ability to cycle through views (guard tour) based on a specified interval.
- .63 NVMS shall display all video sources connected to the system.
- .64 NVMS shall support the ability to drag and drop a video source from a tree of video sources into a window for live or recorded video and audio monitoring.
- .65 NVMS shall support the ability to configure how the tree of video sources and views is displayed.
- .66 NVMS shall support the ability to designate one or more regions in a window for displaying video directly linked to triggered alarms and rules.
- .67 NVMS shall support the ability to manually trigger digital output.
- .68 NVMS shall support the ability to create a map that represents the physical location of cameras and other devices throughout the surveillance system. Maps shall be created from images stored in JPEG, BMP, PNG, or GIF image formats. Maps shall have the ability to contain links so as to create a hierarchy of interlinked maps.
- .69 NVMS shall support the ability to drag and drop a video source from a map into a window for live or recorded video and audio monitoring.
- .70 NVMS shall highlight a camera on a map when an alarm linked to the camera is triggered.
- .71 NVMS shall highlight a linked map that contains a camera when an alarm linked to the camera is triggered.
- .72 NVMS shall support digital zooming and panning on live and recorded video streams.
- .73 NVMS shall support controlling mechanical pan-tilt-zoom, iris, and focus as well as setting pre-sets and patterns.
- .74 NVMS shall synchronously playback recorded video and audio from selected video sources.
- .75 NVMS shall support navigation of recorded video and audio via calendar, timeline, or events.
- .76 NVMS shall support the ability to export recorded video in the following formats: Native, JPEG, PNG, TIFF, AVI, WAV, PDF, Print.
- .77 NVMS shall support the ability to export recorded audio in WAV format.
- .78 NVMS shall support the ability to take a snapshot of a live or recorded image and export it from the system.

- .79 NVMS shall support the ability to export a live stream of images in the following formats:  
JPEG, PNG, TIFF
- .80 NVMS shall support authenticating video that was exported in the Native format to validate that it was not tampered with.
- .81 NVMS shall support reviewing video and audio stored in a backup.

## 1.8 CONTRACTOR QUALIFICATIONS

- .1 The Video Surveillance System shall be installed by a qualified Security Systems Contractor certified by the respective equipment manufacturer, and having a minimum of three years installation, and service experience with similar installations.
- .2 The contractor business, employees, managers and owners must be licensed in the Province of British Columbia under the Private Investigators and Security Agencies Act.
- .3 The business must be licensed and bonded as an Alarm Service and each employee who is installing and servicing security alarm devices and equipment, must be licensed and bonded as an employee of the company and not as a sub-contractor.
- .4 The equipment installers must hold a valid Trade Qualification Certificate issued by the Province of British Columbia. Proof of the Company and Installers Certification shall be requested and reviewed prior to contract award.

## 1.9 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and data sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labelling scheme including:
    - .1 Functional description of equipment
    - .2 Technical data sheets of all devices
    - .3 Device location plans and cable lists
    - .4 Video camera surveillance chart
    - .5 Video interconnection detail drawings
    - .6 Programming worksheets
- .3 Samples: Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit sample floor plans with device layout that will be used with the NVMS.
- .4 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 – Submittal Procedures.
  - .1 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance 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.
    - .1 Submit UL/CSA Product safety Certificates.
  - .3 Instructions: Submit manufacturer's installation instructions.
- .5 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Include following:
  - .1 System configuration and equipment physical layout

- .2 Functional description of equipment
- .3 Instructions on operation, adjustment and cleaning
- .4 Illustrations and diagrams to supplement procedures
- .5 Manufacturer's operation instructions
- .6 All programming worksheets

#### 1.10 WARRANTY

- .1 For all materials, the 24-month warranty for parts and labour.
- .2 Provide a separate maintenance and service agreements options for the following:
  - .1 Extending warranty by 12-months
  - .2 Extending warranty by 24-months
  - .3 Extending warranty by 36-months
  - .4 Additional maintenance and service agreements, with parts to be considered as extra.
- .3 Manufacturer's Warranty: Submit, for Department Representative's Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official.

#### 1.11 SUPPORT SERVICES

- .1 Provide manufacturer/dealer advice, information and support services for 1 year.

#### 1.12 LICENSING

- .1 Contractor shall pay for all software and camera licenses for 1-year. All software and camera licenses shall be valid for 1-year after substantial completion of project.

### 2.0 PRODUCTS

#### 2.1 SUPPLY OF SYSTEM COMPONENTS

- .1 Unless otherwise specified in this document, the contractor shall supply all components necessary to complete the system. All materials shall be new and of the latest hardware, software, and firmware versions.

#### 2.2 MATERIALS

- .1 Network Video Management Software (NVMS):
  - .1 Avigilon Control Center (ACC) version 4.12 or later
- .2 High Definition Network Video Recorder/Server:
  - .1 Edition: Enterprise class reliability with a RAID 5 hard drive configuration
  - .2 Recording Rate: Up to 32 MB/s
  - .3 Camera Channels: Up to 128
  - .4 Recording Image Rate: Up to 30 images per second per channel, total of 3840 for 128 channels
  - .5 Local Viewing: No
  - .6 Operating System: Microsoft Windows Embedded Standard 7
  - .7 Hard Disk Drive: Near-line SAS, hot-swappable, RAID 5
  - .8 Recording Storage: Up to 21TB expandable

- .9 Recording Time Required: Min 30 Days for each NVR
- .10 Processor: Intel Xeon Processor E5-2407
- .11 Memory: 6 GB RAM (3 x 2GB)
- .12 Network Interface: 2 Gigabit Ethernet RJ-45 ports
- .13 Video Outputs: 1 VGA or better
- .14 Optical Drive: 1 DVD-RW or better
- .15 Form Factor: 2U rack mount chassis
- .16 Dimensions: 611.1L x 434W x 86.8mmH
- .17 Weight: 28.2kg
- .18 Power Input: 100 to 240VAC, 50/60 Hz auto- switching
- .19 Power Supply: Single hot-swappable, dual-redundant
- .20 Power Consumption: 495 Watts
- .21 Operating Temperature: 10° C to 35° C
- .22 Referenced product: Avigilon HD-NVR2 Series
- .3 4-Monitor Client Remote Workstations:
  - .1 Edition: Enterprise class reliability with a RAID 5 hard drive configuration
  - .2 Viewing Rate: Up to 10 MB/s
  - .3 Viewing Streams: Up to 144
  - .4 Operating System: Microsoft Windows 7, Professional 64-bit
  - .5 Hard Disk Drive: 1-2 SATA 7200RPM JBOD
  - .6 Recording Storage: 1TB expandable
  - .7 Processor: Dual Intel Xeon E5-2609
  - .8 Memory: 4 GB RAM
  - .9 Network Interface: 1 Gigabit Ethernet RJ-45 ports
  - .10 Video Outputs: 4 active (2 DisplayPort and 2 DVI)
  - .11 Optical Drive: 1 DVD-RW or better
  - .12 Form Factor: Desktop
  - .13 Dimensions: 175L x 360W x 435mmH
  - .14 Weight: 14kg
  - .15 Power Input: 100 to 240VAC, 50/60 Hz auto-switching
  - .16 Power Supply: Single non-redundant
  - .17 Power Consumption: 635 Watts
  - .18 Operating Temperature: 10° C to 35° C
  - .19 Referenced product: Avigilon 1.0TB-HD-NVRWS Series
- .4 LCD Workstation Monitors:
  - .1 Monitor size: 30 Inch
  - .2 Number of Pixels: 2560 (H) x 1600 (V)
  - .3 Pixels Pitch: .2505mm
  - .4 Brightness: 370cd/m<sup>2</sup> or better

- |     |                         |  |
|-----|-------------------------|--|
| .5  | Dynamic Contrast Ratio: | 100,000:1                                    |
| .6  | Backlight Type:         | Direct light type                            |
| .7  | Response Time:          | 7ms or better                                |
| .8  | Panel Aspect Ratio:     | 16:10  |
| .9  | Video Formats:          | 480i/p, 576i/p, 720p, 1080i/p                |
| .10 | Display colors:         | 16.7 million                                 |
| .11 | VESA Mounting:          | 100mm x 100mm                                |
| .12 | Video Inputs:           | VGA, HDMI, DVD-I, Display Port,<br>Component |
| .13 | Mounting Bracket:       | Included – Wall/Ceiling Tilt/swivel          |
| .14 | Approved Product:       | Dell U3011 Series                            |
- .5 Network Video Recorder/Server Uninterrupted Power Supply (UPS)
- |     |                          |                                  |
|-----|--------------------------|----------------------------------|
| .1  | Output Capacity:         | 2000VA/1800Watts                 |
| .2  | User Interface:          | Graphical LCD monitor            |
| .3  | Topology:                | True online, double-conversion   |
| .4  | Input Connection:        | 5-20P                            |
| .5  | Output Receptacles:      | 6 x 5-20R, 1 x L5-20R            |
| .6  | Diagnostics:             | Full system self-test            |
| .7  | UPS Bypass:              | Automatic                        |
| .8  | Remote Power off (REPO): | Yes                              |
| .9  | Nominal Input Voltage:   | 120V, 208V, 220-240V             |
| .10 | Power Draw:              | 16.6A @ 120V                     |
| .11 | Frequency:               | 50/60Hz                          |
| .12 | Power Output Factor:     | 0.9                              |
| .13 | Voltage Waveform:        | Sine Wave                        |
| .14 | Battery Replacement:     | Hot-swappable, internal/external |
| .15 | Serial Port:             | RS-232                           |
| .16 | USB Port:                | HID Standard                     |
| .17 | Communication Cards:     | SNMP/Web                         |
| .18 | Mounting:                | 2U rack mounted                  |
| .19 | Dimensions:              | 7H x 438W x 600mmD               |
| .20 | BTU/hr – Normal:         | 838                              |
| .21 | BTU/hr – On Battery:     | 348                              |
| .22 | Referenced Product:      | EATON PW9130L2000R-XL2U          |
- .6 Client Remote Workstation UPS
- |    |                            |                           |
|----|----------------------------|---------------------------|
| .1 | Output Capacity:           | 980Watts/1500VA           |
| .2 | Nominal Output Voltage:    | 120V                      |
| .3 | Output Voltage Distortion: | Less than 5% at full load |
| .4 | Output Frequency:          | 57-63Hz                   |
| .5 | Waveform:                  | Sine wave                 |



- |     |                        |  |
|-----|------------------------|--|
| .6  | Output Connectors:     | 8 x Nema 5-15R   |
| .7  | Nominal Input Voltage: | 120V   |
| .8  | Input Frequency:       | 50/60Hz  |
| .9  | Input Connectors:      | Nema 5-15P   |
| .10 | Cord Length:           | 1.8 meters   |
| .11 | Battery Type:          | Maintenance free sealed lead-acid battery with suspended electrolyte. Leakproof. |
| .12 | Network Options:       | Included   |
| .13 | Control Panel:         | Multi-function LCD Status  |
| .14 | Regulatory Approvals:  | CSA, ULc, UL 1778  |
| .15 | Approved Product:      | APC Smart-UPS SUA1500  |
- .7 Poe Network Switch:
- |     |                        |  |
|-----|------------------------|--|
| .1  | Ports:                 | 24 Ethernet 10/100/1000 PoE+               |
| .2  | Uplinks:               | 4 x 1 Gigabit Ethernet SFP ports           |
| .3  | Available PoE Power:   | 370 Watts                                  |
| .4  | Max Port PoE Power:    | 12 ports @ 30 Watts, 24 ports @ 15.4 Watts |
| .5  | Support:               | IEEE 802.3af, IEEE 802.3at complaint       |
| .6  | Dimensions:            | 45H x 445W x 386mmD                        |
| .7  | Weight:                | 5.7kg                                      |
| .8  | Current consumption:   | 5 – 2A                                     |
| .9  | Max Power consumption: | 55 Watts @ 100% throughput                 |
| .10 | Referenced Product:    | Cisco WS-C2960S-24PS-L Series              |
- .8 2.0 Megapixel Day/Night H.264 HD 3-9mm Indoor/outdoor Dome Camera
- |     |                       |                                      |
|-----|-----------------------|--------------------------------------|
| .1  | Image Sensor:         | 1/2.7" progressive scan CMOS         |
| .2  | Active Pixels:        | 1920 (H) x 1080 (V)                  |
| .3  | Imaging Area:         | 5.9mm (H) x 3.3mm (V)                |
| .4  | Minimum Illumination: | 0.2 lux color, 0.02 lux monochrome   |
| .5  | Dynamic Range:        | 69dB                                 |
| .6  | Lens:                 | 3-9mm, remote focus and zoom         |
| .7  | Angle of View:        | 35° -98°                             |
| .8  | Image Compression:    | H.264                                |
| .9  | Image Rate (fps):     | 30                                   |
| .10 | Streaming:            | Multi-stream H.264 and Motion JPEG   |
| .11 | Motion Detection:     | Selectable sensitivity and threshold |
| .12 | Electronic Shutter:   | Automatic, Manual                    |
| .13 | Iris Control:         | Automatic, Manual                    |
| .14 | Day/Night Control:    | Automatic, Manual                    |
| .15 | IR Illuminator:       | 850nm wavelength, 15m range          |
| .16 | Flicker Control:      | 50 Hz, 60 Hz                         |
| .17 | Privacy Zones:        | 4                                    |
| .18 | White Balance:        | Automatic, Manual                    |

**VIDEO SURVEILLANCE**

- |     |                         |  |
|-----|-------------------------|--|
| .19 | Backlight Compensation: | Automatic  |
| .20 | I/O Terminals:          | Alarm In, Alarm Out  |
| .21 | Video Output:           | NTSC/PAL, 3.5mm jack   |
| .22 | Audio Input/Output:     | Line level, 3.5mm jack   |
| .23 | Power Source:           | PoE: IEEE 802.3af Class 3 Compliant,<br>24VAC, 12-24VDC  |
| .24 | Power Consumption:      | 5W   |
| .25 | Network:                | 100BASE-TX   |
| .26 | Cabling:                | CAT5   |
| .27 | Network Security:       | HTTPS encryption   |
| .28 | Dimensions:             | 140mm Diameter, 104mm Height   |
| .29 | Weight:                 | .55kg  |
| .30 | Dome Bubble:            | Polycarbonate, clear   |
| .31 | Body:                   | Aluminum outdoor, Plastic indoor   |
| .32 | Network Protocol:       | UDP, TCP, SOAP, DHCP, and others   |
| .33 | Environmental:          | Indoor, Outdoor  |
| .34 | Mounting Accessories:   | Included   |
| .35 | Referenced product:     | Avigilon 2.0-H3-D1 indoor surface, 2.0-H3-D01 outdoor surface, 2.0-H3-DC1 Recessed, 2.0-H3-DP1 pendant |
- .9 3.0 Megapixel Day/Night H.264 HD 3-9mm Indoor/outdoor Dome Camera
- |     |                         |                                      |
|-----|-------------------------|--------------------------------------|
| .1  | Image Sensor:           | 1/2.7" progressive scan CMOS         |
| .2  | Active Pixels:          | 1920 (H) x 1080 (V)                  |
| .3  | Imaging Area:           | 5.9mm (H) x 3.3mm (V)                |
| .4  | Minimum Illumination:   | 0.2 lux color, 0.02 lux monochrome   |
| .5  | Dynamic Range:          | 69dB                                 |
| .6  | Lens:                   | 3-9mm, remote focus and zoom         |
| .7  | Angle of View:          | 35° -98°                             |
| .8  | Image Compression:      | H.264                                |
| .9  | Image Rate (fps):       | 30                                   |
| .10 | Streaming:              | Multi-stream H.264 and Motion JPEG   |
| .11 | Motion Detection:       | Selectable sensitivity and threshold |
| .12 | Electronic Shutter:     | Automatic, Manual                    |
| .13 | Iris Control:           | Automatic, Manual                    |
| .14 | Day/Night Control:      | Automatic, Manual                    |
| .15 | IR Illuminator:         | 850nm wavelength, 15m range          |
| .16 | Flicker Control:        | 50 Hz, 60 Hz                         |
| .17 | Privacy Zones:          | 4                                    |
| .18 | White Balance:          | Automatic, Manual                    |
| .19 | Backlight Compensation: | Automatic                            |
| .20 | I/O Terminals:          | Alarm In, Alarm Out                  |
| .21 | Video Output:           | NTSC/PAL, 3.5mm jack                 |

.22	Audio Input/Output:	Line level, 3.5mm jack
.23	Power Source:	PoE: IEEE 802.3af Class 3 Compliant, 24VAC, 12-24VDC
.24	Power Consumption:	9W
.25	Network:	100BASE-TX
.26	Cabling:	CAT5
.27	Network Security:	HTTPS encryption
.28	Dimensions:	140mm Diameter, 104mm Height
.29	Weight:	.55kg
.30	Dome Bubble:	Polycarbonate, clear
.31	Body:	Aluminum outdoor, Plastic indoor
.32	Network Protocol:	UDP, TCP, SOAP, DHCP, and others
.33	Environmental:	Indoor, Outdoor
.34	Mounting Accessories:	Included
.35	Referenced product:	Avigilon 3.0-H3-D1 indoor surface, 3.0-H3-D 01 outdoor surface, 3.0-H3-DC1 Recessed, 3.0-H3-P1 Pendant
.10	5.0 Megapixel Day/Night H.264 HD 3-9mm Indoor/outdoor Dome Camera	
.1	Image Sensor:	1/2.7" progressive scan CMOS
.2	Active Pixels:	2592 (H) x 1944 (V)
.3	Imaging Area:	4.6mm (H) x 3.4mm (V)
.4	Minimum Illumination:	0.3 lux color, 0.03 lux monochrome
.5	Dynamic Range:	69dB
.6	Lens:	3-9mm, remote focus and zoom
.7	Angle of View:	28° -84°
.8	Image Compression:	H.264
.9	Image Rate (fps):	13 @ full resolution, 30 @ 1920 x 1080
.10	Streaming:	Multi-stream H.264 and Motion JPEG
.11	Motion Detection:	Selectable sensitivity and threshold
.12	Electronic Shutter:	Automatic, Manual
.13	Iris Control:	Automatic, Manual
.14	Day/Night Control:	Automatic, Manual
.15	IR Illuminator:	850nm wavelength, 15m range
.16	Flicker Control:	50 Hz, 60 Hz
.17	Privacy Zones:	4
.18	White Balance:	Automatic, Manual
.19	Backlight Compensation:	Automatic
.20	I/O Terminals:	Alarm In, Alarm Out
.21	Video Output:	NTSC/PAL, 3.5mm jack
.22	Audio Input/Output:	Line level, 3.5mm jack
.23	Power Source:	PoE: IEEE 802.3af Class 3 Compliant, 24VAC, 12-24VDC

- .24 Power Consumption: 9W
- .25 Network: 100BASE-TX
- .26 Cabling: CAT5
- .27 Network Security: HTTPS encryption
- .28 Dimensions: 140mm Diameter, 104mm Height
- .29 Weight: .55kg
- .30 Dome Bubble: Polycarbonate, clear
- .31 Body: Aluminum outdoor, Plastic indoor
- .32 Network Protocol: UDP, TCP, SOAP, DHCP, and others
- .33 Environmental: Indoor, Outdoor
- .34 Mounting Accessories: Included
- .35 Referenced product: Avigilon 5.0-H3-D1 indoor surface, 5.0-H3-D  
01 outdoor surface, 5.0-H3-DC1 Recessed,  
5.0-H3-P1 Pendant
- .11 Hemispheric Camera 360 degrees:
  - .1 Lenses: Hemispherical
  - .2 Sensitivity: Colour: 1 lux - 0.05 lux
  - .3 Sensor: ½" CMOS, progressive scan
  - .4 Image Resolution: 2048 x 1536
  - .5 Image Format: 160 x 120 to 2048 x 1536, PTZ view, Quad view
  - .6 Frame Rate: 4 – 22fps
  - .7 Video Stream: 20 - 30fps
  - .8 Image Compression: MxPEG, M-JPEG, JPG, H.263
  - .9 Internal DVR: MicroSD slot – 32GB
  - .10 Software: MxEasy, MxControlCenter 2.1
  - .11 Image Processing: Backlight compensation, automatic white  
balance, image distortion correction, Motion  
detection
  - .12 Virtual PTZ: Digital pan/tilt/zoom, continuous 8 x zoom
  - .13 Alarm/Events: Motion detection, temperature sensor,  
notification over email, FTP, IP-Telephony (VoIP,  
SIP), Visual/acoustic alarm
  - .14 Audio: Integrated loudspeaker and microphone
  - .15 Interfaces: Ethernet 10/100, USB
  - .16 Power supply: PoE, 4.5W
  - .17 Operating Conditions: -30° to +60°C
  - .18 Dimensions: Diameter: 16cm, Height: 5cm
  - .19 Approved Product: Mobotix Q24 Sec Series
- .12 Equipment Cabinet:
  - .1 Construction: 16 gauge steel
  - .2 Mounting Rails: 14 gauge steel EIA-310-D compliant
  - .3 Load Capacity: 1500lb

.4	Rack Spaces:	12U
.5	Casters:	4 required
.6	Grounding Studs:	Provided on body
.7	Dimensions:	25"H x 24"W X 36"D
.8	Approved Product:	Hammond RCSC1902136BK1 Series

### 2.3 CAMERA CABLING

- .1 Camera cabling shall be CAT5E data cable.

### 2.4 CAMERA JUNCTION BOX

- .1 Metal, sized to handle all system conduit interconnections with appropriate expansion

### 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 datasheet.

#### 3.2 INSTALLATION

- .1 Install video surveillance equipment and components as indicated on drawings and specifications, and in accordance with ULC-S317.
- .2 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.
- .3 Install components secure, properly aligned and in locations shown on reviewed shop drawings.
- .4 Connect cameras to cabling in accordance with installation instructions.
- .5 NVR shall store at minimum 15 days of recorded video.
- .6 Install ULC labels where required.
- .7 Adjust camera video for low light levels such as nighttime or when lights have been turned off. Low light level adjustment shall be done in the evening when the sun has gone down for an hour at least.
- .8 The contractor under this Section is responsible for installing, connecting, programming and testing of all system components.
- .9 Install all video surveillance components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .10 Install all video surveillance components secure to walls, ceilings or other substrates.
- .11 Each cable from component to component shall be continuous without any joint or splice.
- .12 Low voltage cables are not permitted to share the same conduits or ducts with line voltage electrical cables.
- .13 All video communication wiring must be in conduit unless approved otherwise by the departmental representative.
- .14 Install a woven nylon pull string in with cables as cables are pulled into conduits.
- .15 All cables shall be CSA approved. All cables shall be FT4 for non-plenum and FT6 for plenum areas.

### 3.3 PROGRAMMING

- .1 The contractor shall be responsible to program any programmable component related to the video surveillance system, and setup all necessary operating systems.
- .2 The Departmental Representative will inform the contractor of any specific programming requirements. The contractor shall make allowances for custom programming as request by the Departmental Representative.
- .3 All remote download/upload options shall be enabled co-ordinate with Departmental Representative.

### 3.4 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum three (3) sessions of four (4) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the video surveillance systems.
- .2 The contractor as part of their tendered price shall provide a four (4) hour instruction session 30 days after completion of initial training sessions.

### 3.5 VERIFICATION

- .1 Perform verification inspections and test in the presence of Departmental Representative.
  - .1 Provide all necessary tools, ladders and equipment.
  - .2 Ensure appropriate subcontractors and manufacturer's representatives are present for verification.
- .2 Perform system tests for the following:
  - .1 All camera operations
  - .2 All recording operations
  - .3 All camera labeling
  - .4 All network connections
  - .5 All workstation operations
  - .6 All integrations with other security systems
  - .7 All systems required testing
- .3 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
  - .1 Sturdiness of equipment fastening
  - .2 Non-existence of installation related damages
  - .3 Compliance of device locations with reviewed shop drawings
  - .4 Compatibility of equipment installation with physical environment
  - .5 Inclusion of all accessories
  - .6 Device and cabling identification
  - .7 Application and location of ULC approval decals
- .4 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
  - .1 Measurements of tension and power
  - .2 Connecting joints and equipment fastening
  - .3 Measurements of signals (dB, lux, baud rate, etc)

- .4 Compliance with manufacturer's specification, product literature and installation instructions
- .5 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
  - .1 Operation of each device individually and within its environment
  - .2 Operation of each device in relation with programmable schedule and or/specific functions
  - .3 Operation control of camera lens, pan, tilt and zoom
  - .4 Switching of camera to any monitor
  - .5 Switching of system video recorder to selective monitor
  - .6 Set dwell times.
  - .7 Demonstrate:
    - .1 Sequence viewing of cameras on each monitor
    - .2 Bypass capability.

### 3.6 CLEANING AND ADJUSTING

- .1 Remove protective coverings from cameras and components.
- .2 Adjust cameras for correct function.
- .3 Clean camera housings, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

END OF SECTION 282300

1.0 GENERAL

1.1 GENERAL

- .1 Existing Simplex addressable fire alarm system shall be extended into Passport Canada area.
- .2 Existing Graphic annunciator shall be updated as required.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Provide and install components as listed below. New components shall match existing:
  - .1 Fire alarm pull stations.
  - .2 Fire alarm ceiling mounted speakers.
  - .3 Fire alarm visual alarms.
  - .4 Ancillary devices as required.
  - .5 Fire alarm verification of zone(s) affected by this work.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Provide and install new fire alarm devices as shown on drawings. Connect to existing system.
- .2 Update existing Graphic annunciator(s) as required.
- .3 Provide fire alarm verification of zone(s) affected by this work prior to substantial completion.
- .4 Update the fire alarm system's Sequence of Operation as required to suit any new devices or interlocks.

END OF SECTION 283100



## 1.0 WORK INCLUDED

- .1 The unit prices submitted in the Form of Tender shall include the entire cost of supplying all labour, material, equipment and applicable taxes required to install micro-piles where called for on the drawings and outlined in this specification. The work to be performed under this section shall consist of drilling, furnishing, grouting, and testing of piles at locations shown on the plans, or as directed by the Departmental Representative, and in conformity with this specification.

## 2.0 DEFINITIONS

- .1 Pile Length: Refers to the portion of the pile that transmits the load to the surrounding ground.
- .2 Alignment Load (AL):  $AL = 10\%$  of design load ( $P_d$ )
- .3 Design Load ( $P_d$ ): Refers to the anticipated final maximum load in the pile. It is also referred to as the working load.
- .4 Maximum Test Load ( $P_t$ ):  $P_t = 1.5P_d$ . Note: Test load factor can vary from  $1.1P_d$  to  $2.0P_d$ , depending on the application. A factor of 1.50 is used in herein.
- .5 Proof Test: Refers to the incremental loading of a pile by recording the incremental movement of the pile at each specified load stage.
- .6 Creep Test: Refers to a test used to determine the movement of the pile at constant load over a specific period of time.

## 3.0 GENERAL

- .1 Performance  
Perform all work and supply materials as specified herein and in accordance with the Contract documents.
- .2 Soil Report  
A copy of the soil report is available for reference and review upon requested.
- .3 Responsibility of the Contractor  
Firms undertaking to bid this work shall have a minimum of five years experience in projects of this magnitude and shall have equipment and manpower suitable and available for the entire duration of the project. The Contractor shall submit with his proposal a reference list of work performed of equal magnitude and scope.
- .4 Inspection and Testing  
The Departmental Representative will retain an independent testing agency for the testing of cement grout and the inspection of the work. The contractor shall submit to the Departmental Representative the mill test certificate of the steel used to fabricate the micro-piles.
- .5 Shop Drawings  
Submit shop drawings for approval to the Departmental Representative a minimum of 4 weeks prior to commencement of work.  
  
Shop drawings shall include the following information:
  - Pile layout
  - Pile component details, pile length and borehole diameter
  - Pile design capacity

- Grade and properties of the pile material
- Percent of pile yield load at working procedure
- Grout: cement type, strength, additives, mix design
- Proposed drilling method
- Sequence of drilling and installation

.6 Acceptability

Failure of any pile to meet the performance test criteria will result in rejection of the pile in question. The criteria for performance acceptance are outlined in paragraph 9.

.7 Jobsite Conditions

The length of piles has been determined based on available geological data.

If during construction, the site conditions are found to be significantly different from those anticipated, the length and/or the spacing of piles may be changed as directed by the Departmental Representative.

.8 Basis of Payment

The price shall include all costs for mob and demobilization, supply, drilling, installation, grouting and testing of successfully completed anchors as measured by the Departmental Representative.

4.0 PRODUCTS

.1 General Description

The DYWIDAG micro-pile is a pressure grouted compression and tension pile of small diameter (micro-pile). The load-bearing component is a DYWIDAG Threadbar. The grout cylinder encases the Threadbar, which is kept in the center of the borehole by centralizers.

The cement grout protects the steel against corrosion, and stabilizes the pile within the soil against buckling. The load is transferred to the ground by skin frictions between the grout body and the soil.

.2 DYWIDAG Threadbar

The micro-piles shall consist of a 63mm diameter (#20) DYWIDAG Threadbar manufactured in accordance with ASTM A615 or CSA G30.18M.

Grade Steel: 550/725 MPa  
Steel Area:  $A_s = 3,167 \text{ mm}^2$   
Yield capacity:  $P_y = 1,748 \text{ KN}$

Where it indicated on plan, the #11 micro-piles shall consist of a 36mm diameter (#21) DYWIDAG Threadbar manufactured in accordance with ASTM A615 or CSA G30.18M.

Grade Steel: 517/690 MPa  
Steel Area:  $A_s = 1,006 \text{ mm}^2$

Yield capacity:  $P_y = 520 \text{ KN}$

.3 Corrosion Protection

The Threadbar shall be shop grouted inside a corrugated PVC sheathing for the entire length. Corrugated sheathing shall be made of PVC material with a minimum compressive strength of 103 MPa (14,500 psi) and a minimum tensile strength of 48 MPa (7,000 psi). PVC material shall be free of water-soluble chlorides and other ingredients that might enhance corrosion, hydrogen embrittlement or stress corrosion on the steel tendon. The ultimate bond stress between the PVC sheathing and the cement grout shall be a minimum of 4.8 MPa (700psi) based on the minimum compressive grout strength of 28 MPa. The cement grout for the pile shall be non-shrink Portland Cement grout with a minimum 28 day compressive strength of 30 MPa.

.4 Anchorage Nuts and Couplers

Anchor nuts and couplers shall be compatible with the DYWIDAG micro- pile system, and shall develop at least 100% of the ultimate tensile strength of the DYWIDAG Threadbar in tension and compression.

5.0 MICRO-PILE FABRICATION

- .1 Micro-piles shall be shop-fabricated in accordance with approved shop drawings, using personnel trained and qualified in this type of work.
- .2 The prefabricated pile assemblies shall be protected against physical damage and corrosion at all times prior to installation. Any pile or pile component (including the protective sheathing) that is damaged during the work shall be replaced at the expense of the Contractor.

6.0 DRILLING

- .1 Casing is required for drilling of the piles to the minimum borehole diameter as indicated on the contract drawings.
- .2 Pile holes shall be drilled within plus or minus 1% of the theoretical centerline and shall be located within plus or minus 50mm from the location as shown on the contract drawings.
- .3 Pile holes shall be thoroughly cleaned prior to the installation of piles.
- .4 The Contractor shall keep a record of all drilling procedures and drilling time, which shall be made available to the Departmental Representative.

7.0 INSTALLATION

- .1 The installation of the micro-piles shall be supervised by a Professional Engineer or by his/her representative.

- .2 Steel of plastic centralizers shall be provided to ensure that the micro-pile assembly is centrally located in the hole, providing a minimum grout cover of 15.0 mm.
- .3 The Contractor shall maintain a record showing the pile number, cement grout quantity and installation date for each micro-pile.

#### 8.0 GROUTING

- .1 The pile grout shall be Portland Cement grout with a minimum design compressive strength of 35 MPa at 28 days. The mixing water shall be free of any deleterious material. No detrimental additives such as calcium chloride are permitted.
- .2 Mix-design for grout to be designed by the Contractor, meeting the requirements specified herein.
- .3 Use equipment capable of continuous mechanical mixing and pumping to produce a grout free of lumps and undispersed cement.
- .4 The grout shall be pumped into the cased hole through a grout tube from the bottom until neat grout exits from the top of the drill casing.
- .5 The grout shall always be injected at the lowest point of the pile.
- .6 The micro-pile shall then be pressure grouted through the casing.
- .7 Grout shall be injected through a top casing cap, while extracting the casing simultaneously. A minimum injection pressure of 150 psi (1.0 MPa) shall be maintained during the grouting operation.
- .8 The Departmental Representative may request the use of a multi-stage post grouting system capable of developing grouting pressure of up to 900 psi (6.2 MPa) for piles in soft, cohesive ground.
  - Post-grouting shall be performed in accordance with the manufacturer's recommendations.
- .9 After each grouting operation, the piles shall remain in an undisturbed condition until adequate grout strength has been achieved.

#### 9.0 PERFORMANCE TESTS

- .1 All performance testing equipment must be used in accordance with the specifications of the manufacturer and must at all times be maintained in good condition.

The contractor shall provide all necessary devices and instruments for testing of the piles, meeting standard pile testing procedures.
- .2 Proof testing shall not be carried out until the grout has reached its specified strength.
- .3 All performance test data shall be recorded and made available to the Departmental Representative upon request.

- .4 Load versus displacement data for each test shall be plotted on a load extension graph.
- .5 Pile displacements under constant creep test load shall be plotted as displacement in millimetres versus the log of time in minutes.
- .6 Performance testing for the micro-piles shall be conducted as follows:
  - .1 The Departmental Representative may select that all or a certain number of piles be performance tested and creep tested. Cost for testing shall be borne by the Contractor. Allow costs for 6 piles at the locations selected by the Departmental Representative.
  - .2 All selected piles shall be proof tested to 150% of design load.
  - .3 An alignment load (AL), equivalent to 10% of the design load shall be applied to remove the slack from the pile and to engage the equipment. At this time, the dial gauge for elongation measurement shall be set to zero. The pile shall then be loaded by a hydraulic jack in a single operation to  $0.5P_d$  and maintained at that load for 30 minutes for creep measurement. The creep measurement shall be recorded at 1, 3, 5, 10, 15, 20, and 30 minutes. The pile shall then be unloaded to AL and the residual displacement recorded.
  - .4 Repeat the test at  $1.0P_d$  and  $1.5P_d$ . Hold load at  $1.0P_d$  for 30 minutes for creep measurement. Unload the pile to AL and record the residual displacement. Acceptance criteria are met when the slope of the free displacement versus log time plot is less than 1.5 mm per log cycle and the test load levels of  $1.5P_d$ .
  - .5 Reference Resting procedures can be modified to suit job requirements:
    - a) Long term tests (24hours)
    - b) Short term tests (30 minutes)

END OF SECTION 31 63 20