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CONTRACT DOCUMENTS SPECIFICATIONS: ISSUED FOR CONSTRUCTION

PROJECT No. R.055494.001

GOCB FIT-UP – SUITE 201
Saskatoon, Saskatchewan

SOLICITATION No.



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VOLUME 1 of 1

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1 General

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- .1 This Contract includes work, materials and procedures indicated on drawings and in specifications and other documents referenced or related to this project.
- .2 Work of this Contract, identified as Project No R.055494.001, consists of general interior renovations to a suite in the Government of Canada Building, located at 101-22nd Street East, Saskatoon, Saskatchewan.
 - .1 The interior renovations generally include selective demolition, patching and repairs, carpentry, partitions, flooring, ceiling and wall finishes, mechanical and electrical.

1.02 CONTRACT METHOD

- .1 Construct Work stipulated price contract.

1.03 WORK BY OTHERS

- .1 Co-operate with Departmental Representative and other contractors in carrying out their respective works and carry out instructions from Departmental Representative so that work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Departmental Representative.
 - .1 If any part of Work under this Contract depends for its proper execution or result upon work of another contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .2 Work that is scheduled to occur concurrently with Work of this Contract, which is specifically excluded from this Contract, but which will require coordination and cooperation:
 - .1 Shared Services Canada (SSC):
 - .1 During Work SSC will be installing voice/data structured cabling for the project.
 - .2 Coordinate with Departmental Representative and Division 27 & 28.
 - .2 Furniture:
 - .1 Departmental Representative will supply and install furniture following Substantial Completion of the Work. Coordinate with Departmental Representative for scheduling and power and data connections.

1.04 OWNER-FURNISHED, CONTRACTOR INSTALLED ITEMS

- .1 Owner Responsibilities:
 - .1 Deliver bill of materials to Contractor.
 - .2 Arrange and pay for delivery to site in accordance with Progress Schedule.
 - .3 Inspect deliveries jointly with Contractor.
 - .4 Submit claims for transportation damage.
 - .5 Arrange for replacement of damaged, defective or missing items.

- .2 Contractor Responsibilities:
 - .1 Designate delivery date for each product in progress schedule.
 - .2 Receive and unload products at site.
 - .3 Inspect deliveries jointly with Departmental Representative; record shortages, and damaged or defective items.
 - .4 Handle products at site, including uncrating and storage.
 - .5 Protect products from damage, and from exposure to elements.
 - .6 Assemble, install, connect, adjust, and finish products.
 - .7 Provide installation inspections required by public authorities.
 - .8 Repair or replace items damaged by Contractor or subcontractor on site (under its control).
- .3 Schedule of Owner-furnished items:
 - .1 Projection Screen
 - .2 Doors and frames salvaged from fourth floor renovation indicated in Section 08 06 00 – Door and Frame Schedule.

1.05 WORK SEQUENCE

- .1 Construct Work in single continuous phase.

1.06 CONTRACTOR USE OF PREMISES

- .1 Restrict use of site in accordance with requirements of Section 01 14 00 – Work Restrictions.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.07 OWNER OCCUPANCY

- .1 Owner will occupy adjacent portions of premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.
- .3 Refer to Section 01 14 00 – Work Restrictions for additional requirements.

1.08 FIRE SAFETY REQUIREMENTS

- .1 Comply with both the National Building Code of Canada 2015 and the National Fire Code of Canada 2015 for safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire, as follows;
 - .1 The National Building Code (NBC): for fire safety and fire protection features that are required to be incorporated in a building during construction.
 - .2 The National Fire Code (NFC):
 - .1 The on-going maintenance and use of the fire safety and fire protection features incorporated in buildings.
 - .2 The conduct of activities that might cause fire hazards in and around buildings.
 - .3 Limitations on hazardous contents in and around buildings.
 - .4 The establishment of fire safety plans.
 - .5 Fire safety at construction and demolition sites.
- .2 Welding and cutting:
 - .1 At least one week prior to commencing cutting, welding or soldering procedure, provide to Departmental Representative:
 - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.
 - .2 Completed welding permit as defined in NFC.
 - .3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
 - .2 "Fire Watchers" as described in NFC shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 15m may be ignited by conduction or radiation.
- .3 Where work requires interruption or cause activation of fire alarms or fire suppression, extinguishing or protection systems:
 - .1 Provide "Watchman Service" as described in NFC; In general, watchman service is defined as an individual conversant with "Fire Emergency Procedures", performing fire picket duty within an unprotected and unoccupied (no workers) area once per hour.
 - .2 Retain services of manufacturer for fire protection systems on daily basis or as approved by Departmental Representative, to isolate and protect all devices relating to:
 - .1 Modification of fire alarms, fire suppression, extinguishing or protection systems; and/or
 - .2 Cutting, welding, soldering or other construction activities that might activate fire protection systems.
 - .3 Immediately upon completion of work, restore fire protection systems to normal operation and verify that all devices are fully operational.
 - .4 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation.

1.09 COST BREAKDOWN

- .1 Before submitting first progress claim, submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval by Departmental Representative cost breakdown will be used as the basis of progress payments.
 - .1 Refer to Section 01 32 16 – Construction Progress Schedule- Critical Path Method (CPM) for additional requirements.

1.10 PRECEDENCE

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

1.11 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

1.12 FIELD QUALITY CONTROL

- .1 Carry out Work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
- .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
- .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.13 PERMITS

- .1 Building Permit will be applied for prior to Work on behalf of Owner.
- .2 Contractor shall pick up and pay for Building Permit.
- .3 Specification Content: The *Specifications* use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1.14 SPECIFICATION FORMATS AND CONVENTIONS

- .1 Specification Format: The specifications are based on MasterFormat® jointly published by Construction Specifications Canada (CSC) and Construction Specifications Institute (CSI) using the 2016 updated master list of numbers and titles that classify work results or construction practices:
 - .1 Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents.
 - .2 Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete and not intended to be read as a continuous and sequential page-by-page requirement.
 - .3 Consult Section 00 01 10 - Table of Contents at beginning of Project Manual to determine Section numbers and titles in the Contract Documents.
 - .4 Section numbers do not, and cannot indicate scope of work for individual Subcontractors (trade scope of work); rather they establish the *Work* required for the *Project*.
- .2 MasterFormat is primarily used to organize Project Manuals, organize detailed cost information and relate notations on *Drawings* to the *Specifications*.
 - .1 As described in MasterFormat, Section numbers and titles may be identified with the following precision:
 - .1 Level 2: 07 51 00 – Built-Up Bituminous Roofing
 - .2 Level 3: 07 51 13 – Built-Up Asphalt Roofing
 - .3 Level 4: 07 51 13.13 – Cold-Applied Built-Up Asphalt Roofing
- .3 Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - .1 Related Requirements: Related requirements listed in Specifications indicate Specifications Sections that are related to work of the Section do not create a trade scope of work:
 - .1 Related requirements are provided to indicate closely coordinated requirements during preparation of Contract Documents and that may aid the Contractor in fully incorporating components relating to trade scope of work.
 - .1 Coordinate with Sections affecting work and ensure that trade scope of work is fully accounted for, including requirements of Divisions 00 and 01 and other Sections that may not be listed in the listings associated with related requirements.
 - .2 Laws, Statutes, Codes and Reference Standards: Dated reference standards listed in the Specifications generally reflect the version used to establish the performance requirements for the work described:
 - .1 Reference to any provincial or national statutes and codes includes the full content of the code or statute including and amendment, revision or consolidation published by the Authority Having Jurisdiction.
 - .2 Dated reference standards listed in provincial or national codes or statutes apply to the Work of the Contract.

- .3 Dated reference standards listed in provincial codes or statutes govern where an older or newer version of a reference standard is listed in the Specifications.
- .3 Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated to aid interpretation of the documents:
 - .1 Words and meanings shall be interpreted as appropriate and are intended to be read as a whole, not extracted and read individually.
 - .2 Words implied but not stated, shall be inferred as the sense requires.
- .4 Imperative Mood and Streamlined Language: Generally used in the Specifications to avoid assigning specific responsibilities to the Contractor or the Subcontractor that affect trade scopes of work:
 - .1 Requirements expressed in the imperative mood are to be performed by the Contractor.
 - .2 Occasionally, the indicative or subjunctive mood may be used in the Section text for clarity to describe responsibilities that must be fulfilled by the Contractor or by others when so noted.
- .5 Use of May, Shall, Must and Will: Use of the words may, shall, must and will is minimized throughout the Specifications, but are used to indicate preferred directives to the Contractor where greater clarity to the documentation is achieved using those words:
 - .1 For the purposes of this Contract, the word “may” is indicative of a directive subject to discretion on the part of the party from whom the action is forthcoming, and the other party has an obligation to act upon when the purpose or result of the directive is identified.
 - .2 For the purposes of this Contract, the word “shall” is indicative of a directive when one party “has a duty” to another, and where a failure to do something has potential to breach an obligation under the contract; typically requiring that the Contractor undertake a specific task or assignment.
 - .3 For the purposes of this Contract, the word “must” is indicative of a directive when one party “is required to” perform an action or directive, with no other interpretation.
 - .4 For the purposes of this Contract, the word “will” is indicative of a directive that one party “has an express obligation” to the other party; typically, an action or task required by the Departmental Representative.
- .6 Use of Singular and Plural Words: The language of the Specifications is essentially plural, and usage of singular and plural words is governed as follows:
 - .1 Every attempt has been made to apply singular and plural word usage based on numbers of components required by the Project; however, it is expected that use of singular and plural words will be interpreted in context to what the Contract Documents indicate.

- .2 The use of plural words when ascribed to a singular requirement shall be reasonably interpreted as relating to a singular requirement when a count of components described by the plural word indicates a single occurrence.
- .3 The use of a singular word version when ascribed to multiple requirements shall be reasonably interpreted as relating to multiple requirements when a count of components described by the singular word indicates multiple occurrences.
- .7 Use of Gender Specific Words: The language of the Specifications is generally written as nouns arising from the Contract and that relate to the partnerships, firms or corporations involved and generally avoid the use of gender specific pronouns wherever possible:
 - .1 Words describing gender and that relate to the partnerships, firms and corporations can be interpreted as relating to the Contractor as defined by the Contract within the context of what the Contract Documents require for those parties.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

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1 General

1.01 ACCESS AND EGRESS

- .1 Maintain existing services to building and provide for personnel and vehicle access.
- .2 In the event temporary openings are required in exterior walls, ensure openings are weathertight, and vermin proof. Reinstate exterior walls to condition that existed prior to construction.
 - .1 Obtain approval from Departmental Representative prior to creating openings.
 - .2 Refer to Section 01 52 00 – Construction Facilities
- .3 Maintain safe occupant access, egress and internal circulation for occupied areas of the buildings, and for construction workers in the area of the Work.
 - .1 Ensure Authorities Having Jurisdiction review and approve egress routes. Do not alter egress routes without prior approval from Authorities Having Jurisdiction.
 - .2 Post egress routes as part of emergency procedures.

1.02 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Departmental Representative will provide BGIS contact information for at start up meeting.
- .2 Construction activity hours of work: Monday to Friday between 0600 and 1730 hr.
 - .1 Extended Hours: Obtain special permission from Departmental Representative to work outside of indicated Construction activity hours of Work. Refer to “Special Requirements” in this Section.
- .3 Limit use of premises for Work, for storage, and for access to allow:
 - .1 Occupancy of adjacent areas.
 - .2 Work by other contractors.
- .4 Laydown and construction staging space is not available on site outside designated construction areas within the building. Contractor to obtain and pay for space required to facilitate laydown, staging and construction office facilities.
- .5 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .6 Generally, restrict construction activities to designated work areas. Where Work must proceed outside of designated areas, arrange scheduling with Departmental Representative not less than ten working days prior to commencement of such work.
- .7 Use public circulation entrances, corridors, elevators, and stairs for access to work areas.
- .8 Existing Elevator: Use only freight elevator, existing in building, for moving materials and workers, and removal of construction debris.
 - .1 Protect walls of elevator, to approval of Departmental Representative prior to use.

- .2 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .3 Coordinate use with Departmental Representative.
 - .1 Elevator is controlled by card access.
 - .2 Contractor will not have exclusive use of freight elevator.
- .9 At completion of Work, condition of existing work: equal to or better than that which existed before Work started.
- .10 Repair or replace portions of existing work which have been altered during construction to match existing or adjoining work, as approved by Departmental Representative.
- .11 Closures: protect work temporarily until permanent enclosures are completed.
- .12 Maintain life safety routes, and fire access/control.

1.03 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Areas adjacent to the Work will remain occupied and in use during entire construction period for execution of normal operations.
- .2 Disruption to building occupants in adjacent areas of the premises may impact Contractor's hours of work. Cease disruptive activities immediately as directed by Departmental Representative, and coordinate rescheduling of disruptive activities.
- .3 Execute work with least possible interference or disturbance to building operations, occupants, and normal use of premises.
- .4 Protect infrastructure and services running through the area of the Work that supports occupied operational spaces.

1.04 EXISTING SERVICES

- .1 Provide alternative routes for pedestrian traffic.
- .2 Notify Departmental Representative, and BGIS of intended interruption of services. Obtain required permission 10 Working days in advance of interruption.
- .3 Where Work involves interruption of services to occupied adjacent areas, breaking into or connecting to existing services, give Departmental Representative and BGIS minimum ten Working Days' notice for necessary interruption throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by Department Representative, or governing authorities with minimum disturbance to facility operations.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services to maintain critical building systems, as directed by Departmental Representative.

- .7 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.

1.05 SPECIAL REQUIREMENTS

- .1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic, noise, and security regulations.
- .2 Schedule delivery of materials during regular business hours, but outside of peak traffic times, unless otherwise approved by Departmental Representative.
 - .1 Deliver materials to loading dock and transport to construction area using freight elevator.
- .3 BGIS Property Management: Work occurs within a Brookfield Global Integrated Solutions (BGIS) managed facility.
 - .1 Work Permit: Complete, and submit to BGIS, Work Permit Application prior to commencement of Work.
 - .2 Job Hazard Assessment (JHA): Complete and submit to BGIS a project specific Job Hazard Assessment in conformance with BGIS requirements.

1.06 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Personnel employed on this project are required to sign in and out at front reception desk each day.
 - .1 Extended Hours Security: When extended hours are acceptable to Departmental Representative, construction personnel must obtain and pay for services of Commissionaire.
 - .1 Commissionaire must be present for duration of extended hours work.

1.07 CONTROL OF NOISE, VIBRATION, DUST, NOXIOUS FUMES AND SMOKE

- .1 Be aware of locations of existing mechanical air intakes and vents. Prevent noxious fumes and smoke associated with the Work from entering surrounding occupied buildings.
- .2 Minimize noise, vibration and dust-generating activities from affecting occupied areas. Provide 72 hours' notice to Departmental Representative prior to work causing noise, vibration, and dust generation.
 - .1 Schedule noise-generating work outside of normal office hours.
 - .1 Normal Office Hours: 0800 to 1630 hr.

- .3 Be prepared to stop and reschedule Work upon verbal notice from Departmental Representative that the Work is causing detrimental effect on the operation of occupied areas.
- .4 Dust Management:
 - .1 Place sticky mat in area directly outside construction work zones in occupied areas, to trap dust from equipment and shoes of personnel leaving construction zone. Vacuum mat daily and when visibly soiled.
 - .2 Wear clean coveralls, and booties over construction footwear. Remove coveralls, and vacuum themselves with HEPA-filtered vacuum to remove dust from their clothing before leaving construction zone.
 - .3 Clean work area with HEPA-filtered vacuum at end of each work day.
 - .4 Cover and protect equipment and furnishings with clean tarpaulins.
 - .5 Seal doors, vents, and other sources of potential air leak between construction zone and adjacent occupied areas.
 - .1 Provide a minimum merv 8 filtration on existing inlets and return air ducts and systems during course of construction.
 - .6 Enclose supplies, equipment and waste in covered containers when transporting through public areas.
 - .7 Where construction/demolition dust migrates beyond construction areas, apply additional control measures as directed by Departmental Representative including but not limited to negative pressurization of construction area.

1.08 BUILDING SMOKING POLICY

- .1 Comply with smoking restrictions. Smoking is not allowed in building or on property.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

1 General

1.01 APPOINTMENT AND PAYMENT

- .1 Provide testing and inspection specified except where explicitly indicated to be performed by Departmental Representative.
- .2 Departmental Representative may appoint and pay for services of testing laboratory for random quality assurance testing, except follows:
 - .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 conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified in technical specifications to be carried out by Contractor.
- .3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.02 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

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1 General

1.01 ADMINISTRATIVE

- .1 Schedule and administer project meetings every two weeks, or as directed by Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to the Departmental Representative, and major Subcontractors involved in the Work.
- .4 Provide for telephone and web-based conferencing. Physical meeting space is not required.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties with associated due dates.
- .7 Distribute electronic copy of minutes within three days after meetings to meeting participants, and affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents

1.02 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, but before start of Work, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative and senior representatives of Contractor, major Subcontractors, field inspectors, and supervisors will be in attendance.
- .3 Departmental Representative will establish time and location of meeting and notify parties concerned minimum five working 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 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM), including critical work sequencing, long-lead items, delays, Risk management, Substantial Performance of Work, Final Completion.
 - .3 Schedule of submission of shop drawings, samples, colour chips.
 - .4 Requirements for temporary facilities in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Site security
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .7 Owner provided products.

- .8 Record drawings.
 - .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .11 Monthly progress claims, administrative procedures, photographs, hold backs, cost breakdown, cash flow.
 - .12 Appointment of inspection and testing agencies or firms.
 - .13 Insurances, transcript of policies.
 - .14 Communications.
 - .15 RFI process.
 - .16 Health and safety requirements.
 - .17 Progress review inspections, and meetings.
 - .18 Labour conditions.
 - .19 Bonds.
 - .20 Warranties and guarantees.
 - .21 Permits and by-laws.
 - .22 Material delivery.
 - .23 Certificates.
 - .24 Hazardous Materials.
 - .25 Security Requirements.
 - .26 Commissioning.
 - .27 Pre-construction document checklist.
 - .28 On-site postings.
 - .29 Contract documentation.
 - .30 Hot work permits.
 - .31 Fuel tanks.
 - .32 PSPC Project forms.
 - .33 Liability and indemnification.
- .6 Submit Construction Progress Schedule, and Shop Drawing Submittal Schedule at initial start-up meeting.

1.03 PROGRESS MEETINGS

- .1 Departmental Representative and senior representatives of Contractor, major Subcontractors, field inspectors, and supervisors will be in attendance.
- .2 Establish time and location of meeting and notify parties concerned minimum five working days before meeting.
- .3 Agenda:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Contractor's Construction Schedule:
 - .1 Review progress since the last meeting.
 - .2 Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule.
 - .3 Determine corrective measures and procedures to regain projected schedule, and secure commitments from parties involved to do so.

- .4 Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
- .5 Review proposed changes for affect on construction schedule and on completion date.
- .6 Review progress schedule, during succeeding work period.
- .7 Review detailed 4-week look ahead schedule.
- .3 Review present and future needs of each entity present, including the following:
 - .1 Interface requirements.
 - .2 Sequence of operations.
 - .3 Status of submittal and submittal schedules.
 - .4 Safety.
 - .5 Deliveries.
 - .6 Off-site fabrication delivery schedules.
 - .7 Access.
 - .8 Site utilization.
 - .9 Noisy and otherwise disruptive work to building tenants.
 - .10 Temporary facilities and controls.
 - .11 Service interruptions, and system shutdowns.
 - .12 Progress cleaning.
 - .13 Quality and work standards.
 - .14 Status of correction of deficient items.
 - .15 Field observations, problems and conflicts.
 - .16 Status of RFIs.
 - .17 Status of proposal requests.
 - .18 Pending changes.
 - .19 Status of Change Orders.
 - .20 Documentation of information for payment requests.
- .4 Problems which impede construction schedule.
- .5 Review security measures in place, security incidents, and revisions required to respond to construction activities.
- .6 Risks and opportunities: Identify, categorize, prioritize, and mitigate or avoid risks before they occur.
- .7 Other business.

1.04 PREINSTALLATION MEETINGS

- .1 Preinstallation Meetings: Conduct a preinstallation meeting at Project site before each construction activity that requires coordination with other construction.
- .2 Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Notify Departmental Representative of scheduled meeting dates 10 working days before meeting.
- .3 Agenda: Review progress of other construction activities and preparations for the particular activity under consideration
- .4 Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

- .5 Reporting: Distribute minutes of the meeting to Departmental Representative, each party present, and to other parties requiring information, within three working days of meeting.
- .6 Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

END OF SECTION

1 General

1.01 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 Actual Finish Date (AF): point in time that Work actually ended on activity
- .3 Actual Start Date (AS): point in time that Work actually started on activity.
- .4 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.
- .5 Baseline: original approved plan (for Project, work package, or activity), plus or minus approved scope changes.
- .6 Completion Milestones: they are firstly Interim Certificate and secondly Final Certificate.
- .7 Constraint: applicable restriction that will affect performance of Project. Factors that affect activities can be scheduled.
- .8 Control: process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.
- .9 Critical Activity: any activity on a critical path. Most commonly determined by using critical path method.
- .10 Critical Path: series of activities that determines duration of Project. In deterministic model, critical path is usually defined as those activities with float less than or equal to specified value, often zero. It is longest path through Project.
- .11 Critical Path Method (CPM): network analysis technique used to predict Project duration by analyzing which sequence of activities (which path) has least amount of scheduling flexibility (least amount of float).
- .12 Data Date (DD): date at which, or up to which, Project's reporting system has provided actual status and accomplishments.
- .13 Duration (DU): number of work periods (not including holidays or other non-working periods) required to complete activity or other Project element. Usually expressed as workdays or work weeks.
- .14 Early Finish Date (EF): in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can finish, based on network logic and schedule constraints. Early finish dates can change as Project progresses and changes are made to Project plan.

- .15 Early Start Date (ES): in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can start, based on network logic and schedule constraints. Early start dates can change as Project progresses and changes are made to Project Plan.
- .16 Finish Date: point in time associated with activity's completion. Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.
- .17 Float: amount of time that activity may be delayed from its early start without delaying Project finish date. Float is mathematical calculation, and can change as Project progresses and changes are made to Project plan. This resource is available to both Departmental Representative and Contractor.
- .18 Lag: modification of logical relationship that directs delay in successor task.
- .19 Late Finish Date (LF): in critical path method, latest possible point in time that activity may be completed without delaying specified milestone (usually Project finish date).
- .20 Late Start Date (LS): in critical path method, latest possible point in time that activity may begin without delaying specified milestone (usually Project finish date).
- .21 Lead: modification of logical relationship that allows acceleration of successor task.
- .22 Logic Diagram: see Project network diagram.
- .23 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .24 Milestone: significant event in Project, usually completion of major deliverable.
- .25 Monitoring: capture, analysis, and reporting of Project performance, usually as compared to plan.
- .26 Near-Critical Activity: activity that has low total float.
- .27 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.
- .28 Project Control System: fully computerized system utilizing commercially available software packages.
- .29 Project Network Diagram: schematic display of logical relationships of Project activities. Always drawn from left to right to reflect Project chronology.
- .30 Project Plan: formal, approved document used to guide both Project execution and Project control. Primary uses of Project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines. Project plan may be summary or detailed.
- .31 Project Planning: development and maintenance of Project Plan.
- .32 Project Planning, Monitoring and Control System: overall system operated by Contractor to enable monitoring of Project Work in relation to established milestones.

- .33 Project Schedule: planned dates for performing activities and 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.
- .34 Quantified days duration: working days based on 5 day work week, discounting statutory holidays.
- .35 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on Project's objectives.
- .36 Scheduled Finish Date (SF): point in time that Work was scheduled to finish on activity. Scheduled finish date is normally within range of dates delimited by early finish date and late finish date.
- .37 Scheduled Start Date (SS): point in time that Work was scheduled to start on activity. Scheduled start date is normally within range of dates delimited by early start date and late start date.
- .38 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.
- .39 Work Breakdown Structure (WBS): deliverable-oriented grouping of project elements that organizes and defines total Work scope of Project. Each descending level represents increasingly detailed definition of Project Work.

1.02 SYSTEM DESCRIPTION

- .1 Construction Progress Schedule (Project Time Management): describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly co-ordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.
- .2 Planning: this is most basic function of management, that of determining presentation of action and is essential.
 - .1 It involves focusing on objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.
 - .2 Planning and scheduling facilitates accomplishment of objectives and should be considered continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.
- .3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. Detail Project schedule is used for analysis and progress monitoring.
- .4 Ensure project schedule efficiencies through monitoring.
 - .1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.

- .2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
- .3 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.
- .5 Project monitoring and reporting: as Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to Bar Charts and CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.
 - .1 Narrative reporting begins with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

1.03 CPM REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.
- .2 Revise and resubmit Master Plan and Detail Schedule deemed impractical by Departmental Representative, for approval.
- .3 Acceptance of Master Plan and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract. Duration of Contract may only be changed through bilateral Agreement.
- .4 Consider Master Plan and Detail Schedule deemed practical by Departmental Representative, showing Work completed in less than specified Contract duration, to have float.
- .5 First Milestone on Master Plan and Detail Schedule will identify start Milestone with an "ES" constraint date equal to Award of Contract date.
- .6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.
- .7 Substantial Performance with "LF" constraint equal to calculated date.
- .8 Calculations on updates to be such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.
- .9 Delays to non-critical activities, those with float may not be basis for time extension.
- .10 Do not use float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times or imposed dates other than required by Contract.
- .11 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated. Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

- .12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration. Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.
- .13 Arrange participation on and off site of subcontractors and suppliers, as required by Departmental Representative, for purpose of network planning, scheduling, updating and progress monitoring. Approvals by Departmental Representative of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.
- .14 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.

1.04 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative Project Control System for planning, scheduling, monitoring and reporting of project progress.
- .3 Include costs for execution, preparation and reproduction of schedule submittals in bid documents.
- .4 Submit letter assuring that schedule has been prepared in co-ordination with major sub-contractors.
- .5 Refer to article "Progress monitoring and reporting" of this specification Section for frequency of Project control system submittals.
- .6 Submit Project planning, monitoring and control system data as part of initial schedule submission and monthly status reporting in following form.
 - .1 CD files in original scheduling software containing schedule and cash flow information, labelled with data date, specific update, and person responsible for update.
 - .2 Master Plan Bar Chart.
 - .3 Construction Detail schedule Bar Chart.
 - .4 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
 - .5 Criticality report listing activities and milestones with negative, zero, and up to three days total float used as first sort for ready identification of both critical and or near critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.
 - .6 Progress report in early start sequence, listing for each trade, activities due to start, underway, or finished within two months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.
 - .7 Detailed 4-week look ahead schedule.

1.05 QUALITY ASSURANCE

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

1.06 PROJECT MEETING

- .1 Meet with Departmental Representative within three working days of Award of Contract date, to establish Work requirements and approach to project construction operations.

1.07 WORK BREAKDOWN STRUCTURE (WBS)

- .1 Prepare construction Work Breakdown Structure (WBS) within eight working days of Award of Contract date. Develop WBS through at least five levels: Project, stage, element, sub-element and work package.

1.08 MASTER PLAN

- .1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.
- .2 Prepare comprehensive construction Master Plan (CPM logic diagram) and dependent Cash Flow Projection within ten working days of finalizing Agreement to confirm validity or alternates of identified milestones.
 - .1 Master Plan will be used as baseline.
 - .1 Revise baseline as conditions dictate and as required by Departmental Representative.
 - .2 Departmental Representative will review and return revised baseline within five working days.
- .3 Reconcile revisions to Master Plan and Cash Flow Projections with previous baseline to provide continuous audit trail.
- .4 Initial and subsequent Master Plans will include:
 - .1 CD containing schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.
 - .2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.
 - .3 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.
 - .4 Actual/projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.
 - .5 Required shutdowns.

1.09 DETAIL SCHEDULE

- .1 Provide detailed Baseline project schedule (CPM logic diagram) within 15 working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:
 - .1 Start-up meeting.
 - .2 Hazard Assessment Site Inspection by Contractor.

- .3 Submission of Hazard Assessment and Site Specific Safety Plan (HASSSP).
- .4 Approval of HASSSP.
- .5 Site mobilization.
- .6 Required shutdowns. Each shutdown shall be treated as a milestone start and finish; include an exhaustive listing of all required shutdowns in the schedule.
- .7 Shop drawings.
- .8 Samples.
- .9 Mock-ups.
- .10 Approvals.
- .11 Procurement.
- .12 Construction Phases.
- .13 Installation.
- .14 Testing.
- .15 Commissioning start for each phase.
- .16 Commissioning completion for each phase.
- .17 Substantial Performance.
- .18 Final completion.
- .19 Warranty review walk-through.
- .2 Detail CPM schedule to cover in detail minimum period of six months beginning from Award of Contract date with each activity duration approximately 0.5 days.
 - .1 Show remaining activities for CPM construction network system up to Final Certificate and develop complete detail as project progresses.
 - .2 Detail activities completely and comprehensively throughout duration of project.
- .3 Relate Detail Schedule activities to basic activities and milestones developed and approved in Master Plan.
- .4 Clearly show sequence and interdependence of construction activities and indicate:
 - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
 - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
 - .1 Time for submittals, resubmittals and review.
 - .2 Time for fabrication and delivery of manufactured products for Work.
 - .3 Interdependence of procurement and construction activities.
 - .4 Time for preparation and review of mock-ups. Separate mock-ups from the Critical Path by a minimum of ten business days float.
 - .3 Include sufficient detail to assure adequate planning and execution of Work. Activities should generally range in duration from 3 to 15 workdays each.
- .5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.
- .6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.

- .7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Departmental Representative for review effects created by insertion of new Change Order.

1.10 REVIEW OF THE CONSTRUCTION DETAIL SCHEDULE

- .1 Allow five working days for review by Departmental Representative of proposed construction Detail Schedule.
- .2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit to Departmental Representative for review within three working days.
- .3 Promptly provide additional information to validate practicability of Detail Schedule as required by Departmental Representative.
- .4 Submittal of Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

1.11 COMPLIANCE WITH DETAIL SCHEDULE

- .1 Comply with reviewed Detail Schedule.
- .2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Departmental Representative.
- .3 Shutdowns not listed on the schedule shall not be permitted.
- .4 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.
 - .1 Corrective measures may include:
 - .1 Increase of personnel on site for effected activities or work package.
 - .2 Increase in materials and equipment.
 - .3 Overtime work, additional work shifts.
- .5 Submit to Departmental Representative, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. Include as part of supporting evidence:
 - .1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.
 - .2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.
 - .3 Other supporting evidence requested by Departmental Representative.
 - .4 Do not assume approval of Contract extension prior to receipt of written approval from Departmental Representative.
 - .5 In event of Contract extension, display in Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.

- .6 Departmental Representative will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.
- .7 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

1.12 PROGRESS MONITORING AND REPORTING

- .1 On ongoing basis, Detail Schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work and send formal invitation to Departmental Representative for a walk-through minimum of twice monthly. Confirm that Works has been inspected by Contractor's own forces and is ready for review.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Perform Detail Schedule update every two weeks with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Submit to Departmental Representative three copies of updated Detail Schedule. Provide electronic schedule copy in MS Project format.
- .6 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .7 Submit every two weeks, written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:
 - .1 Description of progress made.
 - .2 Pending items and status of: permits, shop drawings, mock-ups, Change Orders, possible time extensions, and items of note from project meetings.
 - .3 Status of Contract completion date and milestones.
 - .4 Current and anticipated problem areas, potential delays and corrective measures.
 - .5 Review of progress and status of Critical Path and Near Critical Path activities.

END OF SECTION

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1 General

1.01 DEFINITIONS

- .1 Action Submittals: Written and graphic information and physical samples that require Departmental Representative's responsive action. Unless specifically noted otherwise in individual sections, the following shall be considered Action Submittals:
 - .1 Product Data.
 - .2 Shop Drawings.
 - .3 Samples.
- .2 Informational Submittals: Written and graphic information and physical samples that do not require Departmental Representative's responsive action. Submittals may be rejected for not complying with requirements. Unless noted otherwise in individual sections, the following shall be considered Informational Submittals:
 - .1 Certificates.
 - .2 Maintenance Data.
 - .3 Test and Inspection Reports.
 - .4 Delegated Design Calculations.
 - .5 Closeout Submittals.
 - .6 Sample warranties.
 - .7 Manufacturer's installation instructions.
- .3 Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.02 ADMINISTRATIVE

- .1 Process submittals using electronic media. Provide submittals in electronic format, unless otherwise agreed to by Contractor and Departmental Representative.
- .2 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.
- .3 Do not proceed with Work affected by submittal until review is complete.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 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.

- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are co-ordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .11 Keep one reviewed copy of each submission on site.
- .12 Submittal Schedules: Provide submittal schedules for Shop Drawings and Product Data, and Samples and Mock-Ups.
 - .1 Prepare and maintain Submittal Schedules during construction.
 - .2 Submit draft Submittal Schedules within 10 Working Days of contract award for approval by Departmental Representative.
 - .3 Update schedule weekly, or more frequently as directed by Departmental Representative.
 - .4 Indicate dates for submitting, review time, resubmission time, float time, last date for meeting fabrication schedule.
 - .5 Include dates when reviewed submittals will be required from the Departmental Representative.
 - .6 Include dates when submittals and delivery will be required for Departmental Representative -furnished items.
 - .7 Present updated schedules at each project meeting.

1.03 ELECTRONIC SUBMISSIONS

- .1 Provide electronic submittals (excluding samples) for information and review in electronic format using the following guidelines:
 - .1 Provide in Portable Document Format (*.pdf) with selectable text and graphics that are readable. Generally, merge documents into one bookmarked document up to 10 mb. Use hierarchical bookmarks to form a table of contents and provide hyperlinks to the subject topic.
 - .2 Break down information into documents of "like" or related materials or systems.
 - .3 Include final ratings, parameters, specifications, options, and other pertinent information. In the case where Departmental Representative returns submittal "Approved As Noted" and includes mark-ups or comments that change originally submitted ratings, parameters, specifications, options, and other pertinent information, the Sub-Contractor shall correct the documents in the original electronic document prior to submitting the final electronic documents.
 - .4 Highlight specific rating, parameter, specification, option, and other pertinent information when original document includes multiple alternatives. For instance when a range of performance parameters are given, or various sizes are shown, or various options are listed, the applicable item shall be indicated by highlight, circle, or pointer.

- .5 Do not include generalized direction from the Departmental Representative that does not relate to ordering and purchasing the equipment. For instance, notes like, "Coordinate with xxx for final motor horsepower" are not to be transferred to the electronic submittal. In that example only the final coordinated sizes would be indicated.
- .6 References within this specification that indicate sheet size will refer to electronic sheet (printing) size.

1.04 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, product data, and other data which the Contractor provides to illustrate details of a portion of the Work.
- .2 When requested for delegated-design, submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in the Province of Saskatchewan, 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 Departmental Representative will endeavour to review each submission within 10 Working Days.
- .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, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Section Number and applicable Part 2 paragraph references to Products submitted.
 - .4 Contractor's name and address.
 - .5 Identification and quantity of each shop drawing, product data and sample.
 - .6 Other pertinent data.
- .8 Submissions include:
 - .1 Designated location for Departmental Representative's review stamp.
 - .2 Date and revision dates.
 - .3 Project title and number.
 - .4 Name and address of Subcontractor, Supplier, and Manufacturer.

- .5 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .6 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.
 - .11 Seal and signature of professional engineer if specified.
- .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 copy of product data sheets or brochures for requirements requested in specification Sections where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copy of certificates for requirements requested in specification Sections.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit electronic copy of manufacturers instructions for requirements requested in specification Sections.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections.
- .15 Submit electronic documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copy of Operation and Maintenance Data for requirements requested in specification Sections.
- .17 Delete information not applicable to project.

- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copy 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.
- .20 Review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 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.

1.05 NAMING CONVENTION

- .1 Name electronic submittal files according to six digit MasterFormat Section number, with sequential alphanumeric identifier, and revision number.
 - .1 Examples:
 - .1 Modified bituminous membrane roofing materials, product data, first submission: 075200_PD001_R0.pdf
 - .2 Modified bituminous membrane roofing materials, shop drawing, first resubmission: 075200_SD001_R1.pdf
 - .3 Glazing materials, sample number 3, first submission: 088050_SL003_R0.pdf

1.06 SAMPLES

- .1 Submit for review samples in duplicate as specified 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.

1.07 PHOTOGRAPHIC DOCUMENTATION

- .1 General: Take photographs using the maximum range of depth of field, and that are in focus. Photographs with blurry or out-of-focus areas will not be accepted.
 - .1 Maintain key plan with each set of preconstruction photographs that identifies each photographic location.
- .2 Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - .1 Date and Time: Include date and time in file name for each image.
 - .2 Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference.
- .3 Preconstruction Photographs: Before commencement of Work, take photographs of Project site, including existing items to remain during construction, existing items for salvage and reuse, and existing items scheduled to be relocated, from different vantage points.
 - .1 Take extensive photographs of existing conditions, finishes, to accurately record physical conditions at start of construction.
 - .2 Submit preconstruction photographs before commencing work.
- .4 Record of Construction Progress:
 - .1 Number of viewpoints: sufficient views and proximity to clearly indicate stages of completion of all work and services before concealment, including above ceiling, in-wall.
 - .2 Frequency: continually. Submit monthly with progress statement.
- .5 As-built Record:
 - .1 Number of viewpoints: all interior elevations in each room.
 - .2 Frequency: Submit with final progress statement.

1.08 INFORMATIONAL SUBMITTALS

- .1 Submit electronic copy of test reports for requirements requested in specification Sections.
 - .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.
- .2 Submit electronic copy of certificates for requirements requested in specification Sections.
 - .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.
- .3 Submit electronic copy of manufacturers' instructions for requirements requested in specification Sections.

- .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.
- .4 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections.
- .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 Province of Saskatchewan
 - .1 The Saskatchewan Employment Act, SS 2013, c S-15.1.
 - .2 Occupational Health and Safety Regulations, 1996, RRS c O-1.1 Reg 1.
 - .3 Occupational Health and Safety (Prime Contractor) Regulations, RRS c S-15.1 Reg 2
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA, Z462-08, Workplace Electrical Safety Standard
 - .2 CAN/CSA-Z460-05 (R2010), Control of Hazardous Energy

1.02 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two hard copies and one electronic copy of Hazard Assessment and Site Specific Safety Plan (HASSSP): Within 7 days after date of Notice to Proceed and prior to commencement of Work. Hazard Assessment and Site Specific Safety Plan (HASSSP) must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Based on the Building Asbestos Report available upon request from Departmental Representative, submit the following:
 - .1 Environmental Protection Plan.
 - .2 Hazardous Material Plan.
 - .3 Transportation of Hazardous Material Report.
- .4 Submit electronic copy of Contractor's authorized representative's work site health and safety inspection reports, and copy of Contractor's weekly safety talk to Departmental Representative weekly.
- .5 Submit electronic copies of reports or directions issued by Federal, and Provincial health and safety inspectors.
- .6 Submit electronic copies of incident and accident reports.
- .7 Submit electronic copies of WHMIS MSDS - Material Safety Data Sheets.
- .8 Departmental Representative will review Contractor's Hazard Assessment and Site Specific Safety Plan (HASSSP) and provide comments to Contractor within seven Working Days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within five Working Days after receipt of comments from Departmental Representative.

- .9 Departmental Representative review of Contractor's final Hazard Assessment and Site Specific Safety Plan (HASSSP) should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .10 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.
- .11 Departmental Representative will provide details of On-site Contingency and Emergency Response Plan for the facility. Incorporate details into Contractor's Hazard Assessment and Site Specific Safety Plan (HASSSP). Address standard operating procedures to be implemented during emergency situations as directed by Departmental Representative.

1.03 FILING OF NOTICE

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

1.04 SAFETY ASSESSMENT

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

1.05 MEETINGS

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

1.06 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.07 PROJECT/SITE CONDITIONS

- .1 Work at site may involve contact with substances indicated in the Building Asbestos Report, available upon request from the Departmental Representative.

1.08 HAZARDOUS MATERIALS

- .1 Hazardous Materials: product, substance, or organism that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).
- .3 For work in occupied buildings, give Department Representative one week notice for work involving designated substances, and before painting, caulking, installing carpet or using adhesives and other materials, that cause off gassing.

- .4 Should materials resembling spray- or trowel-applied asbestos, PCB, or mould be encountered in the course of the Work, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.

1.09 GENERAL REQUIREMENTS

- .1 Develop written Hazard Assessment and Site Specific Safety Plan (HASSSP) based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Hazard Assessment and Site Specific Safety Plan (HASSSP) must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.10 RESPONSIBILITY

- .1 Be responsible and assume the role of "Prime Contractor" as described in Occupational Health and Safety (Prime Contractor) Regulations.
- .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, and local statutes, regulations, and ordinances, and with Hazard Assessment and Site Specific Safety Plan (HASSSP).
- .4 Construction Personnel Training Requirements: provide:
 - .1 Training and qualifications of personnel and alternates responsible for site safety and health;
 - .2 Training related to hazards present on site; and
 - .3 Training for use of personal protective equipment.

1.11 COMPLIANCE REQUIREMENTS

- .1 Comply with The Saskatchewan Employment Act.
- .2 Comply with CAN/CSA, Z462 (Workplace Electrical Safety Standard).
- .3 Comply with CAN/CSA-Z460 - Control of Hazardous Energy, for work requiring lock outs/power isolations.

1.12 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of authority having jurisdiction, and in consultation with the Departmental Representative, including:
 - .1 Emergency procedures
 - .2 General requirements
 - .3 Health and Safety Representative
 - .4 Joint Health/Safety Committee
 - .5 Material Safety Data Sheets
 - .6 HRSDC Labour Program orders
 - .7 Notice of Project
 - .8 Occupational Health and Safety Act
 - .9 Safety Policy
 - .10 HRSDC Labour Program / MOL Safety Regulatory Officer reports and orders.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 POWDER ACTUATED DEVICES

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

1.16 HOT WORK PERMITS

- .1 Request Hot Work Permits for work involving heating above 60 degrees Celsius. Provide minimum 48-hours' notice to Departmental Representative. Do not proceed with hot work until work is approved and permit is issued. Request shall include, but not be limited to:
 - .1 Location of work (as well as areas potentially affected).
 - .2 Work involved (type, extend, tools, etc.)
 - .3 Type(s) of bypass(es) required.
 - .4 Schedule (Start and end times for Hot Work).

1.17 FUEL STORAGE TANKS

- .1 Register temporary and permanent fuel storage tanks located on Federal Government Property with Environment Canada.

1.18 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Departmental Representative has right to stop work for health and safety reasons and is not a reason for delay of work claims.

END OF SECTION

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1 General

1.01 REFERENCES AND CODES

- .1 Perform Work in accordance with the National Building Code of Canada (NBCC), the National Fire Code of Canada (NFC) and other codes of provincial or local application provided that in case of conflict or discrepancy, the most applicable requirements apply in accordance with the Authority Having Jurisdiction.
- .2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 National Building Code of Canada 2015
 - .3 National Fire Code of Canada 2015
 - .4 National Plumbing Code of Canada 2015
 - .5 The Canadian Electrical Code.
 - .6 Specified standards, codes and referenced documents.
 - .7 CAN/CSA, Z462-08, Workplace Electrical Safety Standard
 - .3 Electrical components and equipment which are not CSA approved shall be approved by the Authority Having Jurisdiction prior to connection to the electrical service. Pay for costs associated with obtaining necessary approval.

1.02 PERMITS AND BY-LAWS

- .1 Submit applications, documents and obtain and pay for permits and certificates required in respect to the execution of the Work.

1.03 HAZARDOUS MATERIAL DISCOVERY AND REMOVAL

- .1 Asbestos: Demolition of spray or trowel-applied asbestos is hazardous to health. Should material resembling spray or trowel-applied asbestos be encountered in course of demolition work, immediately stop work and notify Departmental Representative.
- .2 PCBs: includes any chlorobiphenyls referred to in Column I of item 1 of the List of Toxic Substances in Schedule I of the Canadian Environmental Protection Act. Existing transformers and ballasts may contain PCBs. Remove and dispose of PCB-containing materials in accordance with PCB Waste Export Regulations, 1996, SOR/97-109.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.
- .4 Dispose of toxic wastes generated on site in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .5 Ensure toxic waste is shipped to an authorized/licensed treatment or disposal facility and that all liability insurance requirements are met.

1.04 QUALITY ASSURANCE

- .1 Regulatory Requirements: Except as otherwise specified, apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory

requirements and Contract Documents, based on General Conditions of Contract and the following:

- .1 Regulatory requirements and fees in force on date of Bid submission, and
- .2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission

1.05 PERMITS

- .1 Refer to Section 01 11 00 – Summary of Work.
- .2 Occupancy Permits:
 - .1 Apply for, obtain, and pay for occupancy permits, including partial occupancy permits where required by authority having jurisdiction.
 - .2 Departmental Representative will issue appropriate instructions for correction to Work where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits.
 - .1 Correct deficiencies in accordance with instructions. Where deficiency is not corrected, Departmental Representative reserves the right to make correction and charge Contractor for costs incurred.
 - .3 Turn over occupancy permits to Departmental Representative.

END OF SECTION

1 General

1.01 INDUSTRY STANDARDS

- .1 Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to extent referenced. Such standards are made part of Contract Documents by reference.
- .2 Publication Dates: Comply with latest version of standards in effect at date of Bid Closing unless specifically noted otherwise or as noted below:
 - .1 Comply with version of Standards referenced specifically by the National Building Code, in effect at time of Bid and the Authorities Having Jurisdiction.
- .3 Copies of Standards: Be familiar with industry standards applicable to Work of Contract. Copies of applicable standards are not bound with Contract Documents.
 - .1 Where copies of standards are needed to perform required Work of Contract, obtain copies directly from publication source.

END OF SECTION

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1 General

1.01 ABBREVIATIONS

.1 Following abbreviations are used in the Contract Documents:

∠	angle
°	degree (angles)
µm	micrometre
#	number (before numerals)
A	ampere
A/C	air conditioning
AVB	air/vapour barrier
AC	alternating current
ACOUS	acoustic
ACP	acoustic ceiling panel
ACT	acoustic ceiling tile
AD	access door
ADJ	adjustable
AFF	above finished floor
ALT	alternate
ALUM	aluminum
ANOD	anodized
APPROX	approximate
ARCH	architectural
ASC	above suspended ceiling
ASM	air seal membrane
AUTO	automatic
B-ROD	backer rod
BD	board
BF	both faces
BKG	backing
BLDG	building
BLKG	blocking
BLKHD	bulkhead
BLT IN	built in
BLW	below
BM	beam
BMK	benchmark
BOL	bollard
BOT	bottom
B PL	base plate
BRKT	bracket
BS	both sides
BSMT	basement
BTWN	between
BU	built up
BW	both ways
C/C	centre to centre
C/W	complete with
CABT	cabinet

CB	catch basin
CD	concrete with densifier
CEM	cement
CG	corner guard
CGL	clear glass
CH-1	coat hook - single
CH-2	coat hook - double
CHK PL	checkered plate
CIP	cast-in-place
CJ	control joint
CL	centreline
CLG	ceiling
CLR	clear, clear finish
CMU	concrete masonry unit
CLOS	closet
COL	column
CONC	concrete
CONSTR	construction
CONT	continuous
CORR	corridor
CR	crash rail
CRX	chemical-resistant epoxy flooring
C.ROD	coat rod
CS-CI	Contractor supplied-Contractor installed
CSK	countersunk
CT	ceramic/porcelain tile
CW	curtain wall
DB	decibel
DBL	double
deg C	degree Celsius
DEMO	demolition
DEPT	department
DET	detail
DF	drinking fountain
DFT	dry film thickness
DG	double glazed
DIA	diameter
DIFF	difference
DIM	dimension
DIV	division
DN	down
DR	door
DWG	drawing
EG	end guard
EJ	expansion joint
EJC	expansion joint cover
EL	elevation
ELEC	electric
ELEV	elevator
ELF	elastomeric liquid flooring
EMERG	emergency
ENCL	enclosure
EQ	equal

EQUIP	equipment
ESE	existing slab edge
EXIST	existing
EXP	exposed
EXT	exterior
F/F	face to face
FA	fire alarm
FBD	fibreboard
FC	face
FD	floor drain
FDTN	foundation
FE	fire extinguisher
FEC	fire extinguisher cabinet
FFD	funnel floor drain
FG	foot grille
FHC	fire hose cabinet
FHV	fire hose valve
FIN	finished
FIXT	fixture
FLR	floor
FP	fireproofing
FR	fire rating
FRMG	framing
FS	firestopping
FTG	footing
FXD	fixed
g	gram
GALV	galvanized
GFI	ground fault interrupter
GL	float glass/glass/glazing
GB	grab bar
GRD	ground
GRL	grille
GRT	grout
GYP BD	gypsum board
HB	hose bib
HD	hub drain
HDBD	hardboard
HDWD	hardwood
HM	hollow metal
HMI	hollow metal insulated
HORIZ	horizontal
hp	horsepower
HPL	high pressure laminate
HR	hour
HSKPG	housekeeping
HSS	hollow structural section
HT	height
HU	heating unit
HVAC	heating, ventilating and air conditioning
ID	inside diameter

INCL	including
INSUL	insulation
INT	interior
INV	invert
IP	insulated panel
JAN	janitor, janitor's closet
JT	joint
KD	knocked down
kg	kilogram
km	kilometre
kN	kilonewton
KO	knock out
kPa	kilopascal
l	litre
l/s	litre per second
LAB	laboratory
LAM	laminate(d)
LAV	lavatory
LCMU	light weight concrete masonry unit
LEV	level
LGL	laminated glass
LH	left hand
LHR	left hand reverse
LIN	linear
LT	light
m	metre
m ²	square metre
m ³	cubic metre
MATL	material
MAX	maximum
MDF	medium density fibreboard
MECH	mechanical
MEZZ	mezzanine
MIN	minimum
MIR	mirror
MISC	miscellaneous
mm	millimetre
MO	masonry opening
MOD	modified
MPa	megapascal
MRW	mechanical room waterproofing
MTD	mounted
MTL	metal
N/A	not applicable
ND	napkin disposal unit
NEG	negative
NIC	Not in Contract
NO	number
NOM	nominal
NTS	not to scale

O/A	overall
O/H	overhead
O/C	on centre
OD	outside diameter
O/F	outside face
O/O	out to out
OPNG	opening
OPP	opposite
OPT	optional
OWSJ	open web steel joist
PBD	particleboard
PERF	perforated
PERP	perpendicular
PH	phase
PL	plate
PLAM	plastic laminate
PLBG	plumbing
PLYWD	plywood
PNL	panel
POS	positive
PR	pair
PREFAB	prefabricated
PREFIN	prefinished
PRELIM	preliminary
PRJS	projection screen
PS	pressed steel
PSI	pressed steel insulated
PT	paint, pressure treated
PTN	partition
PVC	polyvinyl chloride
PWR	power
QTY	quantity
R	radius, radii
RB	resilient base
RBAR	reinforcing steel bar
RBL	roller blinds
RD	roof drain
REC	recessed
REF	reference
REFURB	refurbish
REINF	reinforced
REQ'D	required
REV	revise, revision
RH	right hand
RHR	right hand reverse
RLG	railing
RM	room
RO	rough opening
RPM	revolutions per minute
RS	reducing strip
RSF	resilient sheet flooring

RT	resilient tile flooring
RVL	reveal
RVS	reverse
SAN	sanitary
SC	sealed concrete
SDT	static dissipative tile
SE	slab edge
SHF	stainless steel shelving
SIM	similar
SJ	soft joint
SPGL	spandrel glass
SPKLR	sprinkler
SPKR	speaker
SQ	square
SS	stainless steel
ST	street
STD	standard
STL	steel
STOR	storage
STRUCT	structural
SUSP	suspended
SWP	sheet wall protection
SYS	system
T/O	top of
t	tonne
T&B	top and bottom
T&G	tongue & groove
TB	tackboard
TD	trench drain
TEL	telephone
TEMP	temporary
TERR	terrazzo
TFM	thermally fused melamine
TGL	tempered glass
TL	task light
TYP	typical
U/C	undercut
U/G	underground
U/S	underside
UGND	underground
UON	unless otherwise noted
UNFIN	unfinished
V	volt
VAR	varies, variable
VARN	varnish
VB	vapour barrier
VCT	vinyl composite tile
VERT	vertical
VEST	vestibule
VR	vapour retarder

W/	with
W/O	without
W	watt
WA	washroom accessory
WB	whiteboard
WC	water closet
WD	wood, solid core wood door
WF	wide flange
WGL	wired glass
WHC	wheel chair
WM	wire mesh
WP	waterproofing
WPM	waterproof membrane
WR	washroom
WVP	wood veneer paneling
WWF	welded wide flange
WWM	welded wire mesh
WWP	wood wall panelling
XBRC	cross bracing
XPS	extruded polystyrene board
Z	zinc
ZVB	zone valve box

END OF SECTION

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1 General

1.01 DEFINITIONS

- .1 Mock-ups: Full-size physical assemblies that are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mock-ups are not Samples. Unless otherwise indicated, approved mock-ups establish the standard by which the Work will be judged.
- .2 Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria
- .3 Product Testing: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL), a national voluntary laboratory accreditation program (NVLAP), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- .4 Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- .5 Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- .6 Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.02 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, or law of Place of Work. Coordinate date and time with regularly scheduled site visits performed by Departmental Representative.
- .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.

1.03 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting or testing portions of Work, for quality assurance purposes. Refer to Section 01 29 83 - Payment Procedures for Testing Services.
- .2 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .3 If defects are revealed during inspection or testing, appointed agency will request additional inspection or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.04 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.

1.05 PROCEDURES

- .1 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .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.
 - .1 Deliver representative samples previously reviewed by Departmental Representative in required quantity to testing laboratory.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.06 CONTRACTOR'S RESPONSIBILITIES

- .1 Tests and inspections not explicitly assigned to the Departmental Representative are the Contractor's responsibility.
- .2 Include cost of tests and inspection in Contract Price.
- .3 Provide labour, equipment material, and facilities to:
 - .1 Provide access to work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good work disturbed by inspection and test.
- .4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and reviewed by Departmental Representative.

- .5 Manufacturer's Field Services: Where indicated, engage factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.
 - .1 Report results in writing as specified in Section 01 33 00 – Submittals.
- .6 Manufacturer's Technical Services: Where indicated, engage manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
 - .1 Report results in writing as specified in Section 01 33 00 – Submittals.

1.07 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative 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.

1.08 REPORTS

- .1 Submit electronic copy of inspection and test reports to Departmental Representative, in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit reports within one week of testing or inspection.
- .3 Provide copies to subcontractor of work being inspected or tested.
- .4 Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - .1 Date of issue.
 - .2 Project title and number.
 - .3 Name, address, and telephone number of testing agency.
 - .4 Dates and locations of samples and tests or inspections.
 - .5 Names of individuals making tests and inspections.
 - .6 Description of the Work and test and inspection method.
 - .7 Identification of product and Specification Section.
 - .8 Complete test or inspection data.
 - .9 Test and inspection results and an interpretation of test results.
 - .10 Record of temperature and weather conditions at time of sample taking and testing and inspecting.

- .11 Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
- .12 Name and signature of laboratory inspector.
- .13 Recommendations on retesting and reinspecting.
- .5 Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - .1 Name, address, and telephone number of technical representative making report.
 - .2 Statement on condition of substrates and their acceptability for installation of product.
 - .3 Statement that products at Project site comply with requirements.
 - .4 Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - .5 Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - .6 Statement whether conditions, products, and installation will affect warranty.
 - .7 Other required items indicated in individual Specification Sections.
- .6 Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - .1 Name, address, and telephone number of factory-authorized service representative making report.
 - .2 Statement that equipment complies with requirements.
 - .3 Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - .4 Statement whether conditions, products, and installation will affect warranty.
 - .5 Other required items indicated in individual Specification Sections.
- .7 Permits, Licenses, and Certificates: For Departmental Representative's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.09 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs.
- .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.

1.10 MOCK-UPS

- .1 Mock-ups: Before installing portions of the Work requiring mock-ups, build mock-ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work.
 - .1 Construct mock-ups in location and of size indicated or, if not indicated, as directed by Departmental Representative.
 - .2 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

- .3 Employ supervisory personnel who will oversee mock-up construction. Provide mock-ups using personnel assigned to the Work and Products and techniques to be used on the Work.
 - .4 Demonstrate the proposed range of aesthetic effects and workmanship.
 - .5 Prior to manufacture and delivery of Products, arrange for Departmental Representative's review and acceptance of mock-up.
 - .1 Failure to prepare, and obtain review and acceptance of mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension or extra costs by reason of such default will be allowed. Allow time for modifications and subsequent reviews.
 - .6 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
 - .7 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.
- .2 Coordinate date and time with regularly scheduled site visits performed by the Departmental Representative.
 - .3 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.
 - .4 Mock-ups shall be used to refine design of components. Changes to Mock-ups will be made. Allow time in schedule for revisions to be made to Mock-ups and Shop Drawings. Mock-up review and revisions will not be accepted as basis of claim for delay or additional cost.
 - .1 Modify Mock-ups in accordance with Departmental Representative's review at no additional cost.

1.11 MILL TESTS

- .1 Submit mill test certificates as specified in specification Sections.

1.12 EQUIPMENT AND SYSTEMS

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

1.13 TEST AND INSPECTION LOG

- .1 Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - .1 Date test or inspection was conducted.
 - .2 Description of the Work tested or inspected.
 - .3 Date test or inspection results were transmitted to Departmental Representative.
 - .4 Identification of testing agency or special inspector conducting test or inspection.
- .2 Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Departmental Representative's reference during normal working hours.

1.14 REPAIR AND PROTECTION

- .1 General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - .1 Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 - Execution.
- .2 Protect construction exposed by or for quality-control service activities.
- .3 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

1 General

1.01 INSTALLATION AND REMOVAL

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

1.02 WATER SUPPLY

- .1 Contractor may use without charge, existing building infrastructure for potable water required for Work.

1.03 TEMPORARY HEATING AND VENTILATION

- .1 Use building permanent mechanical systems during construction period to provide heating and ventilation in construction area.
 - .1 Protect permanent systems from construction damage, dust, and debris.
 - .2 Replace filters regularly throughout construction activity, and provide new filters upon substantial performance of work.
 - .3 Departmental Representative will pay utility charges when heat source is existing building equipment.
- .2 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Maintain temperatures of minimum 18 degrees C in areas where construction is in progress.
- .4 Ventilating:
 - .1 Do not allow re-entrainment of exhaust air into building systems.
 - .2 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .3 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .4 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .5 Ventilate storage spaces containing hazardous or volatile materials.
 - .6 Ventilate temporary sanitary facilities.
 - .7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

- .5 Ensure environment (air temperature, relative humidity, air velocities, etc.) of occupied areas is not adversely affected by construction activities.
- .6 Obtain permission of Departmental Representative prior to employing temporary space heaters. Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.04 TEMPORARY POWER AND LIGHT

- .1 Use building permanent electrical systems during construction period to provide power and lighting in construction area.
- .2 Where required by removal of existing systems, provide and maintain temporary lighting throughout project.
 - .1 Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .3 Provide and pay for temporary power during construction for temporary lighting and operating of power tools where building electrical system is insufficient for construction activities.
- .4 For construction activities within occupied existing facilities:
 - .1 Electrical receptacles: Do not exceed 80% of rated circuit capacity. Repair damage.
 - .2 When using power extension cords outside of construction areas ensure power cords do not pose a safety hazard. Locate power cords in a manner that does not restrict fire doors from closing automatically upon fire alarm signal. Where cords are placed on floors in occupied areas secure to floor surface with non-marring tape or other suitable means acceptable to Departmental Representative, or hang from ceiling 2 400 mm above finished floor.
- .5 Provide and maintain temporary lighting throughout project. Provide level of illumination on floors and stairs not less than that required by Authorities Having Jurisdiction.
- .6 Electrical power and lighting systems installed under this Contract may be used for construction requirements, provided that warranties and guarantees are not affected.
- .7 Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.
- .8 Refer to Section 01 14 00 – Work Restrictions, for requirements related interruption of existing services.

1.05 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, and data hook up, necessary for own use and use of Departmental Representative.

1.06 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by authority having jurisdiction, and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

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1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.
 - .2 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.
- .2 Province of Saskatchewan
 - .1 The Saskatchewan Employment Act, SS 2013, c S-15.1.
 - .2 Occupational Health and Safety Regulations, 1996, RRS c O-1.1 Reg 1.
 - .3 Occupational Health and Safety (Prime Contractor) Regulations, RRS c S-15.1 Reg 2

1.02 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Informational Submittal: Submit design drawings, signed and sealed by qualified professional engineer licensed in the province of Saskatchewan, for scaffolds and work platforms.
 - .1 Additions or modifications to scaffolding must be approved by professional engineer in writing.

1.03 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.04 SCAFFOLDING

- .1 Scaffolding: in accordance with CAN/CSA-S269.2, and Province of Saskatchewan, Occupational Health and Safety Regulations, 1996
- .2 Provide and maintain scaffolding, ramps, ladders, and platforms.
- .3 Erect without damage to building or finishes scheduled to remain.

1.05 ELEVATORS

- .1 Refer to Section 01 14 00 – Work Restrictions.

1.06 SITE STORAGE/LOADING

- .1 Refer to Section 01 14 00 – Work Restrictions.
- .2 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

- .3 Do not load or permit to load any part of Work with weight or force that will endanger Work or existing facilities.
- .4 Exterior construction staging area is not available on site for storage of materials.
 - .1 Interior spaces within defined area of construction may be used for limited construction staging.
- .5 Obtain and pay for use of additional staging, storage or work areas needed for operations.

1.07 CONSTRUCTION PARKING

- .1 Parking is not available on site.
- .2 Make own arrangements for parking with City of Saskatoon or adjacent private parking facilities at prevailing rates.

1.08 OFFICES

- .1 Construction office space is not available outside the designated construction area.
 - .1 Establish dedicated space within construction area for site office.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Provide and pay for temporary telephone, and data hook up, lines and equipment necessary for own use.

1.09 EQUIPMENT, TOOL AND MATERIALS STORAGE:

- .1 Provide and maintain, in clean and orderly condition, lockable enclosures for storage of tools, equipment and materials.
- .2 Locate enclosures within designated construction area.

1.10 SANITARY FACILITIES

- .1 Permanent facilities may be used on the second floor.
- .2 Keep area and premises in sanitary condition.

1.11 CONSTRUCTION SIGNS

- .1 Project Identification Signage: Contractor's corporate signage is not permitted.
- .2 Provide common-use signs related to information, instruction, use of equipment, public safety devices, in both official languages or by the use of commonly understood graphic symbols, and to approval of the Departmental Representative.
 - .1 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

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

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Maintain and protect traffic on adjacent roads and parking areas during construction period.
- .2 Protect travelling public from damage to person and property.
- .3 Contractor's traffic on roads selected for transporting material to and from site to interfere as little as possible with public traffic.
- .4 Verify adequacy of existing roads and allowable load limit on these roads. Be responsible for repair of damage to roads caused by construction operations.
- .5 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .6 Dust control: adequate to ensure safe operation at all times.

1.13 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or 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.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

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1 General

1.01 REFERENCES

- .1 Province of Saskatchewan
 - .1 The Saskatchewan Employment Act, SS 2013, c S-15.1.
 - .2 Occupational Health and Safety Regulations, 1996, RRS c O-1.1 Reg 1.
 - .3 Occupational Health and Safety (Prime Contractor) Regulations, RRS c S-15.1 Reg 2

1.02 INSTALLATION AND REMOVAL

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

1.03 WEATHER ENCLOSURES

- .1 Provide weather tight closures to temporary openings, and unfinished exterior openings, tops of shafts and other openings in floors, walls and roofs until permanently enclosed.
- .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. Insulate and provide vapour barrier at enclosures at exterior openings.
- .4 Provide weatherproof, secure, closure for temporary access openings required to perform the Work.

1.04 DUST TIGHT SCREENS

- .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work.
- .2 Maintain and relocate protection until such work is complete.

1.05 FIRE ROUTES AND EGRESS

- .1 Exterior:
 - .1 Do not impede access to property including overhead clearances for use by emergency response vehicles.
 - .2 Keep fire lanes, walkways, and access routes clear at all times.
- .2 Interior:
 - .1 Provide protection to ensure safe passage of people around renovation, and selective demolition areas and to and from occupied portions of building.
 - .2 Do not close or obstruct exits, or other facilities used by occupants without written permission from authorities having jurisdiction.

- .3 Provide temporary exiting requirements as required by authorities having jurisdiction.

1.06 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.07 PROTECTION OF NEW AND EXISTING 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 Clean existing building finishes soiled as a result of the Work to the approval of the Departmental Representative.
- .4 Be responsible for damage incurred due to lack of or improper protection.
- .5 Protect work against damage until take-over.
- .6 Protect adjacent work against the spread of dust and dirt beyond the work areas.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

1 General

1.01 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications. Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.02 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, unless indicated otherwise, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout 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.
- .7 Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.03 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, [Departmental Representative reserves right to substitute more readily available products of similar

1.04 PRODUCT SELECTION PROCEDURES

- .1 General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - .1 Provide Products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - .2 Standard Products: If available, and unless custom products or non-standard options are specified, provide standard Products of types that have been produced and used successfully in similar situations on other projects.
 - .3 Departmental Representative reserves the right to limit selection to Products with warranties not in conflict with requirements of the Contract Documents.
 - .4 Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- .2 When materials are specified only by a consensus or reference standard, select any material that meets or exceeds the specified standard.
- .3 When materials are specified by reference standard, Prescriptive or Performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory reporting, showing that the material or equipment meets or exceeds the specified requirements.

1.05 DELIVERY, STORAGE, HANDLING AND PROTECTION

- .1 Deliver, handle and store products in manner to prevent damage, adulteration, deterioration, soiling, and loss, including theft and vandalism. Comply with manufacturer's instructions.
- .2 Delivery and Handling:
 - .1 Schedule delivery to minimize long-term storage at Place of the Work and to prevent overcrowding of construction spaces.
 - .2 Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - .3 Deliver products to Place of the Work in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - .4 Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

- .3 Storage:
 - .1 Store materials in a manner that will not endanger Project structure.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
 - .3 Store products inside building in designated construction area.
 - .4 Store cementitious products clear of concrete floors, and away from walls.
 - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and protect from incidental moisture.
 - .6 Store sheet materials, and lumber on flat, solid supports.
 - .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .4 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .5 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Do not paint over name plates.

1.06 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.07 MANUFACTURER'S INSTRUCTIONS

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

1.08 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

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

1.09 CO-ORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.
- .3 Do not obstruct access space above removable ceiling tiles or behind access doors, panels or plates.

1.11 REMEDIAL WORK

- .1 Refer to Section 01 73 00 - Execution, and as follows:
- .2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 LOCATION OF FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate, and may be moved by the Departmental Representative up to 1 800 mm from location shown without charge to Contract Price, provided notice is given to Contractor before related work has commenced.
- .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 conflicting installation. Install as directed.

1.13 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Bolts may not project more than one diameter beyond nuts.
- .3 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15 SHEET METAL AND WIRE GAUGE INTERPRETATION

- .1 Unless otherwise indicated, base metal thicknesses on uncoated thicknesses in accordance with the following interpretation guidelines:
 - .1 Steel sheet: manufacturer's standard gauge (msg).
 - .2 Stainless steel sheet: "United States Standard Gauge (Revised)".
 - .3 Non-ferrous sheet metal: "Brown & Sharpe Gauge".
 - .4 Ferrous wire thickness: "US Steel Wire Gauge"
 - .5 Non-ferrous wire thickness: "American Wire Gauge".
 - .6 Cold-formed light weight steel framing members: CSA S136-07

1.16 PROTECTION OF WORK IN PROGRESS

- .1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Departmental Representative, at no increase in Contract Price.
- .2 Protect Work against damage by on-going construction processes, vandalism, and other causes.
- .3 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.17 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

.3 Refer to Section 02 41 19.16 – Selective Interior Demolition.

END OF SECTION

1 General

1.01 DEFINITIONS

- .1 Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- .2 Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate cutting and patching work with selective demolition work specified in Section 02 41 19.16 – Selective Interior Demolition, and applicable technical sections for reinstallation of salvaged products.
- .2 Notice: Notify Departmental Representative and BGIS before disrupting building access or services in accordance with Section 01 14 00 – Work Restrictions.

1.03 INFORMATIONAL 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 Departmental Representative 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 Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.04 QUALITY ASSURANCE

- .1 Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - .1 Structural Elements: When cutting and patching structural elements, notify Departmental Representative of locations and details of cutting and await directions from Departmental Representative before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - .2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - .1 Primary operational systems and equipment.
 - .2 Fire separation assemblies.
 - .3 Air or smoke barriers.
 - .4 Fire-suppression systems.
 - .5 Mechanical systems piping and ducts.
 - .6 Control systems.
 - .7 Communication systems.
 - .8 Fire-detection and -alarm systems.
 - .9 Conveying systems.
 - .10 Electrical wiring systems.
 - .11 Operating systems of special construction.
 - .3 Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - .1 Water, moisture, or vapour barriers.
 - .2 Membranes and flashings.
 - .3 Sprayed fire-resistive material.
 - .4 Equipment supports.
 - .5 Piping, ductwork, vessels, and equipment.
 - .6 Noise- and vibration-control elements and systems.
 - .4 Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Departmental Representative's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

2 Products

2.01 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.
- .3 In-Place Materials: Use materials for patching identical to in-place materials, unless otherwise indicated.
 - .1 If identical materials are unavailable or cannot be used, use materials that, when installed, are acceptable to Departmental Representative for the visual and functional performance of in-place materials.
- .4 Incorporate salvaged, used material in new construction only with Departmental Representative permission, as specified, or as indicated.
 - .1 Salvaged materials for Reinstallation: Refer to schedule in Section 02 41 19.16 – Selective Interior Demolition.
- .5 Items not required for repair of existing work remain property of Departmental Representative, if so requested.

3 Execution

3.01 PREPARATION

- .1 Protect existing finishes, equipment, adjacent work scheduled to remain from damage. Provide protection from adverse weather conditions for portions of Work that might be exposed during cutting and patching operations.
- .2 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .3 After uncovering, inspect conditions affecting performance of Work.
- .4 Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - .1 Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - .2 Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - .3 Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - .4 Existence and location of concealed utilities and construction indicated as existing are not guaranteed. Before beginning Work, investigate and verify existence and location of mechanical and electrical systems, and other construction affecting the Work.

- .5 Beginning of cutting and patching, and construction means acceptance of existing conditions and implies dimensions have been considered, verified and are acceptable.
- .6 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .7 Provide protection from elements for areas which may be exposed by uncovering work.

3.02 EXECUTION

- .1 Execute cutting, fitting, and patching to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for 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.

3.03 INSTALLATION

- .1 General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - .1 Make vertical work plumb and make horizontal work level. Make work square and true to established and defined lines except as indicated.

- .2 Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- .2 Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- .3 Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Performance.
- .4 Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- .5 Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- .6 Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- .7 Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- .8 Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - .1 Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Departmental Representative.
 - .2 Allow for building movement, including thermal expansion and contraction.
 - .3 Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- .9 Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- .10 Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.04 CUTTING AND PATCHING

- .1 Cutting and Patching, General: Assign work of moving, removal, cutting and patching to trades qualified to perform work in manner to cause least damage to each type of work.
 - .1 Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- .2 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- .3 Temporary Support: Provide temporary support of work to be cut.

- .4 Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 14 00 – Work Restrictions.
- .5 Where work of this Contract affects existing structures, equipment, ceiling or floor assemblies, piping, ductwork or conduit, etc. above, below or beyond areas of scheduled work, patch and repair to standard of construction of surrounding materials. Do such work at no additional cost to the Contract.
- .6 Where penetrations through existing walls or floors result from the removal or relocation of existing equipment, piping, ductwork or conduit, repair to standard of construction of surrounding materials.
- .7 Provide means of returning surfaces to appearance of new work.
- .8 Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - .1 Keep cutting to no more than 10% larger than outside dimensions of item penetrating another material.
 - .2 Make cuts with clean, true, smooth edges to minimize patching.
 - .3 Use diamond coring drill for boring through concrete and masonry. Do not use electric or pneumatic impact hammers or hammer drills.
 - .4 Use concrete or masonry saw for cutting concrete and masonry.
 - .5 Wherever possible use equipment driven by an electric motor.
 - .6 Temporarily cover openings when not in use.
 - .7 Do not use pneumatic or vibrating equipment for removal of masonry or concrete.
 - .8 Pneumatic hammers are not permitted, except upon approval of the Departmental Representative.
 - .9 Scan concrete for in-slab services and reinforcement before cutting and coring. Do not proceed with cutting and coring until results of scan have been reviewed with Departmental Representative.
 - .10 Notify Departmental Representative minimum seven Working Days before removal, cutting, drilling or coring of structural or load-bearing members, including floor slabs. Mark out exact locations and dimensions to allow review. Do not proceed with work until Departmental Representative has reviewed and approved proposed work.
 - .11 Openings and penetrations:
 - .1 Cut openings and penetrations that exceed 150 mm diameter through walls, floors, and roofs that are required for installation of new work such as piping, conduits, ducts.
 - .2 Openings and penetrations smaller than 150 mm diameter are the responsibility of the trade requiring the opening
 - .3 Firestop penetrations through existing fire resistive rated assemblies immediately, and as specified in Section 07 84 00 – Firestopping.
 - .12 Recesses:
 - .1 Cut recesses that exceed 800 by 800 mm size in walls and floors that are required for installation of new work such as distribution boxes, panels, and cabinets.

- .2 Recesses smaller than 800 by 800 mm are responsibility of trade requiring recess.
- .13 Remove or cut openings in interior masonry partitions to accommodate new work. Remove masonry partitions completely down to structural slabs.
- .14 Cut finish surfaces, plaster, and metals by methods to terminate surfaces in straight lines, at natural points of division.
- .9 Cut, move, remove items as required for access, to allow work to proceed:
 - .1 Repair, removal of hazardous, unsanitary conditions.
 - .2 Remove abandoned items, items serving no useful purpose, abandoned piping, conduit, and wiring.
 - .3 Remove unsuitable, extraneous materials not marked for salvage, equipment, debris, rotted wood, rusted metals, deteriorated concrete.
 - .4 Cleaning of existing surfaces, removal of surface finishes required to install new Work, finishes.
- .10 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - .1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - .2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - .1 Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - .2 Restore damaged pipe covering to its original condition.
 - .3 Make smooth, approved transition where new work abuts, finishes flush with existing work.
 - .3 Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove in-place floor and wall coverings, and replace with new materials, as necessary, to achieve uniform colour and appearance.
 - .1 Terminate existing surfaces along straight lines at natural division line, provide approved trim when finished surfaces cut in manner preventing smooth transition with new work.
 - .2 Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces at a distance of 1.5 m.
 - .4 Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - .1 Terminate existing surface along straight lines at natural division line, provide approved trim when finished surfaces cut in manner preventing smooth transition with new work.
- .11 Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces

3.05 DEPARTMENTAL REPRESENTATIVE-INSTALLED PRODUCTS

- .1 Equipment indicated as "Departmental Representative-Installed Products" will be installed after Substantial Completion of the Work, except as described in Section 01 11 00 – Summary of Work as "Work By Others"
- .2 Furniture installed by Departmental Representative requires power and data connections as indicated on drawings. Coordinate with Departmental Representative for scheduling and connection requirements.

3.06 PROTECTION OF INSTALLED CONSTRUCTION

- .1 Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Performance.

3.07 DAMAGED SURFACES

- .1 Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements of Article "Cutting and Patching."
 - .1 Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- .2 Restore permanent facilities used during construction to their specified condition.
- .3 Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- .4 Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- .5 Remove and replace chipped, scratched, and broken glass or reflective surfaces.

3.08 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

1 General

1.01 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Departmental Representative or other contractors.
- .2 Remove waste materials from site minimum once daily at regularly scheduled times, or as often as necessary to prevent a hazardous occurrence arising, and as required by the Departmental Representative. Deposit in waste containers at end of each Work Day. Remove waste materials more frequently as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site suitable containers for collection of waste materials, and debris.
 - .1 Locate waste containers on site where directed by Departmental Representative.
 - .2 Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to applicable regulations. Remove volatile waste from premises at end of each work day.
 - .1 Use containers intended for holding waste materials of type to be stored.
- .5 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .6 Dispose of waste materials and debris off site. Do not wash waste materials down sewers or into waterways.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces, infiltrate into occupied areas, or trigger fire alarm smoke or dust detectors.
- .11 Do not damage or soil existing waste handling and housekeeping rooms. Do not plug or obstruct hoppers, toilets, sinks or drains.

2 Products

2.01 NOT USED

3 Execution

3.01 PROGRESSIVE CLEANING

- .1 Remove liquid spills promptly.
- .2 Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- .3 Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- .4 Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- .5 Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Performance.
- .6 In occupied areas, clean-up work area each day, before leaving area. Vacuum area with HEPA vacuum and leave ready for use.
 - .1 Refer to Section 01 14 00 – Work Restrictions for Dust Management.
- .7 Wet mop or vacuum immediate interior building areas when work in area is complete or ready to receive finish painting. Continue cleaning operations on an as-needed basis until all work is complete or until work is ready for Substantial Performance or occupancy. Maintain tools and equipment necessary for cleaning operations on site (i.e. pails, mops, vacuum cleaners with excellent suction capabilities, etc.).
- .8 During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Performance of Work.
- .9 Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- .10 Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.02 FINAL CLEANING

- .1 In preparation for Substantial Performance, conduct inspection of sight-exposed surfaces.
- .2 Remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

- .4 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .5 Clean and polish glass, mirrors, hardware, stainless steel, chrome, epoxy resin and phenolic resin surfaces, plastic laminate, granite surfaces, baked enamel surfaces; washroom fixtures, and toilet compartments; and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .6 Remove stains, spots, marks, grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior and exterior finished surfaces, electrical and mechanical fixtures, furniture fitments, walls.
- .7 Clean lighting reflectors, lenses, and other lighting surfaces.
- .8 Clean equipment and fixtures to sanitary condition. Clean or replace filters of mechanical filters.
- .9 Vacuum clean and dust building interiors, behind grilles, louvres and screens in area of Work. Vacuum exterior surfaces of exposed ductwork.
- .10 Prepare floor finishes as recommended by manufacturer.
- .11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Remove dirt and other disfiguration from exterior surfaces resulting from construction activities.
- .13 Remove debris and surplus materials from accessible concealed spaces including above ceiling tile.
- .14 Clean glazing of windows in area of Work.

END OF SECTION

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1 General

1.01 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.

1.02 REFERENCE STANDARDS

- .1 Public Works and Government Services Canada (PSPC)
 - .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
 - .2 CRD Waste Management Market Research Report (available from PSPC's Environmental Services).
 - .3 Sustainable Development Strategy 2007-2009: Target 2.1 Environmentally Sustainable Use of Natural Resources.
 - .1 Real Property projects over \$1 million and in communities where industrial recycling is supported, implementation of CRD waste management practices will be completed, with waste materials being reused or recycled.
 - .2 Contractually ensure resources used in construction or maintenance are consumed and recovered in a sustainable manner.

1.03 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PSPC's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.
- .2 This Project shall generate the least amount of waste possible. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- .3 Project Waste Management Goal: minimum 75 percent of total Project Waste to be diverted from landfill sites. Provide documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
 - .1 Specific material target percentages for reuse and/or recycling:
 - .1 Masonry and pavement: 100 %.
 - .2 Metals: 100 %.
 - .3 Wood: 100 %.
 - .4 Glass: 100%
 - .5 Gypsum board (unpainted): 100 %
 - .6 Gypsum board (painted): 0%
 - .7 Ceramic Tile: 100%
 - .8 Ceiling materials: 100 %.
 - .9 Carpet & Carpet Pad: 100 %
 - .10 Paint: 100 %
 - .11 Electrical - 100 %.

- .12 Packaging: 90 %.
- .4 Target percentage goals are achievable for waste diversion. Contractor to review and confirm Departmental Representative's Waste Audit acceptable values.
- .5 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .6 Protect environment and prevent environmental pollution damage.

1.04 DEFINITIONS

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).
- .5 Inert Fill: inert waste - exclusively asphalt and concrete.
- .6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 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.
- .10 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.
- .11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .12 Separate Condition: refers to waste sorted into individual types.

- .13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .14 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.
- .15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
- .16 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .17 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

1.05 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Waste Audit (Schedule A).
 - .2 Waste Reduction Workplan (Schedule B).
 - .3 Waste Source Separation Program.
 - .4 Schedules completed for project.

1.06 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to construction start-up:
 - .1 Electronic copy of the completed Waste Audit (WA): Schedule A.
 - .2 Electronic copy of the completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Electronic copy of Cost/Revenue Analysis Workplan (CRAW): Schedule E.
 - .4 Electronic copy of Waste Source Separation Program (WSSP).
- .3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Departmental Representative the following:
 - .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
 - .2 Updated Waste Materials Tracking form (Schedule D).
 - .3 Written monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

- .4 Submit prior to final payment the following:
 - .1 Waste Diversion Report, indicating final quantities [in tonnes] by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials (See Schedule C).
 - .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.07 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Refer to Schedule A; submit to the Departmental Representative.

1.08 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW (Schedule B) at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3 WRW should include but not limited to:
 - .1 Applicable regulations.
 - .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
 - .3 Destination of materials identified.
 - .4 Deconstruction/disassembly techniques and schedules.
 - .5 Methods to collect, separate, and reduce generated wastes.
 - .6 Location of waste bins on-site.
 - .7 Security of on-site stock piles and waste bins.
 - .8 Protection of personnel, sub-contractors.
 - .9 Clear labelling of storage areas.
 - .10 Training plan for contractor and sub-contractors.
 - .11 Methods to track and report results reliably (Schedule D).
 - .12 Details on materials handling and removal procedures.
 - .13 Recycler and reclaimer requirements.
 - .14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
 - .15 Requirements for monitoring on-site wastes management activities.
- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Post WRW or summary where workers at site are able to review content.
- .6 Post WRW on site where workers are able to review content regularly.
- .7 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project (Schedule D).

1.09 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

- .1 Prepare CRAW (see Schedule E) and include the following:
 - .1 Cost of current waste management practices.
 - .2 Implementation cost of waste diversion program.
 - .3 Savings and benefits resulting from waste diversion program.

1.10 WASTE SOURCE SEPARATION PROGRAM (WSSP)

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
- .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .5 Locate containers to facilitate deposit of materials without hindering daily operations.
- .6 Provide training for construction personnel in handling and separation of materials for reuse and/or recycling.
- .7 Locate separated materials in area which minimizes material damage.
- .8 Clearly and securely label containers to identify types/conditions of materials accepted and assist construction personnel in separating materials accordingly.
- .9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.
- .10 On-site sale of salvaged materials is not permitted.

1.11 WASTE PROCESSING SITES

- .1 Research and locate waste diversion resources and service providers. Transport salvaged materials off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.12 QUALITY ASSURANCE

- .1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and/or sub-contractors responsible for construction, renovation demolition waste management.
 - .1 Date, time and location will be arranged by Departmental Representative.

- .2 Waste Management Meeting: Waste Management Co-ordinator is to provide an update on status of waste diversion and management activities at each meeting. Written monthly Waste Diversion Report summary to be provided by Waste Management Coordinator (refer to the Waste Diversion Report form in Schedule C and Waste Materials Tracking form in Schedule D).

1.13 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled, or salvaged in locations as approved by the Departmental Representative.
- .2 Unless specified otherwise, materials for removal become the property of the Contractor.
- .3 Retain packaging products for reuse when possible.
- .4 Protect, stockpile, store, and catalogue all salvaged items.
- .5 Separate non-salvageable items from salvageable items. Transport and deliver non-salvageable items to licensed disposal/recycling facility.
- .6 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .7 Separate and store materials produced during project in designated areas.
- .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off site processing facility for separation.
 - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
 - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.14 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not burn or incinerate waste materials.
- .3 Do not dispose of volatile materials, mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers.
- .4 Keep records of construction waste including:
 - .1 Number and weight/volume of bins.
 - .2 Waste type for each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.15 SCHEDULING

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

2 Products

2.01 NOT USED

3 Execution

3.01 APPLICATION

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

3.02 CLEANING

- .1 General Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

3.03 WASTE DIVERSION REPORT

- .1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
 - .1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.
 - .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
 - .1 Supporting documentation.
 - .2 Waybills and tracking forms.
 - .3 Description of issues, resolutions and lessons learned.

3.04 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA): The following has been provided as an example of the minimum requirements of a waste audit:

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

3.05 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B – Waste Reduction Workplan (WRW): The following has been provided as an example of the minimum requirements of a waste reduction workplan:

(1) Material Category	(2) Person(s) Respon- sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina- tion
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packag ing							
Card- board Packag ing							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

3.06 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Schedule E - Cost/Revenue Analysis Workplan (CRAW)

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/Credit \$(+/-)	(6) Category Sub-Total \$(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard - Wood					
Door Trim - Wood					
Cabinet					\$
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate					
Byfold - Closet Glazing					\$
		(7) Cost (-) / Revenue (+)			\$

3.07 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

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

Province	Address	General Inquires	Fax
Saskatchewan	Saskatchewan Environment and Resource Management 3211 Albert Street Regina SK S4S 5W6	306-787-2700	306-787-3941

END OF SECTION

1 General

1.01 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
 - .2 Departmental Representative's Substantial Performance Inspection:
 - .1 Departmental Representative, and Contractor will perform inspection of Work to identify defects or deficiencies.
 - .2 Contractor shall correct Work as directed. Coordinate with Departmental Representative to establish a date for completion of deficiencies.
 - .3 Completion Tasks: submit written certificates in English that the following tasks have been performed:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, adjusted, and balanced, and fully operational.
 - .4 Certificates required by authorities having jurisdiction: submitted.
 - .5 Operation of systems: demonstrated to facility personnel.
 - .6 Commissioning of building systems: completed in accordance with 01 91 13 - General Commissioning Requirements, and technical specifications.
- .2 Prior to Substantial Performance of the Work, or start of operation and instruction period, whichever is earlier, provide:
 - .1 Draft Operation and Maintenance Manuals for mechanical systems, electrical systems, and laboratory equipment prior to start up for reference purposes.
 - .2 Record and "as-built" drawings.
 - .3 Keys for equipment and building as specified, including related keying information and keying charts.
 - .4 Test reports for mechanical and electrical systems, as specified in Divisions 21, 22, 23 25, 26, 27, and 28.
 - .5 Equipment and systems operating instructions and orientation for facility personnel.
 - .6 Spare parts.
 - .7 Written agreement on Service/Maintenance Contracts identified in project specifications.
 - .8 Warranty and Bond Certificates.
 - .9 Commissioning and Commissioning Reports.
 - .10 Work: complete and ready for final inspection.

- .3 Final Inspection:
 - .1 When completion tasks and deficiencies are completed, request final inspection of Work by Departmental Representative.
 - .2 If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .4 Declaration of Substantial Performance: when Departmental Representative advises Contractor that deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Certificate of Performance.
- .5 Commencement of Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period.
- .6 Final Payment:
 - .1 When Departmental Representative considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment.
 - .2 If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.
- .7 Payment of Holdback: after issuance of Substantial Certificate of Performance, submit an application for payment of holdback amount in accordance with General Conditions.

1.02 FINAL CLEANING

- .1 In accordance with Section 01 74 11 – Cleaning.

2 Products

2.01 NOT USED

3 Execution

3.01 NOT USED

END OF SECTION

1 General

1.01 DEFINITIONS

- .1 As-Builts: a set of Contract Drawings marked up by the Contractor during construction, to record changes in the Work and to illustrate actual locations of hidden utilities or concealed elements.
- .2 Record Documents: a collection of construction documents, including Shop Drawings, Product Data sheets, operation and maintenance information, field test records, inspection certificates, manufacturer's certificates, as well as a revised set of the Contract Drawings recording the actual placement, configuration and nature of the various Products used in the construction of a Project.

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Departmental Representative in accordance with Section 01 31 19 – Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Departmental Representative will establish communication procedures for:
 - .1 Notifying Contractor for construction warranty defects.
 - .2 Determining priorities for type of defects.
 - .3 Determining reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: Provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Operating and Maintenance Manuals per Article "Operation and Maintenance Manuals".
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products provided.

1.04 OPERATION AND MAINTENANCE MANUALS

- .1 Submission:
 - .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
 - .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, initial copies of operating and maintenance manuals in English.
 - .1 Format: two hard copies and one electronic copy (PDF).
 - .3 One initial copy will be returned after Substantial Performance, with Departmental Representative's comments.
 - .4 Revise content of documents as required prior to final submittal.
 - .5 Should comments be extensive, the Departmental Representative may require the Initial Submission to be repeated prior to Substantial Performance.
 - .6 Two weeks prior to final inspection of the Work, submit to the Departmental Representative, one electronic copy (PDF) and one hard copy of final operating and maintenance manuals in English.
- .2 Format:
 - .1 Organize data in the form of an instructional manual.
 - .2 Binders: extension type catalogue binders with telescoping posts, metal hinges, heavy duty green fabric covering, with hot stamped gold lettering on spine and front.
 - .3 When multiple volumes are used, correlate data into related consistent groupings.
 - .1 Identify contents of each volume on cover and spine of binder.
 - .2 Identify contents of each electronic volume on cover and in file name.
 - .4 Cover: Identify each volume with printed title 'Operations and Maintenance Manual'; list title of project and identify subject matter of contents.
 - .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
 - .6 Provide tabbed fly leaf in binder and bookmark in electronic copy, for each separate product and system, with description of product and major component parts of equipment.
 - .7 Text:
 - .1 Hard copy: Manufacturer's printed data.
 - .2 Electronic copy: Provide electronic documents in accordance with requirements for electronic submissions in Section 01 33 00 – Submittal Procedures.
 - .8 Drawings:
 - .1 Hard copy: provide hard copies with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 - .2 Electronic copy: Provide PDF copies of drawings in size appropriate for legibility and clarity of information illustrated.
 - .9 Provide full size drawings in 1:1 scaled CAD files in dwg format on CD.

- .3 Contents – Each Volume:
 - .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 names, addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
 - .4 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .2 For Each Item of Equipment and Each System:
 - .1 Include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics, and limiting conditions.
 - .2 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. Update existing panel directories for changes to existing circuitry.
 - .3 Include installed colour coded wiring diagrams.
 - .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 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 charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - .12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - .13 Include test and balancing reports.
 - .14 Completed BGIS CMMS Equipment Data Collection Form (DCF) included as appendix to this section
 - .1 Complete DCF for all equipment installed, removed and replaced in Project.
 - .2 Include copies of each DCF in O&M manual and provide electronic copies of each DCF to BGIS.
 - .15 Additional requirements: As specified in individual specification sections.

- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .1 Include product data, with catalogue number, size, composition, and colour and texture designations.
 - .2 Provide information for re-ordering custom manufactured products.
 - .3 Provide instructions 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.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Text: as required to supplement product data.
 - .1 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 – Commissioning Training.

1.05 RECORD DOCUMENTS AND SAMPLES

- .1 Maintain at the site for Departmental Representative, 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.
 - .1 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.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.06 AS-BUILT DOCUMENTS

- .1 Record as-built information on two sets of white prints, and in copy of the Project Manual, provided by the Departmental Representative.

- .2 Clearly mark both sets of drawings, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by change orders.
 - .4 Details not on original Contract Drawings.
 - .5 References to related shop drawings and modifications.
- .5 Specifications: 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, and other documentation required by individual specifications sections.
- .7 As part of the Work, submit to Departmental Representative, upon Substantial Performance of the Work, before occupancy, one set of marked up as-built drawings and one copy of the marked up Project Manual which reflect as-built information.
- .8 Payment on the Contract will not be made until correct as-built documents are received.

1.07 MAINTENANCE MATERIALS

- .1 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 site, place and store as directed by Departmental Representative.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock 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 site, place and store as directed by Departmental Representative.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 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 site, place and store as directed by Departmental Representative.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.08 DELIVERY, STORAGE AND HANDLING

- .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.

1.09 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative for approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .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 applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.

- .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 10 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include HVAC balancing, pumps, motors, transformers, and commissioned systems such as, but not limited to, laboratory equipment, fire protection, and alarm systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at 10 month post-construction warranty inspection.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.10 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

END OF SECTION

SECTION A - GENERAL INFORMATION

GENERAL INFORMATION	BUILDING NAME: _____		PROJECT NAME: _____	
	GOC BUILDING NUMBER: _____		PROJECT NUMBER: _____	
	BUILDING ADDRESS: _____		PROJECT MGR: _____	
	<input type="checkbox"/> NEW EQUIPMENT		<input type="checkbox"/> REMOVED EQUIPMENT	
<input type="checkbox"/> UPDATED EQUIPMENT		<input type="checkbox"/> CRITICAL SPARES		<input type="checkbox"/> REPLACED EQUIPMENT
		<input type="checkbox"/> TENANT		

SECTION B - EQUIPMENT INFORMATION

SYSTEM (PLEASE CIRCLE THE BOX WHICH APPLIES)									
05-Electrical Low Voltage	06 -Electrical High Voltage	10 - Electrical Auxiliary & Standby Power	15 - Control Monitoring System	20 - Heating	25 - Refrigeration	30 - Ventilation	40 -Compress Air, Auxiliary & Process	50 - Water Supply	55- Plumbing & Drainage
60 - Fire Protection	65 -Transportation Device	70 - Security	72 - Environmental	75 - Special Purpose	79 - Energy	80 - Architectural Structural	85 - Grounds	90 - Cafeteria (Excluding Refrigeration)	
EQUIPMENT DESCRIPTION _____									
LOCATION FLOOR: _____					ROOM: _____				
SPECIFIC LOCATION: _____									
MANUFACTURER: _____					MODEL NUMBER: _____				
SERIAL NUMBER: _____					CMMS LABEL ON EQUIPMENT BEING REPLACED: _____				
DATE OF INSTALLATION (YY/MM/DD): _____			PURCHASE PRICE (without GST): _____			PURCHASE DATE (YY/MM/DD): _____			

SECTION C - SPECIFIC EQUIPMENT INFORMATION

SPECIFIC EQUIPMENT INFORMATION	ELECTRICAL VOLTS: _____ PHASE: _____ AMPS/FLA: _____ PARENT NUMBER: _____								
	MECHANICAL C.F.M/G.P.M _____ Capacity _____ Belt Size _____ Quantity: _____ Filter Size _____ Quantity _____ Type _____								
	FIRE SUPPRESSION TYPE: _____ CAPACITY: _____ MANUFACTURER DATE: _____								
	COOLING CAPACITY: _____ REFRIGERANT TYPE: _____ CHARGE (KG): _____								
	FUEL STORAGE TANKS: _____ ABOVEGROUND _____ UNDERGROUND STORAGE VOLUME: _____ DOUBLE WALLED: YES _____ NO _____								
	ENERGY SOURCE: <input type="checkbox"/> NATURAL GAS <input type="checkbox"/> OIL <input type="checkbox"/> PROPANE <input type="checkbox"/> ELECTRIC <input type="checkbox"/> STEAM <input type="checkbox"/> HOT WATER <input type="checkbox"/> COLD WATER								
	ENVIRONMENT DOCUMENTS ATTACHED: YES _____ NO _____								

SECTION D - WARRANTY

WARRANTY	WARRANTOR NAME: _____		WARRANTY START DATE (YY/MM/DD): _____	
	COMMENTS			

COMMENTS				

FOR CMMS USE ONLY

FOR CMMS USE ONLY	SCHEDULING: ANNUAL _____		NEW EQUIPMENT NUMBER: _____	
	EQUIPMENT NUMBER LABEL PROVIDED: _____		TENANT WA# _____	
	EQUIPMENT ADDED TO ASSET GROUP: <input type="checkbox"/> YES <input type="checkbox"/> NO			

A) PLEASE SEND COMPLETED FORMS TO YOUR CMMS COORDINATOR FOR PROCESSING
B) PLACE COMPLETED FORM IN PROJECT O&M BINDER IF APPLICABLE

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1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to FPT of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 O M - Operation and Maintenance.
 - .5 SV - Static Verification.
 - .6 FPT - Functional Performance Testing.
 - .7 TAB - Testing, Adjusting and Balancing.

1.02 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 Functional Performance Testing 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 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.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.03 COMMISSIONING OVERVIEW

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 31 - 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 Substantial Completion Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components, systems and integrated systems have been fully commissioned and functional as per design intent within the context of the Owner Requirement.
 - .3 Final O&M and Training Manuals have been received, reviewed and approved by Departmental Representative for suitability.
 - .4 Training session to Operational and Maintenance staffs has been completed.

1.04 NON-CONFORMANCE TO FUNCTIONAL PERFORMANCE TESTING REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, 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.

1.05 PRE-CX REVIEW

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

- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.06 CONFLICTS

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

1.07 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 5 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 5 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.08 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Static Verification (SV) / Functional Performance Testing (FPT) Forms for requirements and instructions for use.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.09 COMMISSIONING SCHEDULE

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

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

- .4 At 50% construction completion stage, Departmental Representative 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 Departmental Representative Cx Agent, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 50% 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 Departmental Representative to witness of start-up and testing.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative 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 Departmental Representative
 - .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 SV 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 FPT: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial Functional Performance Testing: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved FPT forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be removed from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

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

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

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

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 14 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and Functional Performance Testing of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

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

1.20 COMMISSIONING FUNCTIONAL PERFORMANCE TESTING

- .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 Functional Performance Testing.

1.21 WITNESSING COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

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 Departmental Representative 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 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 in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Provide manpower and instrumentation to verify up to 100 % of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative.
- .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 25% of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive either Departmental Representative's or Consultant's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative 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.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

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 during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and FPT if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Where permitted by the Departmental Representative, calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 FUNCTIONAL PERFORMANCE TESTING 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, unless otherwise noted.
- .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 will not relieve Contractor from compliance with specified start-up and testing procedures.

2 Products

2.01 NOT USED

.1 Not Used.

3 Execution

3.01 NOT USED

.1 Not Used.

END OF SECTION

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1 General

1.01 SUMMARY

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

1.02 REFERENCES

- .1 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 202-2013, Commissioning Process for Buildings and Systems.
 - .2 ASHRAE Guideline 0-2005, Commissioning Process.
- .2 Canadian Standards Association (CSA)
 - .1 CSA Z320-11, Building Commissioning Standard and Check Sheets.
- .3 Underwriters' Laboratories of Canada (ULC)

1.03 GENERAL

- .1 Provide a fully functional facility:
 - .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.

1.04 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Plan to be 95% completed by the Departmental Representative and transmitted to the contractor.
- .2 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.
- .3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.05 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 weeks 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.

1.06 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 Departmental Representative Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 Departmental Representative 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.

1.07 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.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Specialist Cx agency:

- .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
- .5 Client: responsible for intrusion and access security systems.
- .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O M personnel.
 - .4 Redistribution of electrical services.
 - .5 Modifications of fire alarm systems.
 - .6 Modifications to voice communications systems.
- .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.08 EXTENT OF CX

- .1 Commission mechanical systems and associated equipment:
 - .1 Plumbing systems:
 - .1 New sink/fixtures and hardware.
 - .2 HVAC and exhaust systems:
 - .1 HVAC systems – New VAV boxes.
 - .2 HVAC systems – New inline fan.
 - .3 EMCS:
 - .1 All new and existing thermostats within scope of work.
 - .2 All new points within graphical user interface.
- .2 Commission electrical systems and equipment:
 - .1 Lighting systems:
 - .1 Lighting equipment
 - .2 Emergency lighting systems, including battery packs
 - .3 Fire exit emergency signage
 - .4 Lighting levels
 - .2 Fire alarm systems, equipment:
 - .1 Annunciators
 - .2 Control panels
 - .3 Devices:
 - .1 Smoke detectors
 - .2 FA Speakers
 - .3 FA Strobes
 - .3 Other systems and equipment:

- .1 Intrusion system
 - .2 Sound masking system.
 - .3 Panels
 - .4 Switches and receptacles
- .3 Commission architectural systems and equipment:
- .1 Doors and windows

1.09 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.
 - .8 Preventative maintenance program
 - .9 Standard operating procedures (SOP)
 - .10 Contractors and sub-contractors as-built drawings

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 performed by Owner/User.
- .10 Training Plans.
- .11 Cx Reports.
- .12 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 - 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.
 - .3 EMCS:
 - .1 EMCS trending to be available as supporting documentation for performance verification.
 - .2 Perform point-by-point testing in parallel with start-up.
 - .3 Carry out point-by-point verification.
 - .4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.
 - .5 Perform final Cx and operational tests during demonstration period and 30 day test period.

- .6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".
- .3 Pre-Cx activities - ELECTRICAL:
 - .1 Lighting systems:
 - .1 Emergency lighting systems:
 - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
 - .2 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.
 - .3 Intrusion alarm systems: to include verification by Departmental Representative.
 - .4 Demonstrate performance of lighting switches, receptacles and panels.

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:
 - .1 Air Terminal Units
 - .2 Controls
 - .3 Lighting Controls
 - .4 Sound Masking
- .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 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 OF 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 HVAC and associated systems forming part of integrated HVAC systems: Air Terminal Units, Force Flow Heaters.
 - .2 Emergency Lighting Systems.
 - .3 Fire Alarm System.
- .6 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative 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 PERFORMANCE 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 [critical path] 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: 28days 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: 3months 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 14days before start of integrated system Cx.
- .12 Identification of deferred Cx.
- .13 Implementation of training plans.
- .14 Cx of smoke management/control systems: after Cx of related systems is completed and 7 days before proposed date of Cx these systems.
- .15 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 Departmental Representative.
- .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 Substantial Completion 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.

1.22 TRAINING PLANS

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

1.23 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.

2 Products

2.01 NOT USED

- .1 Not Used.

3 Execution

3.01 NOT USED

- .1 Not Used.

END OF SECTION

1 General

1.01 SUMMARY

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

1.02 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.

1.03 STATIC VERIFICATION (SV) REPORT FORMS

- .1 Static Verification (SV) forms compile 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 Functional Performance Testing (FPT) of systems complete items on SV forms related to systems and obtain Departmental Representative's and Commissioning Manager approval.

1.04 FUNCTIONAL PERFORMANCE TESTING (FPT) FORMS

- .1 FPT 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 FPT report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to FPT of integrated system, complete FPT forms of related systems and obtain Departmental Representative's and Commissioning Managers approval.

1.05 SAMPLES OF COMMISSIONING FORMS

- .1 Project specific Forms provided at the end of the section.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Project specific Commissioning forms and a complete index of produced to date will be attached to this section.

1.06 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from Departmental 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

1.07 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.

1.08 LANGUAGE

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

2 Products

2.01 NOT USED

- .1 Not Used.

3 Execution

3.01 NOT USED

.1 Not Used.

END OF SECTION

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Commissioning Systems Components List



NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
 Winnipeg, MB – R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

Item	Item Description	Status
VAV-1	Variable air volume terminal unit – Operation based on space temperature and CO2 concentration	
VAV-2	Variable air volume terminal unit – Operation based on space temperature and CO2 concentration	
VAV-3	Variable air volume terminal unit – Operation based on space temperature	
VAV-4	Variable air volume terminal unit – Operation based on space temperature	
VAV-5	Variable air volume terminal unit – Operation based on space temperature	
EF-1	Transfer air fan – Operation based on occupied/unoccupied schedule	
EF-2	Transfer air fan – Operation based on occupied/unoccupied schedule	
EF-3	Transfer air fan – Operation based on occupied/unoccupied schedule	
EF-4	Transfer air fan – Operation based on occupied/unoccupied schedule	
EF-5	Transfer air fan – Operation based on space temperature	
SK-1	Kitchenette sink and trim	
DDC User Interface	Building automation system user graphical interface	

Commissioning Systems Components List



Lighting Fixtures	Installed, operational	
Lighting Controls	Switches, dimmers, sensors, room control installed & programmed	
Exit Signs	Installed, operational	
Power Distribution	Electrical panels with updated label, schedule	
Mechanical Equipment	Feeder connected, disconnect installed	
Structured wiring	Data outlet rough-in with conduit to ceiling space, cable tray & J hooks installed	
A/V & Floor Box	Device installed with AV cables	
Sound Masking	Control panel and speakers, volume control, programming	
Fire Alarm	Horn/strobes, smoke detector, heat detector, verification report	
Security	Rough-in for intrusion detector, access control & duress	

VAV BOX -

Start-Up



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

Operation	Yes	No
Thermostat is operational		
CO2 sensor is operational		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

VAV BOX -
Functional Performance Testing



REVISION #: _____

NAME: Travis Defoort
 COMPANY: Epp Siepman Engineering
 ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
 PROJECT: ESDC OFFICE RENOVATION
 FILE NUMBER: R.055494.001
 DATE: 16-02-2018

SEQUENCE OF OPERATIONS VERIFICATION

Operation	Yes	No	N/A
VAV damper modulates when space temperature is above/below setpoint			
VAV damper modulates open on rising CO2 concentration			
Night setback sequence is operational			
Alarm point is provided on DDC screen if high zone temperature is reached			
Alarm point is provided on DDC screen if low zone temperature is reached			
Alarm point is provided on DDC screen if high zone CO2 concentration is reached			

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

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EXHAUST FAN -

Static Verification



REVISION #: _____

NAME: Travis Defoort
 COMPANY: Epp Siepman Engineering
 ADDRESS: 400-136 Market Ave
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
 PROJECT: ESDC Office Relocation
 FILE NUMBER: R.055494.001
 DATE: 16-02-2018

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

EXHAUST FAN	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER			
TYPE/ SIZE			
MODEL NO.			
MOTOR CONTROL CENTRE NO.			
MOTOR HP			
VOLTAGE / PHASE / FREQUENCY			
STATIC PRESSURE AIR (PA)			
FAN RPM			
AIR VOLUME (L/S)			
VIBRATION ISOLATOR TYPE			

EXHAUST FAN	STATUS	COMMENTS
INSTALLED AS PER DRAWINGS & SPECIFICATIONS		
INSTALLED AS PER MANUFACTURER'S REQUIREMENTS		
FAN BEARINGS LUBRICATED		
GREASE EXTENSION LEADS REQUIRED		
FAN ROTATION CORRECT		
FAN CASING CLEANED		
BELT GUARDS INSTALLED		
ALIGNMENT REPORT ATTACHED		
INLET & OUTLET GUARDS INSTALLED		
DUCT GEOMETRY CORRECT		
FLEXIBLE CONNECTORS CORRECT		
VIBRATION ISOLATORS CORRECT		
STARTER & DISCONNECT COMPLETE		
DISCONNECT LOCATION CORRECT		
FAN WHEEL CLEARANCE		
FAN INTERLOCKS CORRECT		
VARIABLE SPEED DRIVE/VOLUME CONTROLS		

EXHAUST FAN -

Static Verification



REVISION #: _____

NAME: Travis Defoort
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ADDRESS: 400-136 Market Ave
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC Office Relocation
FILE NUMBER: R.055494.001
DATE: 16-02-2018

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

AIR DISTRIBUTION SYSTEM	STATUS	COMMENTS
QUALITY OF DUCT CONSTRUCTION		
SUITABILITY OF DUCT FITTINGS		
DUCTWORK INSULATION		
WALL PENETRATIONS SEALED		
ACCESS FOR INSPECTION & SERVICING		

START-UP	STATUS	COMMENTS
ALL SYSTEM COMPONENTS STARTED AS DETAILED ON EQUIPMENT START-UP SHEETS.		
DUCTWORK PRESSURE TESTED		
NOISE & VIBRATION		
AIR BALANCING COMPLETE		
AIR BALANCE REPORT ATTACHED		

--

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	

EXHAUST FAN -

Static Verification



REVISION #: _____

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 COMPANY: Epp Siepman Engineering
 ADDRESS: 400-136 Market Ave
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
 PROJECT: ESDC Office Relocation
 FILE NUMBER: R.055494.001
 DATE: 16-02-2018

SERVICE	LOCATION
---------	----------

MOTORIZED DAMPER	STATUS		
	NO. 1	NO. 2	NO. 3
LINKAGE CONNECTIONS INSTALLED			
FREE MOVEMENT & STROKE			
ACCESS TO DAMPER			
ACTUATOR NOT IN AIR STREAM			
NORMAL POSITIONS AS SPECIFIED			
DAMPER CONTROL SEQUENCES			
MIXING DAMPERS STROKE IN UNISON			
LINKAGE CONNECTIONS INSTALLED			
FREE MOVEMENT & STROKE			
ACCESS TO DAMPER			
ACTUATOR NOT IN AIR STREAM			
NORMAL POSITIONS AS SPECIFIED			
DAMPER CONTROL SEQUENCES			
MIXING DAMPERS STROKE IN UNISON			

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Building Operations and Maintenance Staff		
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

EXHAUST FAN -

Start-Up



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Ave
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC Office Relocation
FILE NUMBER: R.055494.001
DATE: 16-02-2018

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Building Operations and Maintenance Staff		
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

EXHAUST FAN -
Functional Performance Testing



REVISION #: _____

NAME: Travis Defoort
 COMPANY: Epp Siepman Engineering
 ADDRESS: 400-136 Market Ave
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
 PROJECT: ESDC Office Renovation
 FILE NUMBER: R.055494.001
 DATE: 16-02-2018

SEQUENCE OF OPERATIONS VERIFICATION

Operation	Yes	No	N/A
Fan is in operation during building occupied hours as set by the DDC			
Fan is disabled after occupied hours as set by the DDC			
Fan is enabled on a rise in space temperature			
Fan is disabled when space temperature is satisfied			
Alarm point is provide on DDC screen if fan is manually turned off when called to be on			
Alarm point is provide on DDC screen if fan is manually turned on when called to be off			
Alarm point is provide on DDC screen if space temperature is above allowable limit			

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Building Operations and Maintenance Staff		
Cx Authority/ Commissioning Provider		
Design Consultants		
Contractors/Subcontractor		

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BUILDING SYSTEM INTEGRATION

Static Verification



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE	ALL RELATED EQUIPMENT AND SYSTEMS	LOCATION	

DESCRIPTION	RELATED SYSTEMS	POWER REQUIREMENTS	OPERATION TESTED & VERIFIED

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

BUILDING SYSTEM INTEGRATION

Start-Up



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

Operation	Yes	No	N/A
Graphics are updated to show current floor plan			
Graphics are updated to show new thermostat locations and zones			
Graphics are updated to show VAV's			
Graphics are updated to show transfer air fans			

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

BUILDING SYSTEM INTEGRATION

Functional Performance Testing



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

Operation	Yes	No	N/A
Alarms for VAV's are functioning			
VAV position is live for all zones			
Alarms for Exhaust Fans are functioning			
Exhaust fan status is live for all fans			
Space temperature and space temperature setpoint are live for all zones			
Space CO2 concentration is live for all relevant zones			
Links between zones and equipment are functioning			

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

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PLUMBING FIXTURE

Static Verification



REVISION #: _____

NAME: Travis Defoort
 COMPANY: Epp Siepman Engineering
 ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
 PROJECT: ESDC OFFICE RENOVATION
 FILE NUMBER: R.055494.001
 DATE: 16-02-2018

NAMEPLATE			
MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

START-UP	SPECIFIED	COMMENTS
INSTALLED AS PER DRAWINGS & SPECIFICATIONS		
INSTALLED AS PER MANUFACTURER'S RECOMMENDATIONS		
COLD WATER FEED CLEAN		
COLD WATER FEED PRESSURE		
HOT WATER FEED CLEAN		
HOT WATER FEED PRESSURE		
FIXTURE CLEAN		
PIPE ARRANGEMENT & SUPPORT		
NO LEAKAGE FROM SEALS		
FIXTURE WORKS CORRECTLY		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Cx Authority/ Commissioning Provider		
Contractors/Subcontractor		

PLUMBING FIXTURE -

Start-Up



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

Operation	Yes	No
Water flows when taps are turned on		
No leaks are present when taps are turned off		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Cx Authority/ Commissioning Provider		
Contractors/Subcontractor		

PLUMBING FIXTURE -

Functional Performance Testing



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

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Operation	Yes	No
Cold water flows when tap is turned on		
Hot water flows when tap is turned on		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Cx Authority/ Commissioning Provider		
Contractors/Subcontractor		

DRAINAGE SYSTEM

Start-Up



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

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GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Cx Authority/ Commissioning Provider		
Contractors/Subcontractor		

DRAINAGE SYSTEM

Functional Performance Testing



REVISION #: _____

NAME: Travis Defoort
COMPANY: Epp Siepman Engineering
ADDRESS: 400-136 Market Avenue
Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
PROJECT: ESDC OFFICE RENOVATION
FILE NUMBER: R.055494.001
DATE: 16-02-2018

Operation	Yes	No
Fixture drains properly		

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Cx Authority/ Commissioning Provider		
Contractors/Subcontractor		

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Lighting Controls

Static Verification



REVISION #: _____

NAME: Jun Fan
 COMPANY: Epp Siepman Engineering
 ADDRESS: 400-136 Market Ave
 Winnipeg, MB - Manitoba R3B 0P4

CUSTOMER: PWGSC
 PROJECT: ESDC OFFICE RENOVATION
 FILE NUMBER: R.055494.001
 DATE: 16-02-2018

FIXTURE NAMEPLATE			
LIGHT FIXTURE NUMBER:			
MANUFACTURER		Model Number	
SERIAL NO.		Voltage:	
Color:		Wattage	

	Yes	NO	N/A	
Wall Mount				
Ceiling Mount				
Suspended Down				
Nameplate Match Spec				
Mfgr's test sheets complete				
Wiring Complete				
Test Sheets Attached				

* ACCEPTANCE TESTING ONLY

GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE
Building Owner/Representative		
Cx Authority/ Commissioning Provider		
Contractors/Subcontractor		
Manufacturer's Representatives		

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1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Requirements
 - .1 Section 22 42 16 – Commercial Lavatories and Sinks
 - .2 Section 25 05 01 – EMCS – General Requirements
 - .3 Section 23 36 00 – Air Terminal Unit
 - .4 Section 26 50 00 – Lighting
 - .5 Section 27 51 19 – Sound Masking System
 - .6 Section 28 31 00 – Fire Detection and Alarm

1.02 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Property Facility Manager, building operators, BGIS operations staff, 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.

1.03 INSTRUCTORS

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

1.04 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.

1.05 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 Property 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 Multimedia presentations.
 - .2 Manufacturer's training videos.
 - .3 Equipment models.

1.06 SCHEDULING

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

1.07 RESPONSIBILITIES

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

1.08 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.

1.09 VIDEO-BASED TRAINING

- .1 Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 1 month prior to commencement of scheduled training.
- .2 On-Site training videos:
 - .1 Videotape training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.
- .3 Production methods to be high quality.

2 Products

2.01 NOT USED

- .1 Not Used.

3 Execution

3.01 NOT USED

- .1 Not Used.

END OF SECTION

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1 General

1.01 RELATED REQUIREMENTS

- .1 Section 08 11 00 – Metal Doors and Frames: For installation of metal doors and frames.
- .2 Section 08 14 16 – Flush Wood Doors: For installation of salvaged wood doors.
- .3 Section 12 24 13 – Window Shades: For installation of existing window blinds.

1.02 REFERENCES

- .1 CSA Standard S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .2 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012
 - .2 Canadian Environmental Protection Act (CEPA), 2012
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34
 - .2 Motor Vehicle Safety Act (MVSA), 1995
 - .3 Hazardous Materials Information Review Act, 1985.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.03 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove: Synonymous with Demolish.
- .3 Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage. Deliver salvaged materials to Departmental Representative-designated location.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Store materials scheduled for reuse in the Work; include fasteners or brackets needed for reattachment elsewhere.
- .5 Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- .6 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

- .7 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal and as follows:
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
- .8 Construction Waste Management Plan (CWM Plan): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .9 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .10 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.04 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with Departmental Representative for the material ownership as follows:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain, demolished materials become Contractor 's property and shall be removed from Project site.
 - .2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.
 - .3 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Departmental Representative that may be encountered during selective demolition remain Departmental Representative's property:
 - .1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Departmental Representative.
- .2 Work by Others: Coordinate with Departmental Representative for removal of existing security devices as indicated on electrical drawings.
- .3 Pre Demolition Meeting: Convene meeting one week prior to beginning work of this Section, with Contractor, Departmental Representative in accordance with Section 01 31 19- Project Meetings to:
 - .1 Confirm extent of salvaged and demolished materials
 - .1 Review and record condition of elements designated for salvage.
 - .2 Discuss Departmental Representative's location for final storage of salvaged components.

- .2 Review Contractor 's demolition plan
 - .1 Verify existing site conditions adjacent to demolition work
 - .2 Coordination with other construction sub trades
- .3 Review procedures for noise control and dust control.
- .4 Review requirements of work that rely on substrates exposed by selective demolition operations.
- .5 Review procedures for protection of adjacent building elements, components and finishes.
- .4 Hold project meetings every week.
- .5 Ensure key personnel, site supervisor, subcontractor representatives, WMC attend.
- .6 WMC must provide verbal report on status of waste diversion activity at each meeting.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Make following submittals before starting any work of this Section:
 - .1 Submit Schedule of Selective Demolition Activities: Indicate following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Coordinate with Departmental Representative, for ongoing site operations, and limit the number of interruptions during regular business hours.
 - .3 Interruption of utility services. Indicate duration of utility services interruption.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
 - .5 Use of elevator and stairs. Refer to Section 01 14 00 – Work Restrictions.
 - .6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
 - .7 Coordination with Departmental Representative for continuing occupancy of portions of existing building.
 - .2 Demolition Plan: Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:
 - .1 Proposed Dust Control, Noise Control measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Departmental Representative reserves the right to make modifications where proposed methods interfere with the ongoing building operation.
 - .2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.
 - .3 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

- .4 Pre demolition Photographs : Submit photographs indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.
- .3 Proposed Protection Measures: Submit description of proposed measures for protecting individuals and property including but not limited to components and finishes scheduled to remain; character defining elements, and for dust control and noise control. Indicate proposed locations and construction of temporary barriers.

1.06 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:
 - .1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.
 - .2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.
 - .3 Conform to Saskatchewan Occupational Health and Safety Act and Regulation.
 - .4 Conform to Workers' Compensation Board Regulations.
 - .5 Conform to City of local bylaws and regulations governing this type of work.
- .2 Perform selective demolition work by specialists familiar with materials affected.
- .3 Regulatory Requirements: Perform work in compliance with CEPA, TDGA, and applicable Provincial and Municipal regulations.

1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, regional and municipal regulations.
- .3 Dispose of materials that are not scheduled for salvage and cannot be recycled, in accordance with applicable codes at licensed facilities.

1.08 ENVIRONMENTAL PROTECTION

- .1 Ensure that selective demolition work does not adversely contribute to excess air and noise pollution.
- .2 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout Work.
- .3 Do not pump water containing suspended materials into watercourses, sanitary or storm system.

1.09 SITE CONDITIONS

- .1 Portions of building immediately adjacent to selective demolition area will be occupied.
 - .1 Conduct selective demolition so that building operations will not be disrupted.
 - .2 Provide before disrupting building access or services in accordance with Section 01 14 00 – Work Restrictions.
- .2 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent occupied or used facilities
 - .1 Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent areas without written permission from Departmental Representative or Authority Having Jurisdiction.
 - .2 Provide temporary exiting requirements as required by authorities having jurisdiction.
- .3 Hazardous Materials: The building is constructed with known hazardous materials.
 - .1 Hazardous materials will be as defined in the Hazardous Materials Act
 - .2 Building Asbestos Reports are included a separately bound appendix document.
 - .1 Examine report to become aware of locations where hazardous materials are present.
 - .3 If materials suspected of containing hazardous materials are encountered in course of work, do not disturb; immediately notify Departmental Representative.
 - .1 Hazardous materials will be removed by Departmental Representative under a separate contract or as a change to the Work.

2 Products

2.01 DESCRIPTION

- .1 Work of this Section includes, but is not necessarily limited to, following:
 - .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris.
 - .2 Selective demolition to allow new walls, bulkheads, ceilings and other materials to meet existing construction as indicated
 - .3 All material from demolition shall be removed from site immediately with no salvage, selling, sorting or burning permitted on site
 - .4 Retain items indicated on drawings for re use in new construction

2.02 DEBRIS

- .1 Make arrangements for transport and disposal of demolished materials from site.

2.03 EQUIPMENT

- .1 Provide equipment required for safe and proper demolition of building interiors indicated.
- .2 Wherever possible use equipment driven by electric motor. Pneumatic and gas driven equipment are not permitted.
- .3 Do not use vibrating equipment for removal of masonry or concrete.

2.04 REPAIR MATERIALS

- .1 Use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - .2 Use material whose installed performance equals or surpasses that of existing material.
 - .3 Comply with material and installation requirements specified in individual Specification Sections.
- .2 Floor Patching and Levelling Compounds: Cement based, trowelable, self levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.
- .3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- .4 Gypsum Board Patching Compounds: Joint, bedding and finishing compounds to Section 09 21 16 – Gypsum Board
 - .1 Provide skim coat to patch and prepare existing painted gypsum board walls in construction area ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Systems.
- .5 Hoarding and Dust Screens: Refer to Section 01 56 00 – Temporary Barriers and Enclosures.

2.05 EXISTING MATERIALS

- .1 Items to be retained for re use in new construction include, but are not limited to following:
 - .1 Cabinet convector heater covers.
 - .2 Visual display boards.
 - .3 Specialties.
 - .4 Window coverings.
 - .5 Thermostats.
 - .6 Other miscellaneous items identified on drawings.
- .2 Confirm with Departmental Representative materials scheduled for re use that are not in re usable condition prior to installation

3 Execution

3.01 EXAMINATION

- .1 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .2 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

- .3 Notify Departmental Representative where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit written report to Departmental Representative.
 - .2 Departmental Representative will issue additional instructions or revise drawings as required to correct conflict.
- .4 Confirm existing electrical systems are in working condition prior to carrying out modifications.
 - .1 Where existing systems are not operable, notify Departmental Representative prior to carrying out work.
 - .2 Inoperable electrical systems will be repaired by Departmental Representative under separate contract or as change to the Work at the sole discretion of the Departmental Representative.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- .1 Existing Services/Systems to Remain: Maintain services/systems not indicated for demolition and protect them against damage.
 - .1 Protect existing fire alarm devices and exit lighting, and keep in service for duration of work.
 - .2 Provide temporary support acceptable to Departmental Representative for existing services to remain where required by demolition of existing supporting structures.
- .2 Existing Services/Systems to Be Removed, Relocated: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - .1 Arrange to shut off indicated utilities with utility companies as required.
 - .2 If services/systems are required to be removed, or relocated, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - .1 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .2 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound. Patch concrete using cementitious grout.
 - .3 Disconnect, demolish, and remove plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - .1 Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - .2 Equipment and Fixtures to Be Removed: Disconnect and cap services and remove equipment and fixtures.
 - .3 Ducts to Be Removed: Remove portion of ducts indicated and plug remaining ducts with same or compatible ductwork material.
 - .4 Abandonment of redundant equipment and systems in place is unacceptable. Remove unused services back to active mains. Cap at existing point of connection to main.

3.03 PREPARATION

- .1 Check conditions, obtain and confirm actual site dimensions, as required to ensure correct execution of Work. Notify Departmental Representative in writing of matters, discrepancies between actual site conditions and Contract Documents that may hinder proper execution of Work.
- .2 Identify and mark all equipment and materials identified to be retained by Departmental Representative, or to be re used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.
- .3 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.
- .4 Do not disrupt active or energized utilities crossing the demolition site
- .5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of Work in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.
- .6 Arrange for temporary disruption of existing services with Departmental Representative.
- .7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.
- .8 Locate, disconnect, cap, plug or divert, as required, existing utility services within property where they interfere with execution of Work, in conformity with requirements of authorities having jurisdiction. Mark location of these and previously capped or plugged services and indicate location (horizontal and vertical) on record drawings. Support and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative, in case of damage to any service, designated to remain in place.
- .9 Immediately notify Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.04 SELECTIVE DEMOLITION

- .1 Carefully remove items indicated for reuse and reinstallation. Store in dry, weather protected location for reinstallation where indicated.
- .2 Carefully remove items indicated for salvage. Transport to location on property as directed by Departmental Representative.
- .3 Selectively demolish and remove existing construction only to extent required by future construction and as indicated.
 - .1 Demolish and dismantle work in neat and orderly manner and in strict accordance with all regulations.
 - .2 Demolish in a manner to minimize dusting and to prevent migration of dust.
- .4 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.

- .5 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .6 Neatly cut walls, openings and holes plumb, square, and true to dimensions required.
 - .1 Use cutting methods least likely to damage construction to remain or adjoining construction.
 - .2 Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
 - .3 Temporarily cover openings to remain.
 - .4 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.
- .7 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- .8 Demolish existing carpet, resilient flooring and adhesive remnants as follows:
 - .1 Vacuum existing carpet thoroughly, prior to removal, using vacuum equipped with power head/sweeper.
 - .2 Apply fine mist water spray to carpet as required to minimize dust generation during removal. Avoid spraying near electrical outlets.
 - .3 Demolish existing carpet and resilient floor finishes, remove and dispose of off site.
 - .4 Remove adhesive to the greatest extent possible using scrapping tools and as follows:
 - .1 Do not use solvent based cleaners to remove adhesive remnants.
 - .2 Lightly shot blast or grind floor using machine designed for purpose to remove adhesive remnants.
 - .3 Vacuum floor ready for application of skim coating.
 - .4 Repair all slab depressions and damage with cementitious patching compound.
 - .5 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.
 - .5 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through resilient flooring materials and carpets.
 - .6 Recycle materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .9 Demolish ceiling components as indicated. Retain in place existing ceiling suspension wall angle at perimeter widow walls and as indicated.
- .10 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
- .11 Protect interiors of parts not to be demolished from exterior elements at all times.
 - .1 Refer to Section 01 56 00 – Temporary Barriers and Enclosures.
- .12 Lower waste materials in controlled manner; do not drop or throw materials from heights.
- .13 Contain fibrous materials (e.g. insulation) to minimize release of airborne fibres while being transported within facility.

3.05 REMOVAL FROM SITE

- .1 Remove and dispose of demolished materials off-site in accordance with authorities having jurisdiction, and Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Burning of materials on site is not permitted.

3.06 PATCHING AND REPAIRING

- .1 Floors and Walls:
 - .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
 - .2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
 - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .4 Patch with durable seams that are as invisible as possible.
 - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - .6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - .7 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- .2 Ceilings: patch, repair, or re hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.07 PROTECTION

- .1 Prevent movement, settlement or damage of adjacent parts, components, systems, and assemblies of existing building to remain.
- .2 Protect construction indicated to remain against damage and soiling during selective demolition.
 - .1 When permitted by Departmental Representative, items may be removed to suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- .3 Do not damage or deface existing construction, equipment or finishes indicated to remain.
- .4 Provide temporary dust screens, covers, supports and other protection as required. Refer to Section 01 56 00 – Temporary Barriers And Enclosures.
- .5 Maintain safe access to and egress from occupied areas adjoining.
- .6 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.08 CLEANING AND RESTORATION

- .1 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.
- .2 Waste Management: Separate waste materials for reuse, recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal , and as follows:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill to site approved by Departmental Representative.
- .4 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material.
 - .1 Remove rubbish resulting from demolition work daily in accordance with Section 01 74 11 - Cleaning.
- .5 Transport material designated for alternate disposal using approved receiving organizations listed in CWM Plan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in CWM Plan.
- .6 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in CWM Plan.
 - .2 Written authorization from Representative Consultant is required to deviate from disposal facilities listed in CWM Plan.
- .7 Clean existing materials indicated for reinstallation.
 - .1 Clean prior to storing.
 - .2 Obtain written cleaning instructions from original manufacturer.
- .8 Damage from Demolition: Upon completion of Work of this Section review designated work area with Departmental Representative to identify areas damaged by demolition.
 - .1 Reinstate areas affected by Work to condition which existed prior to beginning of Work as established by pre-construction photographs.
 - .2 Where pre-construction photographs do not show pre-existing conditions, repair damage as directed by Departmental Representative.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A153/A153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .2 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
 - .3 ASTM F2329-13, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- .2 Canadian Standards Association (CSA International)
 - .1 CSA O112-M Series 1977 R2006, Standards for Wood Adhesives.
 - .2 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .3 CSA O141-05 (R2014), Softwood Lumber.
 - .4 CSA O151-14, Canadian Softwood Plywood.
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2005.

1.02 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data: manufacturer's printed data sheet including technical data for performance requirements specified.

1.03 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 in accordance with CSA and ANSI standards.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 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

2.01 FRAMING AND STRUCTURAL 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.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs:
 - .1 S2S is acceptable.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Post and timbers sizes: "Standard" or better grade.

2.02 PANEL MATERIALS

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .1 No added urea-formaldehyde
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .1 No added urea-formaldehyde

2.03 ACCESSORIES

- .1 General purpose adhesive: Polyurethane based moisture curing adhesive compatible with materials being adhered.
- .2 Nails, spikes and staples: to ASTM F1667-11ae1.
- .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.

2.04 FASTENER FINISHES

- .1 Galvanizing: To ASTM A153, Class D, and ASTM F2329, use galvanized fasteners for fire retardant treated materials.

2.05 FIRE-RETARDANT-TREATED MATERIALS

- .1 General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- .2 Fire-Retardant-Treated Lumber and Plywood by Pressure Process: UCF-1 classified to CSA O80, products with flame spread rating of 25 or less, and smoke development classification of 35 or less when tested according to CAN/ULC S102, and with no evidence of significant progressive combustion when test is extended additional 30 minutes.
 - .1 Use treatment that does not promote corrosion of metal fasteners.

3 Execution

3.01 INSTALLATION

- .1 Comply with requirements of NBC 2015 Part 9 supplemented by following paragraphs.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.
- .5 Select exposed framing for appearance. Install materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .6 Install furring and blocking as required to space-out and support casework, cabinets, electrical equipment mounting boards, and other work as required.
 - .1 Concealed Blocking: Provide 19 mm CSP panel material in accordance with requirements of other sections except provide dimensional lumber blocking where required by manufacturer of product being supported.
- .7 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .8 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .9 Install fire-retardant treated wood materials with galvanized fasteners and bolts to ASTM A153, Class D, and ASTM F2329.
- .10 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .11 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .12 Countersink bolts where necessary to provide clearance for other work.

3.02 SCHEDULES

- .1 Wall Panels: fire-retardant treated plywood, DFP or CSP, SEL TF grade.

END OF SECTION

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1 General

1.01 RELATED REQUIREMENTS

- .1 Section 06 08 99 – Rough Carpentry for Minor Works: for furring and blocking to support cabinets.
- .2 Section 07 92 00 - Joint Sealants: Sealant materials and application

1.02 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/BHMA A156.9-2010, Cabinet Hardware.
 - .2 ANSI A208.1-09, Particleboard.
 - .3 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
 - .1 Architectural Woodwork Standards (AWMAC AWS), 2014.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA O112-M Series 1977 R2006, Standards for Wood Adhesives.
 - .2 CSA O121 08 (R2013), Douglas Fir Plywood.
 - .3 CSA O141 05 (R2014), Softwood Lumber.
 - .4 CSA O151 14, Canadian Softwood Plywood.
 - .5 CSA O153-M1980 (R2014), Poplar Plywood.
- .5 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).

1.03 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- .2 Pre-Installation Meeting: Prior to enclosing framing, convene a meeting of contractor, casework fabricator, casework installer, framing subcontractor and Departmental Representative.
 - .1 Review locations of backing required for casework installation as shown on shop drawings and as necessary for installation.
 - .2 Review method of attachment for backing to wall system.
 - .3 Review coordination with other affected sections

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Prepare and submit material list in accordance with AWMAC AWS, cross-referenced to specifications.
 - .2 Include manufacturer's instructions, printed product literature, data sheets and catalogue pages for all materials and products to be incorporated into architectural wood casework and include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.
 - .2 Hardware List:
 - .1 Submit hardware list cross-referenced to specifications.
 - .2 Include manufacturer's specification sheets indicating name, model, material, function, finish, BHMA designations and other pertinent information.
 - .3 Shop Drawings: Prepare and submit shop drawings in accordance with AWMAC AWS and as follows.
 - .1 Indicate details of construction, jointing, fastening and other related details.
 - .1 Scales: details half full size.
 - .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 Show location on casework elevations of backing required in supporting structure for attachment of casework.
 - .5 Indicate seaming of high pressure laminate countertops where required.
 - .6 Indicate AWMAC AWS quality grade where different from predominant grade specified.
 - .7 Include color schedule of all casework items, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.
 - .4 Samples: Prepare and submit samples in accordance with AWMAC AWS and as follows.
 - .1 Apply sample finishes to specified substrate or core material minimum 300 x 300 mm.
 - .2 Submit duplicate samples of HPDL and LPDL for each specified colour selection.
 - .3 Submit duplicate samples of laminated plastic joints, edging, cutouts and post-formed profiles.
 - .4 Edge banding:
 - .1 Sample deck for full range.
 - .2 Representative samples of each edge band thickness applied to core material with HPDL finish.

- .3 Informational Submittals:
 - .1 Submit WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's for adhesives, solvents and cleaners.

1.05 CLOSEOUT SUBMITTALS

- .1 Submit information in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Cleaning and maintenance instructions for high pressure laminate surfaces and thermally fused melamine surfaces.
 - .2 Written Warranty.

1.06 QUALITY ASSURANCE

- .1 Fabricator Qualifications: Fabricator shall be either of the following:
 - .1 Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of minimum five years' successful in-service performance with value within 20% of cost of work of this Section, or
 - .2 Member in good standing of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), the American Woodwork Institute (AWI), or the Woodwork Institute (WI).
- .2 Installer Qualifications: Fabricator of products.
- .3 Fabrication Shop Requirements: Indoor relative humidity (RH) within 5-10% of indoor RH of the building where the installation is intended.
- .4 Quality Standard: Unless otherwise indicated, comply with AWMAC AWS "Architectural Woodwork Quality Standards" custom grade quality of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1.07 WARRANTY

- .1 Provide two year manufacturer's warranty from sate of Substantial Performance of 'work covering architectural woodwork materials and workmanship, except:
 - .1 Hinge warranty: Lifetime.
 - .2 Laminated Plastic warranty: Warrant against warpage and delamination from substrate for period of three years from date of Substantial Performance of Work.

1.08 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions, and 01 61 00 - Common Product Requirements.
- .2 Deliver wood casework only when area of work is enclosed, plaster and concrete work is dry, and area is broom clean and site environmental conditions are acceptable for installation.
- .3 Protect millwork against dampness and damage during and after delivery.

- .4 Store millwork in ventilated areas, protected from extreme changes of temperature and humidity, and within range recommended by AWMAC AWS for location of project.
 - .1 If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Site Conditions" Article.
- .5 Store materials indoors in clean, dry area.
- .6 Protect architectural woodwork and hardware from nicks, scratches, and blemishes.
- .7 Replace defective or damaged materials with new.
- .8 Waste Management: for packaging and materials, in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .9 Do not install woodwork until painting and similar operations that could damage woodwork have been completed in installation areas.

1.09 SITE CONDITIONS

- .1 Environmental Limitations: Do not deliver or install woodwork until HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- .2 Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 MAINTENANCE MATERIALS

- .1 Turn over surplus materials of edge banding material.

2 Products

2.01 QUALITY GRADE

- .1 Provide materials and perform fabrication in accordance with AWMAC AWS Custom Grade, except where specified otherwise.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, highest quality requirements govern.

2.02 LUMBER

- .1 Wood Materials: containing no added urea-formaldehyde.
 - .1 Softwood and Hardwood Lumber: Sound lumber to specified AWMAC AWS quality grade requirements, kiln-dried to moisture content recommended by AWMAC AWS for location of the Work.
 - .2 Machine stress-rated lumber is acceptable for all purposes.

2.03 PANEL MATERIALS

- .1 Douglas fir plywood (DFP): to CSA O121, 7-ply veneer core, S4S, moisture content 4 to 9% or less.
- .2 Canadian softwood plywood (CSP): to CSA O151, 7-ply veneer core, S4S, moisture content 4 to 9% or less, solid two sides.
- .3 Poplar plywood (PP): to CSA O153, 7-ply veneer core, S4S, moisture content 4 to 9% or less.
- .4 Interior mat-formed wood particleboard: to ANSI A208.1, industrial grade M-2 or M-3, medium density (640-800 kg/m³), thickness in accordance with AWMAC AWS grade requirements.
 - .1 Use moisture resistant grade 2-M-2 or 2-M-3 for countertops and splash-backs to receive plumbing fixtures.
- .5 Medium density fibreboard (MDF): to ANSI A208.2, Grade MD, density 640 to 800 kg/m³, thickness in accordance with AWMAC AWS grade requirements.
 - .1 Use moisture resistant MR grade for countertops and splash-backs to receive plumbing fixtures.
- .6 Hardwood lumber: moisture content 4 to 9% or less, and in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
- .7 Hardboard: To CAN/CGSB-11.3.

2.04 DECORATIVE OVERLAID COMPOSITE PANELS

- .1 Thermofused Melamine Panels (LPDL): particleboard or MDF core, finished on both faces with high wear-resistant thermally fused, melamine-impregnated decorative paper complying with NEMA LD 3.
 - .1 Abrasion Resistance: Equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
 - .2 Colour: exposed and semi-exposed, to match HPDL selected by Departmental Representative.
 - .3 No added urea-formaldehyde, or urea-formaldehyde containing resins.

2.05 LAMINATED PLASTIC MATERIALS

- .1 High-Pressure Decorative Laminate (HPDL): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard. Colours, patterns, finish, and textures, selected from manufacturers' entire range, by Departmental Representative. No added urea-formaldehyde.
 - .1 Horizontal applications: High Wear or Superior Wear, high abrasion resistance, Horizontal Grade Post forming, HGP, complying with NEMA LD3.
 - .2 Vertical surfaces, all remaining exposed or semi-exposed surfaces: VGS.
 - .3 Colours, patterns and finishes: Minimum 5 colours.

- .4 Backing sheet: Grade BK, Type HD not less than 1.2 mm thick or same thickness as face laminate., except for concealed surfaces.
 - .1 Colour: acceptable to Departmental Representative.

2.06 EDGING

- .1 Edge Banding: ABS Colour and pattern-through; with colour, pattern, and finish matched to each selected HPDL and LPDL colour and pattern; allow for full rolls and/or minimum order quantity of each specified pattern, colour, and thickness.
 - .1 Thickness as follows:
 - .1 3 mm thickness: Countertop edges, drawer and door panels, and exposed edges of boxes, gables, and shelves.
 - .2 1 mm thickness for semi-exposed shelves, and drawer boxes.

2.07 CABINET HARDWARE

- .1 Hinges: institutional hinge for full overlay with 3 mm width reveal, semi-concealed, Grade 1 to ANSI/BHMA A156.9-2003 Standard, 270 degree opening, self-closing, c/w cover cap, all-metal with two-way hinge arm adjustment, and mounting plate. Provide doors up to 810 mm high with two hinges, doors between 810 and 1200 mm with three hinges, and doors over 1200 mm high with four hinges.
- .2 Angle reduction clip – to set/adjust max degree of door opening to 90° to prevent contact with perpendicular surfaces.
- .3 Regular Drawer Slides: for drawers up to 150 mm high and 400 mm wide, 40 kg dynamic load rating, undermount, full extension, soft-close, synchronized with rack & pinion, fully adjustable, 4 way adjustments, 500 or 550 mm length or to suit maximum cabinet depth.
- .4 Heavy Duty Drawer Slides: Minimum 60 kg dynamic load rating, undermount, full extension, soft-close, synchronized with rack & pinion, fully adjustable, 4 way adjustments, length or to suit maximum cabinet depth.
- .5 Door and Drawer Pulls: surface mounted contemporary style metal pull; 170 stainless steel, 12 mm diameter straight rod, 128 mm centres, 160 mm overall length, 35 mm projection; Centre on drawers 180 mm height or less. Position horizontally on door and drawer fronts, 50 mm from top edges, centered on drawer widths, and 50 mm from side edge of doors, typical.
- .6 Shelf Supports: typical for cabinets unless otherwise noted; pre-drilled type, shelf support and socket, nickel-finish steel.
- .7 Support Brackets: typical for countertop or work surfaces: epoxy coated metal, size to suit countertop depth indicated; load capacity 500 kg/pair; with openings to allow cables to bypass. Allow one pair per 900 mm span of worktop or countertop knee space typically.
- .8 Magnetic catches: fabricator's option.
- .9 Door bumpers: 9 mm dia. clear, nylon, peel and stick, fabricator's option.

2.08 MISCELLANEOUS MATERIALS

- .1 Furring, Blocking, Shims, and Hanging Strips: 19 mm thick veneer core plywood.
- .2 Blind framing: 19 by 64 mm lumber.
- .3 Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide non-ferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- .4 Adhesives, General: Adhesives shall not contain urea formaldehyde.
 - .1 Construction Adhesive: waterproof, high solids content, polyurethane for bonding metal to metal, and metal to wood.
 - .1 Maximum VOC Content: 30 g/L, less water
 - .2 Laminate Adhesive: water-resistant, as recommended by manufacturer for high-pressure bonding.
 - .1 Maximum VOC Content: 250 g/L, less water
- .5 Draw Bolts and Splines: as recommended by fabricator.
- .6 Sealer: Latex based primer from approved products list for MPI #39.
 - .1 Maximum VOC Content: 200 g/L, less water

2.09 FABRICATION, GENERAL

- .1 Interior Woodwork Grade: Unless otherwise indicated, provide AWMAC AWS Custom-grade interior woodwork.
- .2 Drawing utilize the AWMAC AWS - Architectural Woodwork Standards Casework Design Series (CDS) numbering system to identify units required.
- .3 Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- .4 Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- .5 Use continuous lengths up to 3 660 mm to minimize joints.
- .6 Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - .1 Seal edges of openings in countertops with a coat of varnish.
- .7 Shelving: Adjustable, on shelf supports, unless otherwise indicated.

2.10 CASEWORK FABRICATION - GENERAL

- .1 Fabricate casework of specified core and surface finish materials to specified AWMAC AWS quality grade.
 - .1 Construction type: A - frameless.
 - .2 Door-cabinet interface: flush overlay.
- .2 Shop install cabinet hardware for doors, shelves and drawers.
- .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.

2.11 LAMINATED PLASTIC CASEWORK FABRICATION

- .1 Do laminated plastic fabrication in compliance with NEMA LD3, Annex A and specified AWMAC AWS quality grade.
- .2 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .3 Veneer laminated plastic to MDF or particleboard core material as indicated and 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 3 000 mm. Keep joints 600 mm from sink cutouts.
- .4 Form shaped profiles and bends as indicated, using post-forming grade laminate to laminate manufacturer's instructions.
- .5 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.
- .6 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .7 Drawer Construction:
 - .1 Sides: LPDL on MDF.
 - .2 Bottoms: LPDL on MDF.
 - .3 Joinery: Meeting requirements of AWMAC for Grade specified.
- .8 Exposed Surfaces:
 - .1 Cabinet Boxes: 19 mm thick particleboard or MDF core, LPDL finish.
 - .2 Counter Gables: 19 mm thick particleboard with HPDL finish.
 - .3 Door and Applied Drawer Fronts: 19 mm thick particleboard with HPDL finish.

- .9 Semi-Exposed Surfaces:
 - .1 Surfaces: 19 mm thick particleboard or MDF core, LPDL finish.
 - .2 Cabinet Backs: 13 mm thick particleboard or MDF core, LPDL finish.
 - .3 Drawer Boxes: LPDL, 1 mm thick edge banding on top edge.
- .10 Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure laminate, Grade BKL, for balanced construction.
- .11 Provide dust panels of 6 mm plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
- .12 Edge Banding: 3 mm edge-banding.
- .13 Valance: height indicated, continuous front and side returns; 19 mm thick particleboard with HPDL finish and 3 mm thickness edge-banding.
- .14 Filler panels: 19 mm thick particleboard with HPDL finish.
 - .1 Vertical at ends of cabinet runs: nominal 50 mm wide typically, equal at both ends.
 - .2 Provide horizontal filler panels at top and bottom of cabinets at ends and at corners.
- .15 Toe Kick: 19 mm thick particleboard, prepared to receive base material as indicated for walls in room finish schedule.
 - .1 Refer to Division 9 flooring specifications for applicable base materials.

2.12 COUNTERTOPS

- .1 High Pressure Laminate Countertops: Particleboard core, high pressure laminate clad, except plywood for 1 220 mm centred on any plumbing fixtures.
 - .1 Configuration: Post formed edge with splash, except no splash where ceramic tile splash indicated.
 - .2 Side and Backsplash: typical except at ceramic tile.
 - .1 Coordinate work with Section 09 30 13 - Ceramic Tiling.
 - .3 Front Edge: Square Wrap
 - .4 Joint adhesive: manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints.
 - .1 Maximum VOC Content: 250 g/L, less water

2.13 SHOP FINISHING

- .1 Grade: Provide finishes of same grades as items to be finished.
- .2 General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touch-up, cleaning, and polishing until after installation.
- .3 Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

- .4 Sealer: Shop prime all faces and edges of furring, blocking, shims, hanging strips, and blind framing.

3 Execution

3.01 PREPARATION

- .1 Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

3.02 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.
- .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.

3.03 INSTALLATION

- .1 Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- .2 Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- .3 Install prefinished millwork at locations shown on drawings.
 - .1 Position accurately, level, plumb straight.
 - .2 Install level and plumb (including tops) to a tolerance of 3 mm in 2 440 mm
- .4 Fasten and anchor millwork securely.
 - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .5 Install woodwork level, plumb, true, and straight. Shim as required with concealed shims.
- .6 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.
- .7 Make cutouts for inset equipment and fixtures using templates provided.
- .8 Apply water-resistant building paper, or other moisture barrier acceptable to Departmental Representative, over wood framing members in contact with masonry or cementitious construction.

- .9 Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
 - .1 Seal site cuts with specified shop applied sealer except transparent finish where required to match specified final finish.
- .10 Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to centre doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - .1 Install cabinets with no more than 3 mm in 2 440 mm sag, bow, or other variation from a straight line.
- .11 Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - .1 Use draw bolts in countertop joints.
 - .2 Install countertops with no more than 3 mm in 2 440 mm sag, bow, or other variation from a straight line.
 - .3 Caulk space between countertop and tile backsplash with mildew resistant silicone sealant to Section 07 92 00 - Joint Sealants.
 - .4 Provide HPDL countertops except as indicated.
- .12 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .13 Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.04 ADJUSTING AND CLEANING

- .1 Adjust joinery for uniform appearance.
- .2 Clean, lubricate, and adjust hardware.
- .3 Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
- .4 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.
 - .1 Leave Work area clean at end of each day.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
 - .1 Clean inside and outside surfaces of woodwork.
 - .2 Remove excess glue, pencil and ink marks from surfaces.
- .6 Waste Management: separate waste materials for recycling, reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.05 PROTECTION

- .1 Protect woodwork from damage until final inspection.
- .2 Repair damage to adjacent materials caused by architectural woodwork installation.
- .3 Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork.

END OF SECTION

1 General

1.01 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM E2174-14B, Standard Practice for On-Site Inspection of Installed Firestops
 - .2 ASTM E2393-10A(2015), Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
 - .3 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Firestop Systems.

1.02 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) and 9.10.9.6(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.

1.03 ADMINISTRATION

- .1 Pre-Construction Meeting: Conduct mandatory pre-construction meeting after Design System Listings Shop Drawings are reviewed by Departmental Representative.
 - .1 Ensure attendance by each subcontractor affected including but not limited to concrete, masonry, window, gypsum board/steel stud, mechanical and electrical, along with Firestopping subcontractor, Contractor, Departmental Representative and independent inspection agency.
 - .2 Provide copy of reviewed Design System Listings Shop Drawings for each attendee.

- .3 Review standard installation procedures, scheduling / sequencing of other work around or affecting outcome of installation, precautions, annular opening sizes, wall/floor service single and multi – preparations, joints and perimeter joints shall be reviewed to ensure attendees understand full complexity of fire stop installation, based on approved Design System Listings Shop Drawings.
- .4 Record minutes of meeting and distributing to attendees.
- .2 Sequencing And Scheduling: Do not cover up firestopping installations until Departmental Representative or Authorities Having Jurisdiction have examined installation.

1.04 SUBMITTALS

- .1 Make 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 system design listings, including illustrations from qualified testing and inspection agency applicable to each firestop configuration. Indicate proposed material, reinforcement, anchorage, fastenings, and method of installation. Construction details should accurately reflect actual job conditions.
 - .3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.
 - .4 Submit Design Listings Shop Drawings as follows:
 - .1 Provide list of each proposed Design Listing and corresponding service penetration type or joint type in a matrix spreadsheet schedule, indicating floor and wall system, including rating for each.
 - .2 Provide list of each proposed Design Listing with approximate total quantity or amounts of each listing per floor on separate sheet.
 - .3 Number each penetration corresponding to the exact number of plate penetration no. identified in Part 2.
 - .4 Provide copies of all fire and smoke stop system ULC or cUL Design No. listings for each penetration type for all areas located.
 - .5 Provide product data, MSDS and all other technical data information required as indicated in this section.
- .3 Informational Submittals:
 - .1 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.
 - .2 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .4 Provide certifications of each installer proposed on working on the Project.
- .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
- .4 Closeout Submittals:
 - .1 Operations and maintenance manual in accordance with Section 01 78 00 – Closeout Submittals.
 - .1 As-Builts:
 - .1 Provide as-built drawings, project manual, schedules, submittals, and firestop drawing details on site and make them available for periodic review by the Departmental Representative.
 - .2 Drawings, schedules, submittals and details shall be marked up on weekly basis showing alterations, changes and confirmation of each Design Listing in relationship to submittal documents.
 - .3 Indicate service penetrations, and joints for each reference wall, and floor in the submittal schedules. Record information by indicating and imputing all required descriptions based on actual on-site condition. Turn over schedules to Departmental Representative at end of project for electronic imputing for Owner's maintenance use.

1.05 QUALITY ASSURANCE

- .1 Fire-Test-Response Characteristics: Provide firestopping System Design Listing by testing and inspection agency in accordance with appropriate ASTM standard(s).
 - .1 Qualified testing and inspection agencies include UL, ULC, cUL, Intertek Testing Services, or another agency performing testing and follow-up inspection services for firestop materials that is acceptable to authority having jurisdiction.
- .2 Installer qualifications:
 - .1 Firestop Contractors International Association Contractor (FCIA) Member in good standing.
 - .2 Licensed by local authority, where applicable.
 - .3 Shown to have successfully completed not less than five comparable scale projects.
- .3 Single Source Responsibility: Obtain firestop systems for each kind of penetration and construction conditions indicated from a single primary firestop systems manufacturer.
 - .1 Do not intermix materials of different manufacture than allowed by tested and listed system in the same firestop system or opening.
 - .2 Tested and listed firestop systems are to be used first. If such systems are not possible, install an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).
- .4 Single Source Installation: Provide one sub-contractor for installation of all fire-stopping on project.
- .5 Schedule pre-construction meeting for parties involved prior to start of construction.

1.06 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver firestopping products to Project Site in original, unopened containers, or packages with intact and legible manufacturer's labels identifying product and manufacturer.
- .2 Store and handle firestopping materials in accordance with manufacturer's written instructions.

1.07 SITE CONDITIONS

- .1 Environmental Conditions: Install firestopping in accordance with manufacturers written instructions.
- .2 Ventilation: Ventilate in accordance with firestopping manufacturers' instructions or Material Safety Data Sheet (MSDS).

1.08 WASTE MANAGEMENT AND DISPOSAL

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

2 Products

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 Firestopping systems produced to resist spread of fire and passage of smoke and other gases according to requirements indicated, including but not limited to:
 - .1 Firestop perimeter joints and penetrations passing through fire resistance rated wall and floor assemblies, and other locations as indicated.
 - .2 Compatibility: Provide firestopping composed of components that are compatible with each other, substrates forming openings, and items penetrating firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
 - .3 Provide components for each firestopping system needed to install fill material. Use only components specified by firestopping manufacturer and approved by qualified testing agency for proposed fire-resistance-rated systems.
 - .4 Where there is no specific third party tested and classified firestop system is available for a particular firestop configuration, obtain Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFFRA) for submittal from firestop manufacturer.
 - .5 Fire stopping and smoke seal systems: In accordance with ULC-S115.
 - .1 For service penetrations and joints through fire separation wall: Provide firestop system with "F" Rating as determined by ULC or cUL as indicated below:
 - .2 Fire Resistance Required ULC or cUL "F"
 - .3 Rating of Separation Rating of Firestopping Assembly
 - .4 0 minutes 60 minutes
 - .5 30 minutes 20 minutes

- | | | |
|-----|--|------------|
| .6 | 45 minutes | 45 minutes |
| .7 | 1 hour | 45 minutes |
| .8 | 1.5 hours | 1 hour |
| .9 | 2 hours | 1.5 hours |
| .10 | 3 hours | 2 hours |
| .11 | 4 hours | 3 hours |
| .12 | For combustible pipe penetrations through Fire Separation: Provide firestop system with "F" Rating as determined by ULC or cUL which is equal to fire resistance rating of fire separation being penetrated. | |
| .13 | For penetrations through horizontal fire separation: Provide firestop system with "FT" Rating as determined by ULC or cUL which is equal to fire resistance rating of fire separation being penetrated. | |
| .14 | Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with ULC S115. | |
| .1 | L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures. | |
| .15 | For joints at perimeter of fire separations provide firestop system with Assembly Rating as determined by CAN/ULC S115 or UL 2079 which is equal to fire resistance rating of adjacent fire separation. | |
- .6 Firestop products produced by FCIA Manufacturer Members in good standing.
- .7 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.02 MATERIALS

- .1 Service penetration assemblies: Certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
- .2 Service penetration firestop components: Certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .3 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: Elastomeric seal.
- .4 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: Elastomeric seal.
- .5 Primers: To manufacturer's recommendation for specific material, substrate, and end use.
- .6 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.
- .7 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.
- .8 Sealants for vertical joints: Non-sagging.

- .1 Maximum VOC Content: 250 g/L (less water)
- .9 Labels: self-adhering-type metal labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - .1 The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Damage."
 - .2 Plate Penetration Number.
 - .3 Floor Level.
 - .4 Room Number.
 - .5 Product Name.
 - .6 ULC or cUL System Design No.
 - .7 Fire Rating Required: hour(s)
 - .8 Contractor's name, address, and phone number.
 - .9 Date of installation.
 - .10 Manufacturer's name.
 - .11 Installer's name.
 - .12 Re-penetrated by:
 - .13

Company	Installer	Date
.1		
.2		
.3		
.4		

3 Execution

3.01 EXAMINATION

- .1 Examine substrates and conditions with installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping.
 - .1 Notify Departmental Representative of unsatisfactory conditions.
 - .2 Do not proceed with installation until unsatisfactory conditions have been corrected.
- .2 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.
- .3 Verify that field dimensions are as indicated and as recommended by manufacturer.
- .4 Perform field review of existing fire separations prior to commencing Work of this Section.
 - .1 Determine fire resistance ratings: Perform visual review of labels and markings on fire separations. Where labels and markings are not provided, review building as-built documents available from Departmental Representative.
 - .1 Submit written record of fire separation ratings for Departmental Representative's review.

- .2 Deficiencies: Where observed submit to Departmental Representative written report with photographs documenting deficiencies.
 - .1 Fire Separation deficiencies will be repaired by Departmental Representative under separate contract or as change to the Work at the sole discretion of the Departmental Representative.

3.02 PREPARATION

- .1 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.
- .2 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .3 Mask where necessary to avoid spillage and over coating onto adjoining surfaces.
 - .1 Remove masking as soon as it is possible to do so without disturbing the firestopping seal with substrates.
- .4 Remove stains on adjacent surfaces.

3.03 INSTALLATION

- .1 General:
 - .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
 - .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 a neat finish.
 - .5 Remove excess compound promptly as work progresses and upon completion.
- .2 Penetration Firestops:
 - .1 Coordinate with other trades to ensure pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
 - .2 Schedule Work to ensure partitions and other construction that conceals penetrations are not erected prior to installation of firestop and smoke seals.
 - .3 Install fill materials for through-penetrations firestop systems to produce the following result:
 - .1 Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - .2 Install materials so they contact and adhere to substrates formed by opening and penetrating items.
 - .3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces.

- .3 Firestop Joint Systems:
 - .1 Install joint fillers to provide support of firestop materials during application and at position required to produce cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
 - .2 Install systems by proved techniques that result in firestop materials:
 - .1 Directly contacting and wetting joint substrates.
 - .2 Filling recesses provided for each joint configuration.
 - .3 Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
 - .3 Tool non-sag firestop materials immediately after application and prior to skinning. Form smooth, uniform beads of configuration indicated or required to:
 - .1 Produce fire-resistance rating.
 - .2 Eliminate air pockets.
 - .3 Ensure contact and adhesion with sides of joint.

3.04 FIELD QUALITY CONTROL

- .1 Daily Worksheet:
 - .1 Keep daily log of firestopping activities on site during course of construction. Develop worksheet to be utilized during course of construction, indicate general location within rooms, floor, or wall assembly, required rating, penetration, joint, ULC Design No., where no ULC Design is available then reference engineering judgement, date installed, quality control reviews, name and title of reviewers.
 - .2 Departmental Representative will make periodic reviews of these worksheets during the course of construction.
- .2 Inspection and Testing: Engage and pay costs for third party inspection and testing agency to examine firestop penetration seals for proper installation, labelling, adhesion and curing appropriate for respective seal material before concealing or enclosing areas.
 - .1 Base examination on format similar to ASTM E2174 and ASTM E2393.
 - .2 Random review of installation, include:
 - .1 Construction progress.
 - .2 Construction photographs.
 - .3 Product storage, handling and delivery.
 - .4 As-built schedules and drawings.
 - .5 Penetration / Joint label installation.
 - .6 Barrier marking installation
 - .7 Protection of installed systems.
- .3 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .4 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.

3.05 LABELING

- .1 Install labels adjacent to through wall/floor service penetrations and joints that are fire stopped, and at joint penetrations. Provide one assembly identification label per penetration opening and one assembly identification plate at every 6 000 mm along bottom and top of wall joints, and wall to wall joints.
- .2 Fill out and install labels prior to Substantial Performance of Work.
- .3 Clean substrate prior to applying label.
- .4 Securely apply label to substrate.
- .5 Install label 50 mm away from penetration or joint.

3.06 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - 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.

3.07 SCHEDULE

- .1 Fire stop and smoke seal to provide fire-resistance ratings indicated for following conditions.
 - .1 Penetrations through fire-resistance rated partitions.
 - .2 Complete perimeter of fire-resistance rated partitions.
 - .3 Intersection of fire-resistance rated partitions.
 - .4 Control and sway joints in fire-resistance rated partitions.
 - .5 Penetrations through fire-resistance rated floor assemblies.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.
 - .2 ASTM C920, Standard Specification for Elastomeric Joint Sealants

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Manufacturer's literature to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .2 Samples:
 - .1 Submit duplicate colour samples of each type of material and colour.
- .3 Informational Submittals:
 - .1 Manufacturer's Instructions:
 - .1 Submit instructions to include installation instructions for each product used.

1.03 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions, and 01 61 00 - Common Product Requirements
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address
- .3 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .4 Waste Management:

- .1 Deposit packaging materials in appropriate container on site for recycling or reuse.

1.05 SITE CONDITIONS

- .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 5 degrees C.
 - .2 When joint substrates are wet.
 - .3 Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - .4 Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- .2 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.
- .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .4 Ventilate area of work by use of approved portable supply and exhaust fans.
 - .1 For work within existing buildings, arrange with Departmental Representative for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants.

2 Products

2.01 GENERAL

- .1 Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- .2 Do not use sealants that emit strong odours, contain toxic chemicals or are not certified as mould resistant in air handling units.
- .3 Where sealants are qualified with primers use only those primers.
- .4 Maximum volatile organic compound (VOC):
 - .1 Architectural Sealants: Maximum 250 g/L (less water).
 - .2 Modified bituminous sealant primers: Maximum 500 g/L (less water).
 - .3 Architectural sealant primers for non-porous materials: Maximum 250 g/L (less water).
 - .4 Architectural sealant primers for porous materials: Maximum 775 g/L (less water).

2.02 MATERIALS

- .1 Neutral cure, low modulus silicone, for exterior and interior use on concrete, masonry, stone, metals, glass, porcelain, control joints, expansion joints; to ASTM C920, Type S, Grade NS, Class 50, Use NT, colour selected by Departmental Representative.
- .2 Multi-component, polyurethane, for finished, interior, exterior areas in control joints, concrete, precast concrete, tile, floors, and walks, designed for use in pedestrian and vehicular traffic areas, to ASTM C920, Type S, Grade NS, Class 25, Use T, colour selected by Departmental Representative.
- .3 Mildew-resistant, to ASTM C920, Type S, Grade NS, Class 25, one part, high modulus silicone, movement range $\pm 25\%$, for interior use in wet areas around mop sink bases, and lavatories, toilets, and other plumbing fixtures. Colour selected by Departmental Representative.
- .4 Mildew-resistant, paintable silicone, to ASTM C920, Type S, Grade NS, Class 25, one part, high modulus silicone, movement range $\pm 25\%$, for interior use around countertops, other counter surfaces adjacent to painted surfaces.
- .5 Acrylics One Part: general purpose, one part, paintable translucent acrylic, movement range $\pm 10\%$, for interior use in dry areas around windows, door frames, interior caulking to gypsum board, masonry, and metals; to ASTM C834.
- .6 Acoustical Sealant, for use at perimeter joints, and penetrations in sound rated gypsum board partitions, and masonry partitions:
 - .1 For exposed and joints: non-sag, paintable, non-staining latex sealant complying with ASTM C834.
 - .2 For concealed joints: to CAN/CGSB-19.21, non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
- .7 Fire Rated Acoustical Sealant: Sealants to Section 07 84 00 - Firestopping
- .8 Joint Cleaner: Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .9 Primer: as recommended by manufacturer.
 - .1 Maximum VOC Content: 200g/L, less water.
- .10 Back-up Materials:
 - .1 Backer rod: polyethylene, closed cell foam backer rod, compatible with sealant, recommended by manufacturer, diameter oversize 30% to suit joint.
 - .2 Bond breaker tape: polyethylene, pressure sensitive bond breaker tape which will not bond to sealant.

- .11 Preformed Foam Joint Sealant: Manufacturer's standard preformed, pre-compressed, open-cell foam sealant manufactured from urethane foam with minimum density of 160 kg/m³ and impregnated with non-drying, water-repellent agent. Factory produce in pre-compressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

3 Execution

3.01 EXAMINATION

- .1 Examine joints indicated to receive joint sealants, with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- .1 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .2 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.
- .3 Ensure joint surfaces are dry and frost free.
- .4 Prepare surfaces in accordance with manufacturer's directions.
- .5 Test materials being sealed, caulked for staining, adhesion.
- .6 Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal

3.03 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.

3.04 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.

3.05 MIXING

- .1 For multi-component sealants, mix materials in strict accordance with sealant manufacturer's instructions.

3.06 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.
 - .9 Apply non-paintable silicone sealants after wall surfaces have been painted.
- .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.

END OF SECTION

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No.	Door							Frame							Notes
	From	Matl	Type	Finish	Colour	Size (W x H x T)	Matl	Profile	Elev	Finish	Colour	Hdwe Code	Label	Security	
215		WD	A	CLR	CLR	914 x 2134 x 45	HM	1	A	P		10	20 MIN	CR	
217A		WD	A	CLR	CLR	914 x 2134 x 45	HM	1	A	P		2	20 MIN	CR	
217B		WD	A	CLR	CLR	914 x 2134 x 45	HM	1	A	P		1	20 MIN	CR	
218A		WD	B	CLR	CLR	914 x 2134 x 45	HM	1	A	P		2	20 MIN	CR	VIEW WINDOW IN DOOR SECURITY FILM ON GLASS
218B		WD	B	CLR	CLR	914 x 2134 x 45	HM	1	A	P		3	--	CR	VIEW WINDOW IN DOOR SECURITY FILM ON GLASS
219		WD	B	CLR	CLR	914 x 2134 x 45	HM	1	A	P		10	20 MIN	CR	VIEW WINDOW IN DOOR SECURITY FILM ON GLASS
221A		WD	B	CLR	CLR	914 x 2134 x 45	HM	1	A	P		11	--	CR	VIEW WINDOW IN DOOR SECURITY FILM ON GLASS
221B	442	RE WD	A	CLR	CLR	914 x 2134 x 45	HM	1	B	P		5	--	CRX2	PRIVACY FILM ON GLASS SIDELITE
222	445	RE WD	A	CLR	CLR	914 x 2134 x 45	HM	1	B	P		9	--		PRIVACY FILM ON GLASS SIDELITE
223A		WD	B	CLR	CLR	914 x 2134 x 45	HM	1	A	P		2	20 MIN	CR	VIEW WINDOW IN DOOR SECURITY FILM ON GLASS
223B	226	RE WD	A	CLR	CLR	914 x 2134 x 45	HM	1	B	P		4	--	CR	PRIVACY FILM ON GLASS SIDELITE
224A		WD	B	CLR	CLR	914 x 2134 x 45	HM	1	A	P		11	--	CR	VIEW WINDOW IN DOOR SECURITY FILM ON GLASS
224B	229	RE WD	A	CLR	CLR	914 x 2134 x 45	HM	1	B	P		5	--	CRX2	PRIVACY FILM ON GLASS SIDELITE
225	441	RE WD	A	CLR	CLR	914 x 2134 x 45	HM	1	B	P		6	--		PRIVACY FILM ON GLASS SIDELITE
226	230	RE WD	A	CLR	CLR	914 x 2134 x 45	RE HM	N/A	A	P		7	--	CR	
227	228	RE WD	A	CLR	CLR	914 x 2134 x 45	RE HM	N/A	A	P		7	--	CR	
228	232	RE WD	A	CLR	CLR	914 x 2134 x 45	HM	1	B	P		8	--		PRIVACY FILM ON GLASS SIDELITE
229	236	RE WD	A	CLR	CLR	914 x 2134 x 45	RE HM	N/A	A	P		7	--	CR	
234		EX WD	A	CLR	CLR	EX	EX HM	N/A	EX	P		EX	--		NEW FINISH ON RE-USED EXIST DOOR & FRAME
237		EX WD	A	CLR	CLR	EX	EX HM	N/A	EX	P		EX	--		NEW FINISH ON RE-USED EXIST DOOR & FRAME

Project No.
R.055494.001

LEGEND

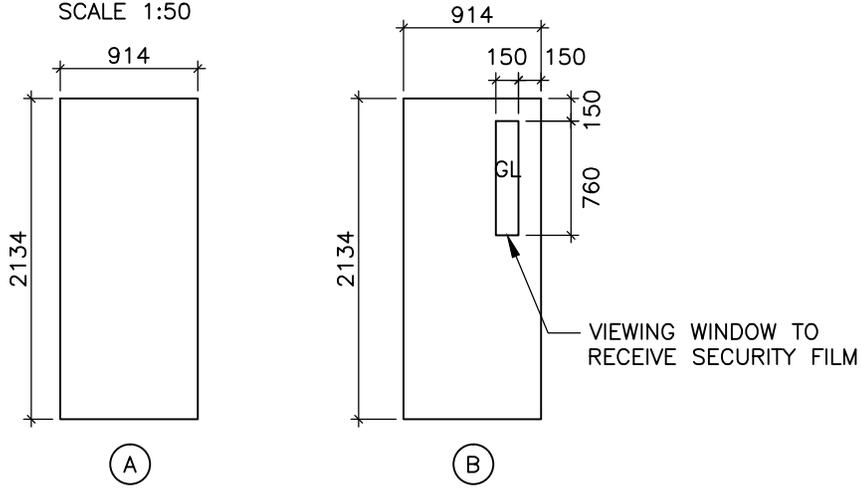
Abbreviations

AL	aluminum
BS	both sides
CLR	clear coat
CR	Card Reader
EG	end guard
EX	existing
EX HM	existing hollow metal
EX WD	existing wood
FROM	from old door number location
HM	hollow metal
N/A	not applicable
PT	paint
PREFIN	prefinished
SS	stainless steel
RE WD	relocated salvaged wood door: repair and refinish existing door to suit re-installation and prepare door for new door hardware; fill unused openings.
RE HM	relocated salvaged hollow metal frame: repair and refinish existing doorframe to suit re-installation and prepare frame for new door hardware.

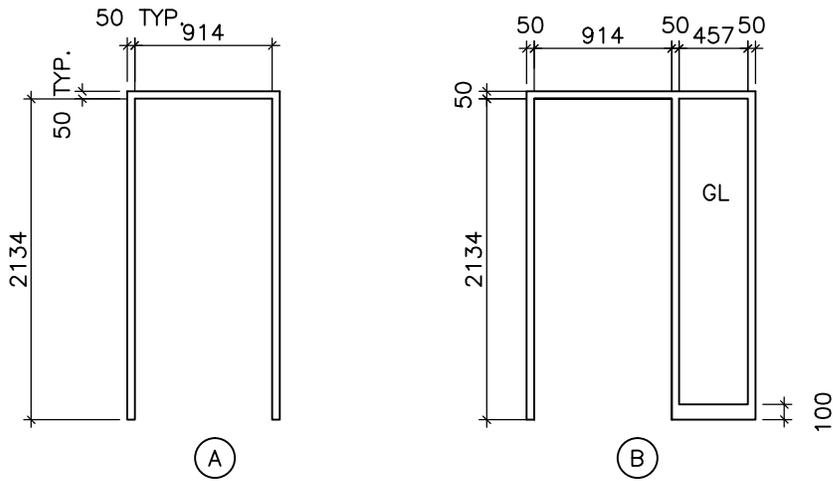
DOOR + FRAME INVENTORY FROM 4TH FLR + 2ND FLR DEMOLITION **FROM / EXIST DOOR NO.**

4th Floor - obtain from BGIS inventory for GOCB	
1 unit inswinging right hinged slab doors	Re-use 441
2 units inswinging left hinged slab doors	Re-use 442, 445
2nd Floor - GC to verify with site conditions:	
1 units inswinging right hinged slab doors	Re-use 228
6 units inswinging left hinged slab doors	Re-use 226, 229, 230, 232, 236, 240
1 unit inswinging left hinged slab doors w/mail slot	Turn over to Owner 231
1 unit inswinging right hinged slab doors w/view window	Turn over to Owner Located between gridlines E and F
1 unit inswinging right hinged slab door w/half view window	Turn over to Owner 235

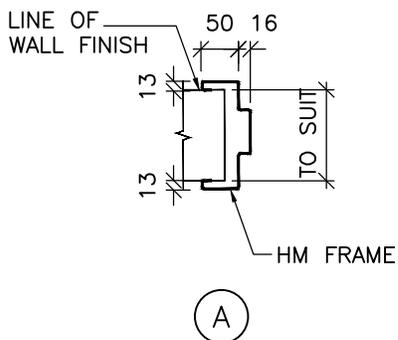
DOOR TYPES
SCALE 1:50



FRAME ELEVATIONS
SCALE 1:50



DOOR FRAME PROFILES
SCALE 1:10



Hardware Sets

Set: 1.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	D80 P D ORB	626	SC
1 Primus High Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Floor Stop	441H	US26D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Round knob is an owner requirement for this door. Key cylinder to be high security Schlage Primus supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 2.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 Primus High Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Floor Stop	441H	US26D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Key cylinder to be high security Schlage Primus supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 3.0

3 Hinge	TA2714 NRP 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 SC1 Standard Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 P9	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Floor Stop	441H	US26D	RO

1 Gasketing	S88BL	PE
1 Door Bottom	4131CRL	PE
1 Card Reader	By Electrical/Security Division	
1 Power Supply	By Electrical/Security Division	

Notes: Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 4.0

3 Hinge	TA2714 NRP 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 SC1 Standard Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 PS	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Hardware shown above is for a guideline only. If possible re-use any existing hardware including lockset. Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 5.0

3 Hinge	TA2714 NRP 114 x 101	US26D	MK
1 Institutional Lock	ND82 P D RHO	626	SC
2 SC1 Standard Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 PS	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
2 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Hardware shown above is for a guideline only. If possible re-use any existing hardware including lockset. Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 6.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Passage Set	ND10S RHO	626	SC
1 Floor Stop	441H	US26D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE

Notes: Hardware shown above is for a guideline only. If possible re-use any existing hardware.

Set: 7.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 SC1 Standard Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Floor Stop	441H	US26D	RO
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Hardware shown above is for a guideline only. If possible re-use any existing hardware including lockset. Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 8.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 SC1 Standard Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Floor Stop	441H	US26D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Hardware shown above is for a guideline only. If possible re-use any existing hardware including lockset. Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 9.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 SC1 Standard Security Cylinder to Suit			SC
1 Floor Stop	441H	US26D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE

Notes: Hardware shown above is for a guideline only. If possible re-use any existing hardware including lockset. Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 10.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 Primus High Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Conc Overhead Stop	6-X36	630	RF
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Key cylinder to be high security Schlage Primus supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

Set: 11.0

3 Hinge	TA2714 114 x 101	US26D	MK
1 Storeroom Lock	ND80 P D RHO	626	SC
1 SC1 Standard Security Cylinder to Suit			SC
1 Electric Strike	8300C-LBM	630	HS
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 250mm	US32D	RO
1 Floor Stop	441H	US26D	RO
1 Gasketing	S88BL		PE
1 Door Bottom	4131CRL		PE
1 Card Reader	By Electrical/Security Division		
1 Power Supply	By Electrical/Security Division		

Notes: Key cylinder to be standard security Schlage SC1 supplied by Burnett's Locksmith in Saskatoon. Hardware supplier to include cost of cylinder in their bid price.

END OF DOCUMENT

1 General

1.01 RELATED REQUIREMENTS

- .1 Section 01 11 00 – Summary of Work: For Owner Supplied Contractor Installed Products.
- .2 Section 02 41 19.16 – Selective Interior Demolition: For existing metal doors and frames removed for reuse.

1.02 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 153/A 153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - .2 ASTM A 591/A 591M, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight Mass Applications
 - .3 ASTM A653/ A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .4 ASTM A1008/A1008M-15, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .5 ASTM A 1011/A 1011M-15, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .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 (R2008), Welded Steel Construction (Metal Arc Welding)
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Commercial Steel Doors and Frames, 2009
 - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 2009
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80-2016, Standard for Fire Doors and Other Opening Protectives
 - .2 NFPA 105, Standard for Smoke Door Assemblies and Other Opening Protectives, 2016 Edition
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN4-S104-M80 (R1985), Standard Method for Fire Tests of Door Assemblies

1.03 COORDINATION

- .1 Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- .2 Coordinate with work of other Sections for insert panels in hollow metal frames. Furnish as-built dimensions of clear openings for panel locations.
- .3 Coordinate with work of Division 28 for access control devices.
- .4 Coordinate with Departmental Representative for Work By Others for installation of security systems.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data: for each type of door specified. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
 - .2 Shop Drawings:
 - .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, panel inserts and trim, location of anchors and exposed fastenings and reinforcing, fire rating, finishes.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
 - .4 Identify existing doors and frames removed for reuse in this contract, and Owner Furnished doors and frames to be installed in this contract.

1.05 QUALITY ASSURANCE

- .1 Fabricate and install steel doors and frames in accordance with Canadian Steel Door Manufacturers' Association, "Canadian Manufacturing Specifications for Steel Doors and Frames".

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- .3 Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- .4 Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 100 mm high wood blocking. Do not store in a manner that traps excess humidity.

2 Products

2.01 DESIGN REQUIREMENTS

- .1 Steel Fire Rated Doors and Frames: Provide doors and frames labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 for ratings specified or indicated.

2.02 OWNER FURNISHED CONTRACTOR INSTALLED PRODUCTS

- .1 Existing hollow metal frames indicated in Section 08 06 00 – Door and Frame Schedule.

2.03 EXISTING MATERIALS FOR REUSE

- .1 Hollow metal frames removed during demolition for reinstallation as part of complete Work. Refer to Section 08 06 00 – Door and Frame Schedule and Section 02 41 19.16 – Selective Interior Demolition

2.04 MATERIALS

- .1 Hot Dipped Galvanized Steel Sheet: tension leveled steel to ASTM A924, galvanized to ASTM A653M, commercial steel (CS) Type B, coating designation ZF120, minimum base steel thickness in accordance with CSDMA Table 1 – Minimum Steel Gauges for Component Parts.
- .2 Hardware Reinforcement: cold or hot rolled steel, galvanneal coated. Minimum base steel thickness in accordance with CSDMA Recommended Specifications for Commercial Steel Door and Frame Products, Table 1 – Minimum Steel Gauges for Component Parts, unless indicated otherwise.
 - .1 Hinge reinforcement: minimum 5 mm thick.
 - .2 Surface mounted hardware reinforcement: minimum 2.5 mm thick.
 - .3 Flush bolt reinforcement: minimum 5 mm thick
- .3 Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized. Minimum base steel thickness in accordance with CSDMA Recommended Specifications for Commercial Steel Door and Frame Products, Table 1 – Minimum Steel Gauges for Component Parts.
 - .1 For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- .4 Core construction:
 - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.
- .5 Touch-up Primer: rust-inhibitive to CAN/CGSB 1.181
 - .1 Maximum VOC limit 150 g/L to GC-11.

- .6 Accessories:
 - .1 Door Silencers: Single stud rubber/neoprene type.
 - .2 Interior door caps: Inverted, spot welded channels at top and bottom, same material as door face sheets.
 - .3 Glazing Stops: Fabricate glazing stops as formed channel, minimum 1.2 mm thick galvanized sheet steel with ZF120 finish, 16 mm height, accurately fitted, butted at corners, suitable for screw fastening to frame sections with counter-sunk oval head sheet metal screws. Design exterior glazing stops to be tamperproof.
 - .4 Metallic Paste Filler: To manufacturer's standard.
 - .5 Fire Labels: Metal riveted.
 - .6 Adhesives:
 - .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .7 Glazing: Safety glass, as specified in Section 08 80 50 - Glazing.
- .8 Frame Sealant: To Section 07 92 00 – Joint Sealants.

2.05 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 Stud partitions: Provide steel anchors of suitable design, on each jamb as follows:
 - .1 Frames up to 2 250 mm in height: three anchors.
 - .2 Frames 2 250 to 2 400 mm in height: four anchors.
 - .3 Frames over 2 400 mm in height: five anchors, plus one additional anchor for each 600 mm or fraction thereof over 2 400 mm.

2.06 FRAMES: WELDED TYPE

- .1 Welding: In accordance with CSA W59.
- .2 Fabricate frames in accordance with CSDMA specifications.
- .3 Fabricate frames to profiles and maximum face sizes as indicated. Provide drywall frame profile with drywall returns for frames installed in gypsum board partitions.
- .4 Interior Frames: 1.6 mm welded construction.
- .5 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

- .6 Perimeter Corner Joints: as defined in Appendix 2 of CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products", except as specified otherwise:
 - .1 Profile welded, punch-mitered: continuously welded on inside of frame along profile faces, rabbets, returns and soffit intersections. Fill exposed faces and grind smooth to uniform seamless surface.
 - .2 Tack welded: not permitted.
- .7 Joints at mullions, sills and centre rails:
 - .1 Accurately coped, butted and tightly fitted.
 - .2 At intersecting flush profile faces: securely welded on inside of frame, filled and ground to smooth, uniform, seamless surface.
 - .3 At intersecting recessed profile faces: securely welded on inside of frame to concealed reinforcements, with exposed hairline face seams.
 - .4 At other intersecting profile elements: exposed hairline face seams.
- .8 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.
 - .1 Provide full height hinge reinforcement where continuous hinges are scheduled.
 - .2 For electronic door hardware and controls provide hinge junction box and outlet junction box at hardware mounting locations as required and cut-outs for hardware items.
- .9 Protect strike and hinge reinforcements, and mortised cutouts with steel guard boxes.
- .10 Provide backbend return on frame throat for gypsum board partitions.
- .11 Prepare non-fire rated frames for door silencers; three for single door, two at head for double door.
- .12 Conceal fastenings except where exposed fastenings are indicated.
- .13 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .14 Securely attach floor anchors to inside of each jamb profile.
- .15 Weld in two temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.07 DOOR FABRICATION GENERAL

- .1 Fabricate doors in accordance with CSDMA specifications.
- .2 Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core:
 - .1 Fire Door Core: As required to provide fire-protection ratings indicated.

- .3 Doors: Laminated Core Construction
 - .1 Interior Doors: Form face sheets from 1.2 mm sheet steel with honeycomb core laminated under pressure to face sheets.
- .4 Door Type: swing type, flush, with provision for glass openings as indicated.
- .5 Edges: Fabricate doors with longitudinal edges mechanically interlocked adhesive assisted, with visible edge seams, except as otherwise indicated. Bevel vertical edge on latch side of single-acting doors 3 mm in 50 mm.
- .6 Blank, reinforce, drill doors and tap for mortised, templated hardware , and electronic hardware.
 - .1 For electronic door hardware and controls provide minimum 13 mm conduit within door as required and cut-outs for hardware items.
- .7 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .8 Reinforce doors where required, for surface mounted hardware, and around perimeter of cut-outs for glazing. Provide full height hinge reinforcement where continuous hinges are scheduled.
- .9 Top and Bottom Edges:
 - .1 Interior doors: Inverted, spot welded channels at top and bottom, same material as door face sheets.
- .10 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .11 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC-S104 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.
- .12 Provide astragals for pairs of doors in accordance with ULC requirements where indicated in Door Hardware Schedule.
- .13 Where pairs of doors are scheduled to receive concealed top and bottom rod exit devices, provide doors that are ULC-approved without the use of an astragal and with only 6 mm clearance from finished floor to bottom of door.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 OWNER FURNISHED CONTRACTOR INSTALLED PRODUCTS

- .1 Obtain hollow metal frames from storage location as directed by Departmental Representative.
- .2 Prepare and install in accordance with general installation requirements, to accept new door and hardware.

3.03 EXISTING PRODUCTS FOR REUSE

- .1 Retrieve frames from storage location, prepare, and install in accordance with general installation requirements, to accept new door and hardware.

3.04 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.

3.05 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
 - .1 Maximum diagonal distortion: 1.6 mm.
- .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 1 200 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 in accordance with Section 07 92 00 – Joint Sealants.

3.06 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Hollow Metal Doors: Fit swing hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - .1 Non-Fire-Rated Standard Steel Doors:
 - .1 Jamb and Head: 3 mm plus or minus 1.6 mm.
 - .2 Between Edges of Pairs of Doors: 3 mm plus or minus 1.6 mm.
 - .3 Between Bottom of Door and Top of Finish Floor (No door sweep): Maximum 6 mm.
 - .2 Fire-Rated Doors: Install doors with clearances according to NFPA 80, except maximum 13 mm clearance at bottom of door to top of finished floor.
 - .3 Smoke-Control Doors: Install doors according to NFPA 105.
- .3 Adjust operable parts for correct function.

3.07 GLAZING

- .1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.
 - .1 Provide tempered safety glass except provide wired glass at fire labelled doors.
- .2 Mechanically fasten removable glazing stops to frame sections with removable screw fasteners at 100 mm o.c. and maximum 50 mm from each end

3.08 FINISH REPAIRS

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

END OF SECTION

1 General

1.01 RELATED REQUIREMENTS

- .1 Section 01 11 00 – Summary of Work: For Owner Supplied Contractor Installed Products.
- .2 Section 02 41 19.16 – Selective Interior Demolition: For existing wood doors removed for reuse.

1.02 REFERENCES

- .1 Architectural Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute (AWI/AWMAC/WI).
 - .1 Architectural Woodwork Standards, Edition 2
- .2 American National Standard Institute (ANSI)
 - .1 ANSI/NPA A208.1-2009, Particleboard
- .3 Door Hardware Institute
 - .1 DHI Recommended Location for Architectural Hardware for Flush Wood Doors
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 80-13, Standard for Fire Doors and Fire Windows.
- .5 Underwriters' Laboratories of Canada (ULC).
 - .1 ULC CAN/ULC-S104M-10, Fire Tests of Door Assemblies.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Shop Drawings:
 - .1 Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - .2 Indicate dimensions and locations of mortises and holes for hardware.
 - .3 Indicate dimensions and locations of cutouts.
 - .4 Indicate requirements for veneer matching.
 - .5 Include Owner Furnished Contractor Installed Products, and existing doors removed for reuse by Section 02 41 19.16 – Selective Interior Demolition.

1.04 COORDINATION

- .1 Coordinate hardware preparation requirements with metal frames.

1.05 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.
- .4 Quality Standard: In addition to requirements specified, comply with AWI/AWMCA/WI Architectural Woodwork Standard, Section 9.
- .5 Single Source Responsibility: Provide doors from a single source to ensure uniformity in quality of appearance, face veneer, finish and construction.

1.06 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.
 - .4 Store doors away from direct sunlight.
 - .5 Mark each door on bottom rail with opening number used on Shop Drawings.

1.07 AMBIENT CONDITIONS

- .1 Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.08 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.01 OWNER FURNISHED CONTRACTOR INSTALLED PRODUCTS

- .1 Existing wood doors indicated in Section 08 06 00 – Door and Frame Schedule.

2.02 EXISTING MATERIALS FOR REUSE

- .1 Wood doors removed during demolition for reinstallation as part of complete Work. Refer to Section 08 06 00 – Door and Frame Schedule and Section 02 41 19.16 – Selective Interior Demolition

2.03 WOOD FLUSH DOORS FOR TRANSPARENT (STAIN) FINISH

- .1 General: Solid-Core Doors to CAN/CSA-O132.2.1 (WD):
 - .1 Composite wood materials contain no added urea-formaldehyde or resins containing urea-formaldehyde.
 - .2 Aesthetic grade: Custom to AWI/AWMAC/WI Architectural Woodwork Standards.
 - .3 Performance grade: Heavy duty to WDMA I.S.1-A.
 - .4 Core Construction:
 - .1 Particleboard: to ANSI A208.1, Grade LD-2.
 - .2 Five plies. Stiles and rails bonded to core, with wood lock blocks and special wood blocking, then entire unit abrasive planed before veneering.
 - .5 Blocking: Provide hardwood blocking in particleboard-core doors as needed to eliminate through-bolting hardware, and as follows:
 - .1 Minimum blocking requirements:
 - .1 Hinged doors: HB-8, 125 mm blocking at vertical edges for hinges, strike edge, locksets, and latchsets.
 - .2 Additional blocking requirements:
 - .1 HB-1, 125 mm top-rail blocking, in doors indicated to have closers.
 - .2 HB-2, 125 mm bottom-rail blocking, in doors indicated to have kick plates.
 - .3 HB-4, 125 mm midrail blocking at both vertical edges for doors with panic hardware and at strike edge for locksets, latchsets and the like.
 - .6 Face Materials: Rift cut, grade A in accordance with WDMA I.S. 1-A, all sapwood, white, maple veneer.
 - .7 Assembly of leaves on door faces: balance match.
 - .8 Pair and set: Match, provide for doors hung in same opening.
 - .9 Exposed vertical edges: Edge Type D, solid wood same species as faces, veneer face edge shows.
 - .10 Adhesive: Type II water resistant for interior doors.

2.04 FIRE RATED WOOD DOORS

- .1 Wood doors: tested in accordance with CAN4-S104 to achieve rating as scheduled.
 - .1 Face materials: To match general solid core wood doors.

2.05 FABRICATION

- .1 Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI Recommended Location for Architectural Hardware for Flush Wood Doors. Comply with final hardware schedules, door frame Shop Drawings, DHI standards, and hardware templates.
 - .1 Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- .2 Prepare doors for glazing. Provide hardwood glazing stops to match face veneer, 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.

2.06 SHOP PRIMING

- .1 Doors for Transparent Finish: Shop prime doors with custom stain, other required pretreatments, and first coat of finish as specified in Section 09 91 00 - Painting.
 - .1 Seal all four edges, edges of cutouts, and mortises with first coat of finish.

3 Execution

3.01 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.

3.02 EXAMINATION

- .1 Examine doors and installed door frames before hanging doors.
 - .1 Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - .2 Reject doors with defects.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.
- .3 Examine Owner Furnished Contractor Installed Products for damage when taking possession of materials.
 - .1 Record damage and deficient conditions and report in writing to Departmental Representative.
 - .2 Departmental Representative will repair damage under separate contract or as change to Work at discretion of Departmental Representative.
- .4 Examine existing materials for reuse when retrieving from storage.
 - .1 Review damage in presence of Departmental Representative.
 - .2 Repair damage from demolition and storage in contract to satisfaction of Departmental Representative.

3.03 INSTALLATION

- .1 Hardware: To Section 08 71 00 - Door Hardware.
- .2 Unwrap and protect doors.
- .3 Install doors and hardware in accordance with manufacturer's printed instructions, and AWI/AWMAC/WI Architectural Woodwork Standards.
- .4 Install labelled fire rated doors to NFPA 80.
- .5 Align and fit doors in frames with uniform clearances and bevels as indicated.
- .6 Machine doors for hardware.
 - .1 Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
- .7 Provide even margins between doors and jambs and doors and finished floor as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet, thresholds: 6 mm, except where scheduled otherwise.
 - .4 Allow for floor fluctuations.
- .8 Adjust hardware for correct function.

3.04 FINISHES

- .1 Apply final finish to doors in accordance with Section 09 91 00 – Painting.

3.05 ADJUSTMENT

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

3.06 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 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156 Series.
- .2 Door Hardware Institute (DHI)
 - .1 Recommended locations for Architectural Hardware for Standard Steel Doors and Frames
 - .2 Recommended locations for Architectural Hardware for Flush Wood Doors
 - .3 Sequence And Format for The Hardware Schedule – Vertical Format
 - .4 Key Systems and Nomenclature
 - .5 Abbreviations and Symbols used in Architectural Door and Hardware Schedules and Specifications
- .3 National Building Code of Canada 2010 (NBCC)
- .4 NFPA 80 Fire Doors and Windows

1.02 COORDINATION

- .1 Templates: Provide templates as required for coordination with related work of other sections.
- .2 Coordinate with work of Section 08 11 13 – Hollow Metal Doors and Frames, Division 26 for power, Division 27 for rough-in of control wiring, and Departmental Representative for access control wiring by Shared Services Canada.

1.03 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 door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Hardware Schedule:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
 - .3 Format: in accordance with DHI reference.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions as requested.
- .5 Wiring Diagrams: Co-ordinate with related trades, meet with Engineer and security provider and submit written description of functional use (mode of operation) of electrical hardware products specified. Include:

- .1 Operation for ingress, egress, fire alarm, and after hours use where applicable.
- .2 Door and frame elevations showing the location of each item of electrical hardware to be installed, mode of operation including diagram showing number and size of all conductors
- .3 Indicate on elevation drawing items provided by related trades, include for back boxes, and 120V power sources.
- .4 Provide point to point drawings showing all terminal connections necessary for a complete installation.

1.04 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 Include manufacturer name, wiring diagrams.

1.05 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, lockset, and exit hardware.

1.06 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.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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 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 strippable coating.
 - .4 Replace defective or damaged materials with new.

- .5 Packaging Waste Management: remove for reuse of pallets, and packaging materials

1.08 WARRANTY

- .1 Manufacturer's Warranty: Provide manufacturer's warranties as follows:

Hardware Item	Length of Warranty
Mortise Hinges	Lifetime
Locks	10 years
Exit Devices	5 year
Door closers -mechanical	10 years
Door Operators - Electro mechanical	2 years
Overhead stops/holders	1 year
Floor/Wall stops	1 year
Key Switches/Power Supplies	1 year
Electric Strikes	5 years

2 Products

2.01 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.02 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 as stated in Hardware Schedule.
 - .2 Lever handles : design as scheduled.
 - .3 Roses: round.
 - .4 Normal strikes: box type, lip projection not beyond jamb.
 - .5 Cylinders: see 2.04 keying below for further information.
- .2 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, size and finish, listed in Hardware Schedule.
 - .2 Supply 3 hinges per door. Doors which exceed 914mm wide or 2200mm high to have 4 hinges.
- .3 Exit devices:
 - .1 To ANSI/BHMA A156.3, type Rim, grade 1 in functions as noted in hardware schedule. Exit devices to come complete with manufacturers cylinder to suit.

- .4 Door Closers and Accessories:
 - .1 Door controls (closers): to ANSI/BHMA A156.4, listed in Hardware Schedule, Door controls - overhead holders: to ANSI/BHMA A156.8, listed in Hardware Schedule.
 - .2 Door closers to have full adjustment features including separate valves for backcheck, general speed and latch speed control.
 - .3 All interior closers will have a reduced opening force spring power to meet barrier free codes of 22N (5 lbs.).
 - .4 Provide all brackets and extension arms as required to suit application.
- .5 Door Operators:
 - .1 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.
- .6 Auxiliary locks and associated products: to ANSI/BHMA A156.5 listed in Hardware Schedule.
 - .1 Cylinders: see 2.04 keying below for further information.
- .7 Architectural door trim: to ANSI/BHMA A156.6, listed in Hardware Schedule.
 - .1 Door protection plates: kick plate, 1.27 mm thick stainless steel
- .8 Auxiliary hardware: to ANSI/BHMA A156.16, listed in Hardware Schedule
 - .1 Door silencer: Door bottom seal: door seal of extruded aluminum frame and closed cell neoprene seal, surface mounted
 - .2 Thresholds: full width of door opening, extruded aluminum mill finish
- .9 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and closed cell neoprene.
 - .2 Door bottom seal:
 - .1 Extruded aluminum frame and closed cell neoprene.

2.03 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.

2.04 KEYING

- .1 All locks and exit devices to be supplied with manufacturer's standard cylinders for use during construction. Cylinders to be keyed alike. Supply 15 construction keys.
- .2 Supply and installation of final cylinders:
 - .1 Project turn-over/acceptance of space: Install high security Schlage primus cylinders and standard cylinders complete with all associated keyway components to replace standard construction cylinders.
 - .2 Arrange for Burnett's Locksmith to co-ordinate the necessary permission between the secure client security specialist (who controls the building keyway) and Schlage to allow the specific Burnett's Locksmith to order, cut, produce and receive any components associated with the secure client building project Schlage keyway.
 - .3 Cylinders to have restricted keyways and keys are to be supplied in contract by Burnett's Locksmith. Locksmith to provide a list of all keys produced, along with the keys to the secure client security specialist.

2.05 FINISHES

Item	BHMA#Base	Description	Material
Hinges	626	Satin Chrome Plated	Brass/Bronze
Hinges	652	Satin Chrome Plated	Steel
Lock Trim	626	Satin Chrome Plated	Brass/Bronze
Exit Devices	630	Powder Coat Aluminum	Steel
Door Closer	689	Powder Coat Aluminum	Steel
Door Pulls	630	Satin Stainless Steel	Stainless Steel
Protective Plate	630	Satin Stainless Steel	Stainless Steel
Door Stops/holders			
Overhead	630	Satin Stainless Steel	Stainless Steel
Wall/Floor	626	Satin Chrome Plated	Brass/Bronze
Thresholds	628	Anodized Aluminum	Aluminum
Weatherstrip	628	Anodized Aluminum	Aluminum
Miscellaneous			
Electric Strikes	630	Satin Stainless Steel	Stainless Steel

3 Execution

3.01 PREPARATION AND EXAMINATION

- .1 Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.
- .2 Ensure that door frames and finished floor are plumb and level to permit proper engagement and operation of hardware.
- .3 Submit in writing a list of deficiencies determined as part of inspection required in 3.01.1 and 3.01.2 to Departmental Representative prior to installation of finished hardware. Correct door frame installation before proceeding with finish hardware installation.

3.02 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 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 Door Hardware Institute.
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.03 FIELD QUALITY CONTROL

- .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.
- .4 Final Inspection: Retain services of hardware supplier to provide final inspection of completed work.
 - .1 Complete inspection after adjusting and balancing of mechanical systems and in advance of Owner demonstration and training.
 - .2 Provide written report confirming proper and functional installation of hardware in accordance with manufactures instructions.

3.04 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Requirements.
 - .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 00 10 - General Requirements.
- .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.05 DEMONSTRATION AND TRAINING

- .1 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 exit hardware.
- .2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.06 PROTECTION

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

3.07 SCHEDULE

- .1 Refer to Section 08 06 71 – Door Hardware Codes.
- .2 Door hardware schedule is furnished for whatever assistance it may afford contractors. Examine drawings and specification, determine extent and hardware quality required. Should any particular door or item be omitted in any schedule hardware group, provide such a door or item with hardware same as required for similar purposes.

END OF SECTION

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1 General

1.01 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets for each glass product and glazing material.
 - .2 Samples: Submit duplicate 300 by 300 mm size samples of each type of specified glazing.
 - .3 Informational Submittals:
 - .1 Certificates.
 - .2 Product Test Reports.

1.02 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Safety Glazing Labeling: Permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- .2 Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures.

2 Products

2.01 MATERIALS

- .1 General:
 - .1 Source Limitations for Glass: Obtain glass products from single source from single manufacturer for each glass type.
 - .2 Strength: Where float glass is indicated, provide annealed float glass, heat-strengthened heat-treated float glass, or fully-tempered heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide fully tempered float glass.

- .2 Float glass: to CAN/CGSB 12.3, Glazing quality, not less than 6mm thick, heat strengthened where indicated, and as required.
- .3 Safety glass: to CAN/CGSB-12.1, clear float glass, not less than 6 mm thick.
 - .1 Type 2-tempered.
 - .2 Class B-float.
 - .3 Category II.
 - .4 Horizontal tempering.
- .4 Security Glazing: 6 mm float glass with security film to Section 08 87 00 – Glazing Films.
- .5 Privacy Glazing: 6 mm float glass with decorative privacy film to Section 08 87 00 – Glazing Films

2.02 ACCESSORIES

- .1 General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- .2 Primer, Sealers, Cleaners: Types recommended by sealant or gasket manufacturer.
- .3 Setting blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, ± 5 , recommended by the manufacturer as being acceptable for use in the intended application, and compatible with glass and glazing materials.
- .4 Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lights in place for installation indicated.
- .5 Edge blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).
- .6 Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - .1 Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- .7 Glazing Sealants - General:
 - .1 Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - .2 Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - .3 Colours of exposed glazing sealants: as selected by Departmental Representative from manufacturer's full range.
- .8 Glazing Tape: Preformed butyl compound, paper released backed.

2.03 FABRICATION OF GLAZING UNITS

- .1 Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- .2 Clean-cut or flat-grind vertical edges of butt-glazed monolithic lights to produce square edges with slight chamfers at junctions of edges and faces.
- .3 Grind smooth and polish exposed glass edges and corners.

3 Execution

3.01 EXAMINATION

- .1 Examine framing, glazing channels and stops, with installer present, for compliance with the following:
 - .1 Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - .2 Minimum required face or edge clearances.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 GLAZING, GENERAL

- .1 Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- .2 Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

- .3 Protect glass edges from damage during handling and installation. Remove damaged glass from site and legally dispose of off-site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- .4 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- .5 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer.
- .6 Do not exceed edge pressures stipulated by glass manufacturers for installing glass lights.
- .7 Provide spacers for glass lights where length plus width is larger than 1270 mm as follows:
 - .1 Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - .2 Provide 3-mm minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- .8 Provide edge blocking where indicated or needed to prevent glass lights from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- .9 Set glass lights in each series with uniform pattern, draw, bow, and similar characteristics.
- .10 Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- .11 Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

- .1 General:
 - .1 Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
 - .2 Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
 - .3 Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

- .4 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
 - .5 Do not remove release paper from tape until just before each glazing unit is installed.
 - .6 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
 - .7 Centre glass lights in openings and rest glazing on setting blocks. Push firmly against tape for full contact at perimeter of light or unit.
 - .8 Knife trim protruding tape to uniform, level line, flush with sight line, to smooth appearance. Do not cut or abrade tempered, heat treated, or coated glass.
- .2 Interior Wood Doors and Frames – Tape One Side:
- .1 Install removable stop against free perimeter of glass, and secure in place.
- .3 Interior Hollow Metal Doors and Frames – Tape Two Sides:
- .1 Place glazing tape on free perimeter of glass in same manner described for fixed stop.
 - .2 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .4 Fire-Rated Hollow Metal Doors and Frames: install glazing in accordance with manufacturer's instructions to meet required fire-resistance rating.

3.05 GASKET GLAZING (DRY)

- .1 Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- .2 Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints mitre cut and bonded together at corners.
- .3 Installation with Drive-in Wedge Gaskets: Centre glass lights in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- .4 Installation with Pressure-Glazing Stops: Centre glass lights in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- .5 Install gaskets so they protrude past face of glazing stops.

3.06 CLEANING AND PROTECTION

- .1 Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove non-permanent labels and clean surfaces.

- .2 Protect glass from contact with contaminating substances resulting from construction operations.
- .3 Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- .4 Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.07 SCHEDULE

- .1 Interior Glazing:
 - .1 Non-fire rated interior doors: 6 mm thick clear tempered safety glass.
 - .2 Security and Privacy Glazing: Refer to Glazing Film Schedule

END OF SECTION

1 General

1.01 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting
 - .2 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .3 ASTM E903, Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- .2 Consumer Products Safety Commission (CPSC)
 - .1 Safety Standard for Architectural Glazing Materials - at Title 16, Part 1201 of the Code of Federal Regulations: 16 CFR 1201
- .3 International Window Film Association (IWFA)
 - .1 IWFA Visual Quality Standard for Applied Window Film 1999.
- .4 Underwriters Laboratories (UL)
 - .1 UL 972, Burglary-Resisting Glazing Material.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals
 - .1 Product Data: Provide manufacturer's printed product data on privacy and security glazing film.
- .3 Informational Submittals:
 - .1 Installation Instructions: Submit manufacturer's installation instructions.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

2 Products

2.01 MATERIALS

- .1 Security Glazing Film: Optically clear polyester film with durable acrylic abrasion resistant coating over one surface and pressure activated adhesive over the other. Adhesive forms physical bond, not chemical bond, to glass.
 - .1 Physical / Mechanical Performance Properties:
 - .1 Film Color: Clear.
 - .2 Thickness: Nominal 0.36 mm

- .3 Tensile Strength: To ASTM D882, 25,000 psi.
- .4 Break Strength: To ASTM D882, (Per Inch Width): 350 lbs.
- .2 Solar Performance Properties:
 - .1 Visible Light Transmission: To ASTM E903, 85 %.
- .3 Impact Resistance for Safety Glazing: Tested on 6 mm annealed glass.
 - .1 Safety Rating: To CPSC 16 CFR, Part 1201, Category II (400 ft.-lbs).
- .4 Forced Entry Protection: Independent lab testing according to UL 972 protocol (Multiple Impact Test).
 - .1 6 mm Annealed Glass: Pass
- .5 Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
 - .1 Flame Spread Index: no greater than 25.
 - .2 Smoke Developed Index: no greater than 55.
- .2 Decorative Glazing Films:
 - .1 Privacy Film (Type H). Translucent polymeric vinyl film with factory applied permanent adhesive, and release liner.
 - .1 Thickness: 75 micron (0.076 mm).
 - .2 Adhesive: clear pressure sensitive solvent based acrylic.
 - .3 Appearance: deep etch, white.
 - .4 Visible Light Transmittance: 20%.
 - .5 Diffuse Visible Light Reflectance exterior: 80 %.
 - .2 Privacy Film (Type G): Translucent polyester film with factory applied permanent adhesive, and release liner
 - .1 Thickness: 50 micron (0.051 mm).
 - .2 Adhesive: clear pressure sensitive solvent based acrylic.
 - .3 Appearance: gradient dot pattern transitioning from translucent to transparent over distance indicated on glazing film elevations.

3 Execution

3.01 INSTALLATION

- .1 General:
 - .1 Install film with adhesive, in accordance with film manufacturer's instructions.
 - .2 Place without air bubbles, creases or visible distortion.
 - .3 No splices or seams permitted.
- .2 Apply security and decorative glazing film to glass surfaces indicated in Section 08 87 05 - Glazing Films Schedule, in accordance with Section 08 80 50 - Glazing, and where indicated
- .3 Apply security film to entire glass surface, except as indicated otherwise.
 - .1 Clamp security film under applied frame stops.
- .4 Apply decorative film with neat square corners and edge to within 1.5 mm of window frame, unless indicated otherwise.

3.02 FIELD QUALITY CONTROL

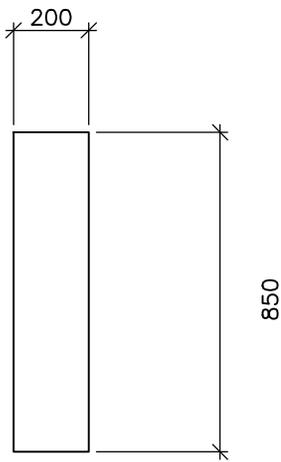
- .1 Visual Inspection: in accordance with IWFA - Visual Quality Standard for Applied Window Film.
 - .1 Conduct inspection in presence of film installer and Departmental Representative.
- .2 Remove and replace without glass replacement, film that shows blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 1 800 mm minimum after 30 day period.

3.03 CLEANING

- .1 Wash interior and exterior of each windows and film using cleaning solution recommended by manufacturer.

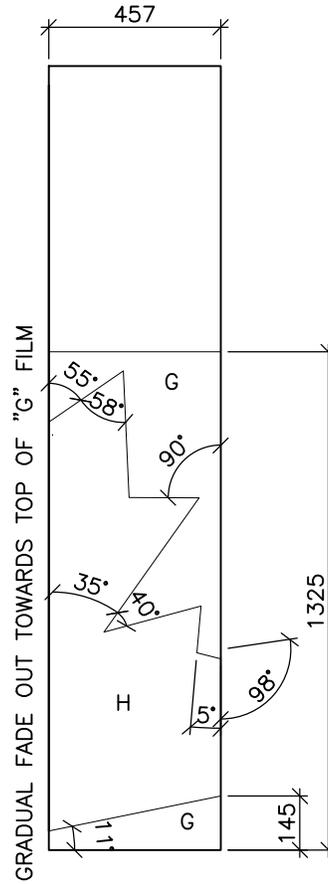
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SECURE TYPE FILM

- SECURITY FILM TO COVER ENTIRE SURFACE OF GLAZING.



PRIVACY FILM

- H - HEAVY FILM (LOW VISIBILITY) TO BE PLACED ON SURFACE OUTSIDE OF ROOM
- G - LIGHT GRADIENT FILM (HIGHER VISIBILITY) TO 1371 AFF, NO FILM ABOVE, TO BE PLACED ON SURFACE INSIDE OF ROOM

No.	Room		Floor		Wall	Ceiling	Notes
	Name		Finish	Base			
215			CPT	RB	P	ACT	
217A			RSF	RB	P	OPN	
217B			RSF	RB	P	ACT	
218			CPT	RB	P	ACT	
219			CPT	RB	P	ACT	
219A			CPT	RB	P	ACT	
219B			CPT	RB	P	ACT	
220			RSF	RB	P	ACT	CT ON BACKSPLASH WALL
221			CPT	RB	P	ACT	
222			CPT	RB	P	ACT	
223			CPT	RB	P	ACT	
224			CPT	RB	P	ACT	
225			CPT	RB	P	ACT	
226			CPT	RB	P	OPN	
227			RSF	RB	P	ACT	
228			CPT	RB	P	ACT	
229			RSF	RB	P	ACT	
234			PREP	RB	P	PREP	PREP FLOOR ONLY FOR NEW FINISH BY OTHERS
237			PREP	RB	P	PREP	PREP FLOOR ONLY FOR NEW FINISH BY OTHERS

NOTES

- 1 Refer to Finishes Plan for paint colour locations and lines of floor finish changes.
- 2 Paint all existing walls in accordance to Finishes Plan
- 3 Paint heater covers typical
- 4 Paint columns typical, colour indicated on Finishes Plan

Project No.
R.055494.001

Room		Floor		Wall	Ceiling	
No.	Name	Finish	Base	Finish (orientation)	Finish	Notes

LEGEND

Abbrev.	Material	Section	Manufacturer	Colour	Pattern
ACT	acoustic ceiling tile	09 51 00			
CT	ceramic tile	09 30 13			
DP	demountable partition	10 22 19	DIRTT		
EX	existing				
FG	frame guard	10 26 00			
FRL	fibre reinforced laminate	06 40 00			
FRP	fibre glass reinforced panel				
HPDL	high pressure laminate	06 40 00			
LPDL	low pressure laminate	06 40 00			
LCKR	locker	10 51 00			
MTL	metal	05 50 00			
OPN	open, no ceiling				
PHEN	phenolic				
PREP	prepare				
PREFIN	prefinished				
PT	paint	09 91 00			
RB	resilient base				
RBL	roller blinds				
RSF	resilient sheet flooring	09 65 16			
SC	sealed concrete				
SPS	solid polymer surface	06 40 00			
SRF	slip resistant flooring	09 65 16			
SS	stainless steel	05 57 00			
STL	steel				
SWP	sheet wall protection	09 72 16			
TGL	tempered glass				
WD	wood				

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1 General

1.01 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C475 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C840, Standard Specification for Application and Finishing of Gypsum Board.
 - .3 ASTM C954, 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.
 - .4 ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .5 ASTM C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .6 ASTM C 1178, Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
 - .7 ASTM C1396/C1396M, Standard Specification for Gypsum Wallboard.
 - .8 ASTM D 3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34 M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 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.
 - .2 Shop Drawings
 - .1 Submit schedule of wall assemblies requiring fire resistance rating.
 - .2 Identify construction solution ULC Design assembly listing numbers for each wall assembly; organize by exterior wall location.
 - .3 Include copy of ULC Design Listing indicating assembly components, project specific materials, and associated fire resistance ratings.
 - .3 Samples:
 - .1 Submit for review and acceptance of each unit.

- .2 Samples will be returned for inclusion into work.
- .3 Submit duplicate 300 mm long samples of corner and casing beads, and cornice cap.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store gypsum board assemblies materials level indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.04 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 Products

2.01 MATERIALS

- .1 Standard board: to ASTM C1396/C1396M Type X, thickness indicated, 1 219 mm wide by maximum practical length, ends square cut, edges bevelled.
- .2 Moisture-Resistant Interior Gypsum Board (GB-MR): To ASTM C 1396M, moisture-resistant, treated core, mould resistance rating 10 to ASTM D 3273. Type X, 16 mm thick for walls, 12 mm thick for ceilings by 1 219 mm wide by maximum practical length, ends square cut, long edges bevelled.
- .3 Interior Glass-Mat Water Resistant Gypsum Backing Board (GB-WR): to ASTM C1178M, Type X, 16 mm thick, 1 219 mm wide by maximum practical length. Mould resistance score 10 in accordance with ASTM D3273. For use as tile backing panels.
- .4 Steel drill screws: To ASTM C1002, except:
 - .1 To ASTM C954 for metal framing 0.91 mm and thicker.
- .5 Laminating compound: as recommended by manufacturer, asbestos-free.
- .6 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process, 0.45 mm base thickness, laminated to paper tape, one piece length per location.

- .7 Cornice cap: 12.7 mm deep x partition width, of 1.6 mm base thickness galvanized sheet steel, prime painted. Include splice plates for joints.
- .8 Sealants: in accordance with Section 07 92 00 - Joint Sealants except as indicated
- .9 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .10 Polyethylene: to CAN/CGSB-51.34, Type 2.
- .11 Insulating strip: Rubberized, moisture-resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.
- .12 Acoustic Insulation: Batt and blanket mineral fibre to CAN/ULC S702, Type 1, mineral wool, non-combustible, install full depth of stud cavity or as indicated.
- .13 Preformed Control Joint: Extruded vinyl V-shape joint with perforated flanges, and tear-off centre protection strip.
- .14 Joint Tape:
 - .1 Interior Gypsum Board: Paper, except where fibreglass mesh tape is indicated.
 - .2 Tile Backing Panels: 10-by-10 glass mesh , except as recommended by panel manufacturer.
- .15 Joint compound: to ASTM C475, asbestos-free.
- .16 Putty Pad: Non corrosive, mouldable putty to seal acoustically rated walls at gypsum board penetrations including but not limited to electrical outlets, HVAC ducts, plumbing, and electrical and telecommunications services.
 - .1 Provide materials tested and listed for use in 1 hour fire-resistant rated assemblies in accordance with UL 1479.

3 Execution

3.01 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.

3.02 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.
- .2 Construct fire-resistance rated partitions in strict accordance with requirements of construction solution ULC listing reviewed submittal.

3.03 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply gypsum board to metal furring or framing using screw fasteners for both layers. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layers at right angles to supports unless otherwise indicated.
 - .3 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 Provide interior glass-mat water resistant gypsum backing board where wall tiles to be applied. Do not apply joint treatment on areas to receive tile finish.
- .4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut outs around electrical boxes, ducts, and all penetrations in partitions where perimeter sealed with acoustic sealant.
- .5 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-resistance rated assemblies require vertical application.
- .6 Install gypsum board with face side out.
- .7 Do not install damaged or damp boards.
- .8 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.04 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, 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 Provide backup at control joints in fire resistance rated assemblies in accordance with ASTM C840 and as follows: multiple layers of 16 mm gypsum board attached to metal framing on one side of joint across entire width and full length of stud.
- .8 Locate control joints where indicated, at changes in substrate construction, at approximate 9 m spacing on long walls, and at approximate 15 m spacing on ceilings.
- .9 Install control joints straight and true.
- .10 Install gypsum board to accommodate deflection at underside of floor and structural beams. Do not fasten gypsum board to deflection framing system specified in Section 09 22 16 - Non-Structural Metal Framing. Coordinate with Section 07 84 00 – Firestopping for installation of firestopping at joint conditions.
- .11 Install access doors to electrical and mechanical fixtures specified in section 08 31 00 – Access Doors.
 - .1 Rigidly secure frames to furring or framing systems.
- .12 Gypsum Board Finish: finish gypsum board walls to following levels in accordance with ASTM C840. Finish gypsum board with following levels of finish for specific areas indicated:
 - .1 Levels of finish:
 - .1 Level 0: Behind solid paneling where fire-resistance or smoke seal is not required.
 - .2 Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - .3 Level 2: Panels that are substrate for tile.
 - .4 Level 4: Where gypsum board is to be painted, except otherwise indicated.
 - .5 Level 5: Where gypsum board is part of special wall assemblies W4 and W5, where dry erase coatings are indicated.
- .13 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.
- .14 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.
- .15 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .16 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.05 CLEANING

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

3.06 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

1 General

1.01 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C645, Specification for Nonstructural Steel Framing Members.
 - .2 ASTM A653/A653M, Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
 - .3 ASTM C754, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .4 ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .5 ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- .2 Definitions:
 - .1 Steel Thickness:
 - .1 Base Steel Thickness: Thickness of bare steel exclusive of coatings.
 - .2 Design Thickness: Target or "nominal" thickness used to determine structural properties of the cold formed Products.
 - .3 Minimum Thickness: Design thickness minus minimum allowable under-tolerance required by CSA S136 (95% of design thickness) or material specification; whichever is more stringent.
 - .4 Designation Thickness: For the purposes of this specification; thicknesses provided will be minimum base steel thicknesses in accordance with CSA S136 as interpreted by Section 01 61 00 – Common Product Requirements and determined by the following table:

Designation Thickness	Minimum Base Steel Thickness		Gauge No. (For reference Only)	Colour
	(mils)	(in)		
18	0.0179	0.455	25	Not Painted
33	0.0329	0.836	20	White
43	0.0428	1.087	18	Yellow
54	0.0538	1.367	16	Green

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.03 QUALITY ASSURANCE

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

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements, and 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 from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

2 Products

2.01 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645, stud size indicated, roll formed from hot dipped galvanized steel sheet, for screw attachment of gypsum board.
 - .1 Minimum Base Steel Thickness:
 - .1 General interior framing: 0.455 mm.
 - .2 Interior framing scheduled for ceramic tile finishes, abuse-resistant gypsum board: 0.836 mm.
 - .3 Jamb framing: 0.836 mm.
 - .4 Special wall construction framing (W3C, W3Cm, W4, W5): 1.087 mm
 - .2 Knock-out service holes at 460 mm centres.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
 - .1 Minimum base steel thickness: matching thickest stud required for wall assembly.
- .3 Deflection systems:
 - .1 Single Track: To ASTM C645, roll formed from hot dipped galvanized steel sheet, Z120 coating designation to ASTM A653, single slotted ceiling track.
 - .1 Movement: Allowing up to 25 mm vertical movement
 - .2 Dimensions: 1.087 mm thick x width required.

- .3 UL classification: 1 and 2 hour fire rating, to ASTM E119 and ASTM E814 for fire and hose stream testing.
- .4 Sheet steel: 1.367 mm thick, rolled commercial quality steel to ASTM A1008M or A1011M., hot dipped galvanized to ASTM A653, coating designation ZF120.
- .5 Expanded Metal: To EMMA 557-99, fabricated from cold rolled carbon-steel sheet to ASTM A1011, diamond size 14 mm SWO by 43 mm LWO x 3.048 mm base metal thickness (3/4-9F), rolled and flattened.
- .6 Metal channel stiffener: 38 x 19 mm size, 1.367 mm thick cold rolled steel, coated with rust inhibitive coating.
- .7 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C1280, galvanized.
- .8 Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 4.12 mm in diameter.
- .9 Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 1.367 mm and minimum 13 mm wide flanges, 38 mm deep.
- .10 Furring Channels (Furring Members): Galvanized steel for screw attachment of gypsum board:
- .11 Security bars: tool-resistant steel bar, grade 1, per ASTM A627.
- .12 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .13 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.
- .14 Metal Framing Fasteners: To ASTM C1513, self-drilling tapping screws, and self-piercing tapping screws, corrosion resistant, head style and size to suit application, except:
 - .1 Pop rivets at special wall construction W4 and W5: 4.5 mm diameter, zinc plated steel body and mandrel.
- .15 Washers: 38 mm OD, 5.5 mm ID, 1.6 mm thick zinc plated carbon steel.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.02 ERECTION

- .1 Install steel framing members and wall protection materials for special wall construction framing (W4 and W5) where noted in accordance with RCMP Lead Agency Guide G13-01, Rev 1.1 (May 2014), Secure Storage Rooms (SSR).
- .2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum, except 300 mm on centre for special wall framing (W4 and W5).
- .3 Place studs vertically as follows:
 - .1 General interior framing: 406 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
 - .2 Special wall construction framing (W4 and W5): 300 mm on centre, construct with double studs at abutting walls, at each side of openings and corners
 - .3 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Where walls are not indicated to extend to underside of floor above, provide lateral bracing above ceilings to underside of floor structure:
 - .1 Bracing: Steel studs matching wall framing thickness and depth, spaced 2 440 mm o.c., angled 45 degree from vertical. Alternate bracing direction for successive braces on long walls.
- .5 Where walls terminate below ceilings, provide box framed steel stud lintel along entire top edge of wall, and provide 100 mm wide flat strap sheet steel shear wall 'X' bracing from corner to corner.
- .6 Erect metal studding to tolerance of 1:1 000.
- .7 Attach studs to tracks as follows:
 - .1 General interior framing: using screws.
 - .2 Special wall construction framing (W4 and W5): using welds or pop rivets.
 - .3 Ensure fastening does not compromise deflection system at upper track.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 Provide two studs extending from floor-to-floor, or floor-to-ceiling, as applicable, at each side of openings wider than stud centres specified.
 - .1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.
 - .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
 - .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.

- .12 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.
- .13 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .14 Install work level to tolerance of 1:1 200.
- .15 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .16 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .17 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .18 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.
- .19 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .20 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .21 Special wall construction framing (W4 and W5): Install anti-spread bracing (channel stud framing) 1 219 mm from bottom of wall between door frame double stud and adjacent stud on both sides of frame.
- .22 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.
- .23 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .24 Extend partitions to ceiling height except where noted otherwise on drawings.
- .25 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
 - .1 Provide deflection system accommodating not less than 25 mm vertical movement or more as indicated and required.
 - .2 Maintain continuity of fire resistance rating at joints in accordance with reviewed ULC firestopping assembly in accordance with Section 07 84 00 – Firestopping.
- .26 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .27 Install two continuous beads of acoustical sealant under studs and above tracks around perimeter of sound control partitions.
- .28 Apply continuous bead of fire-rated acoustic sealant on both sides of top and bottom tracks at Special Wall Construction W4 and W5.

3.03 WALL PROTECTION MATERIAL INSTALLATION – SPECIAL WALL CONSTRUCTION (W4 AND W5)

- .1 Provide expanded metal wall protection material on attack side of wall.
 - .1 Support edges by anti-spread bracing, studs and corners. Butt or inlay mesh at every vertical and horizontal seam on centre line of steel stud or anti-spread bracing and secure with rivets and fender washers in accordance with RCMP Lead Agency Guide G13-01.
- .2 Openings:
 - .1 Reinforce openings with additional layer of 1.367 mm thick sheet steel on inside (secure side) of studs. Secure with 1.5 mm fillet weld, 15 mm long at 200 mm o/c both sides of steel stud, or 8mm plug weld at 200 mm o/c..
 - .2 Extend reinforcing 1 200 mm from all edges of opening.

3.04 VENTILATION DUCT PASS-THROUGHS

- .1 Install ventilation duct pass-throughs for special wall construction framing (W4 and W5) where noted in accordance with RCMP Lead Agency Guide G13-01, Rev 1.1 (May 2014), Secure Storage Rooms (SSR).
- .2 Ceiling mount:
 - .1 Duct sleeve to be at least the same thickness as duct passing through.
 - .2 The overall dimension of the sleeve must be slightly greater than the duct.
 - .3 Construct frames of 35 x 35 x 3 mm angle steel welded around duct sleeve (ceiling mount brackets are recommended).
 - .4 Space 10 mm Ø steel security bars at 150 mm on centre and weld to frame.
 - .5 Secure the duct sleeve to the structural ceiling with mechanical fasteners.
 - .6 Cut protection material 20 mm max from edge of the duct opening (3 sides)
 - .7 Apply fire-rated acoustic sealant between duct sleeve and finished wall.
- .3 Surface mount:
 - .1 Duct sleeve to be at least the same thickness as the duct passing through.
 - .2 The overall dimension of the sleeve must be slightly greater than the duct.
 - .3 Construct frame on each side of the wall of 35 x 35 x 3 mm angle steel welded around duct sleeve.
 - .4 Space 10 mm Ø steel security bars at 150 mm on centre and weld to frame.
 - .5 Secure duct sleeve with 6 mm Ø bolts and hex nuts (inside the room) at 200 mm on centre around the outside duct sleeve. The bolt head shall be on the attack side and be welded in at least three places to the angle frame.
 - .6 Framing around duct sleeve is required.
 - .7 Apply fire-rated acoustic sealant between duct sleeve and finished wall.

3.05 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.

3.06 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

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1 General

1.01 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 Terrazzo Tile and Marble Association of Canada (TTMAC)
 - .1 Tile Specification Guide 09300 Tile Installation Manual, 2009-2010 edition
 - .2 Tile Maintenance Guide, latest edition

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product data:
 - .1 Include manufacturer's information on:
 - .1 Wall tile, marked to show each type, size, and shape required.
 - .2 Mortar and grout.
 - .3 Divider strip.
 - .4 Accessories
 - .2 Samples:
 - .1 Samples for Initial Selection: For each type of grout indicated. Include Samples of accessories involving colour selection.
 - .2 Submit duplicate 300 by 600 mm sample panels of each colour, texture, size, and pattern of tile. Adhere tile samples to 12 mm thick plywood and grout joints to represent project installation.
- .3 Informational Submittals:
 - .1 Manufacturer's installation instructions and recommendations.

1.03 CLOSEOUT SUBMITTALS

- .1 Maintenance Data:
 - .1 Submit maintenance data for incorporation into Operations and Maintenance Manual in accordance with Section 01 78 00 – Closeout Submittals.
 - .2 Submit cleaning and maintenance recommendations for Owner's use.
 - .3 Submit TTMAC Maintenance Guide. Provide specific warning of any maintenance practice or materials that may damage or disfigure finished work.

1.04 MAINTENANCE MATERIALS SUBMITTALS

- .1 Supply extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents:

- .1 Tile: Supply minimum 5% or one full carton (whichever is greater) of each type and colour of tile required for project for maintenance use. Store where directed.

1.05 QUALITY ASSURANCE

- .1 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- .2 Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- .3 Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- .4 Store liquid materials in unopened containers and protected from freezing.
- .5 Waste management and disposal requirements: Refer to Section 01 74 21 – Construction Waste Management and Disposal.

1.07 AMBIENT CONDITIONS

- .1 Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

2 Products

2.01 PRODUCTS, GENERAL

- .1 ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- .2 ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- .3 Factory Blending: For tile exhibiting colour variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colours as those taken from other packages and match approved Samples.

2.02 WALL TILE

- .1 Ceramic tile: to CAN/CGSB-75.1, Type 5, Class MR 4.
 - .1 Module size: 100 x 300 mm.
 - .2 Finish: Glazed

- .1 Matte: 75%
- .2 Bright: 25%
- .3 Colour: Selected by Departmental Representative from manufacturer's full range to match Standard of Acceptance Product.

2.03 MORTAR AND GROUT MATERIALS

- .1 Mortar and grout materials: product of a single manufacturer.
- .2 Thin-Set Mortar: Polymer-enriched, non-sag medium-bed and thin-set mortar specifically for use with large format tile, to ANSI A118.4 and ANSI A118.11, recommended by setting material manufacturer.
 - .1 Maximum VOC Content: 65g/L (less water)
- .3 Polymer-Modified Portland Cement Grout: to ANSI A118.1, A118.6, and A118.7, fast-setting, non-shrinking, colour-consistent, factory prepared, polymer-modified, Portland cement grout. Weather-, shock-, mildew-, and frost-resistant; non-flammable and meeting following requirements:
 - .1 Flexural Strength: Greater than 6.90 MPa to ANSI A118.6.
 - .2 Linear Shrinkage: Less than 0.10% to ANSI A118.6 after seven days.
 - .3 Water Absorption: Less than 7% (immersion to dry).
 - .4 Compressive Strength: Minimum 24.1 MPa at 28 days to ANSI A118.6.
 - .5 Tensile Strength: Minimum 3.45 MPa at 28 days to ANSI A118.7.
 - .6 Maximum VOC Content: 65g/L (less water)
 - .7 Colour: Selected by Departmental Representative from manufacturer's standard range.
- .4 Water: Potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

2.04 ACCESSORIES

- .1 Transition Strips: Purpose made metal extrusion; sloped exposed surface, 4 mm tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer, stainless steel type 304.
- .2 Sealant: Mildew resistant silicone in accordance with Section 07 92 00 - Joint Sealants.

2.05 MIXES

- .1 Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- .2 Add materials, water, and additives in accurate proportions.
- .3 Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.06 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 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 EXAMINATION

- .1 Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - .1 Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - .2 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - .3 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Departmental Representative.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

- .1 Prepare substrate in accordance with manufacturer's recommendations.
- .2 Blending: For tile exhibiting colour variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colours as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.04 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2006/2007, "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 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .6 Bond Pattern: indicated on drawings.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Allow minimum 24 hours after installation of tiles, before grouting.
- .9 Clean installed tile surfaces after installation and grouting cured.

3.05 CLEANING AND PROTECTING

- .1 Cleaning: On completion of placement and grouting, clean tile surfaces so they are free of foreign matter.
 - .1 Remove grout residue from tile as soon as possible.
 - .2 Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- .2 Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- .3 Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

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1 General

1.01 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Obtain samples of each type of light fixture, diffuser, speaker, and sprinkler head to be installed for preparing factory cut-outs.
 - .2 Coordinate suspension system with location of related components, including, but not limited to, mechanical, electrical, and communication fixtures. Centre light fixtures, diffusers, speakers, and sprinkler heads in ceiling components.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data: For each type of product specified.
 - .2 Shop Drawings:
 - .1 Suspension Grid:
 - .1 Submit reflected ceiling plans for special grid patterns as indicated.
 - .2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, change in level details, acoustical unit support at ceiling fixture, lateral bracing and accessories, attachment system, and methods of installation.
 - .2 Panels and Tiles:
 - .1 Indicate each type of ceiling material, location, design of units, methods of installation.
 - .2 Show sizes, and arrangement of ceiling materials on reflected ceiling plans, relating to lighting fixtures, other items.
 - .3 Samples:
 - .1 Submit duplicate 150 by 150 mm size samples of each type of specified ceiling panel and tile.

1.03 EXTRA STOCK MATERIALS

- .1 Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - .1 Turn over open cartons of ceiling tile to Departmental Representative.
 - .2 Provide 1% overage of gross ceiling for each pattern and type required for project, in sealed cartons.
 - .3 Store where directed by Departmental Representative.
 - .4 Provide written receipt signed by Contractor, stating date and quantity delivered.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- .2 Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content
- .3 Handle acoustical panels carefully to avoid chipping edges or damaging units.
- .4 Waste Management:
 - .1 Deposit packaging materials in appropriate container on site for recycling or reuse.
 - .2 Avoid using landfill waste disposal procedures when recycling facilities are available.

1.05 SITE CONDITIONS

- .1 Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

2 Products

2.01 PERFORMANCE/DESIGN CRITERIA

- .1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.
- .2 Maximum supporting point load: 38 kg to ensure tracks and hangers will break away.

2.02 SUSPENSION GRID MATERIALS

- .1 Provide direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- .2 Grid: To match existing base building product:
 - .1 Acceptable Product: Armstrong Prelude XL 15/16"
 - .2 Substitutions: Not permitted.
- .3 Hanger Wire:
 - .1 Galvanized soft annealed steel wire, for use with suspension grid.
 - .2 Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but no less than 2.6 mm diameter wire.
- .4 Hanger Inserts: purpose made. Provide hangers and fasteners for independent suspension of light boxes.

- .5 Metal Edge Mouldings and Trim: Roll-formed, sheet-metal of type and profile indicated or, if not indicated, manufacturer's standard mouldings for edges and penetrations; formed from sheet metal of same material, finish, and colour as that used for exposed flanges of suspension-system runners.

2.03 ACOUSTIC PANEL MATERIALS

- .1 ACT: Acoustic units for suspended ceiling system: To match existing base building product:
 - .1 Acceptable Product: Armstrong Cortega model 769, Medium texture 24x 48x5/8"
 - .2 Substitutions: Not permitted.

3 Execution

3.01 EXAMINATION

- .1 Do not erect ceiling suspension system until work above ceiling including anchors, blockings, sound and fire barriers, mechanical and electrical work has been reviewed by Departmental Representative.

3.02 PREPARATION

- .1 Measure each ceiling area and establish layout of acoustical panels to comply with layout indicated on reflected ceiling plans.

3.03 INSTALLATION - SUSPENSION SYSTEM

- .1 Installation in accordance with ASTM C636 except where specified otherwise.
- .2 Secure hangers to overhead structure using attachment methods acceptable to Departmental Representative. Attach hangers to structural members.
 - .1 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
- .3 Install hangers within 150 mm from ends of main tees. Wall perimeter moulding shall not be considered support for main tees and does not remove requirement for hangers placed at 150 mm from ends of main tees. Hanger spacing maximum 1 200 mm on centre.
- .4 Establish ceiling elevation using laser level.
 - .1 Install ceiling to match elevation of removed ceiling.
 - .2 Continue ceiling over low partitions as indicated on reflected ceiling plans.
- .5 Install edge mouldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - .1 Screw attach mouldings to substrate at maximum 400 mm o.c. and maximum 75 mm from ends, leveling with ceiling suspension system to a tolerance of 3.2 mm in 3.6 m. Mitre corners accurately and connect securely.
 - .2 Do not use exposed fasteners, including pop rivets, on moldings and trim.
- .6 Construct suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles, and speakers. Provide additional hangers as required for loads.

- .7 Interlock cross member to main runner to provide rigid assembly.
- .8 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .9 Finished ceiling system to be square with adjoining walls and level within 3 mm in 3 650 mm.
- .10 Ensure straightness, tolerance, bow, camber, twist of suspension system member does not exceed values in ASTM standards.
- .11 Sharp local kinks, bends, bruises, and dents: not acceptable.
- .12 Level members with supporting hanger tensioned to prevent subsequent downward movement when ceiling loads imposed.
- .13 Do not kink, or bend hanger wires to level system.
- .14 Install cross tees at right angles to main tees, main tees be non-cumulative.
- .15 Ensure no apparent angular displacement from one tee to another.
- .16 Exposed surfaces of suspension system: level, flush, joints tight, straight, and true.

3.04 INSTALLATION – ACOUSTIC PANELS

- .1 Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - .1 For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and mouldings.
- .2 Scribe panels to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .3 Do not use scratched, damaged or broken panels. Replace scratched, damaged and broken panels.

3.05 INTERFACE WITH OTHER WORK

- .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into ceiling components.

3.06 CLEANING

- .1 Touch up scratches, abrasions, voids and other defects in painted surfaces.
- .2 Clean down materials, leave free of grime, dirt, finger prints, other evidence of work.

END OF SECTION

1 General

1.01 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM F1859, Standard Specification for Rubber Sheet Floor Covering Without Backing
 - .2 ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- .2 Electrostatic Discharge Association
 - .1 ESD DSTM7.1-2013, Resistive Characterization of Materials – Floor Materials
 - .2 ANSI/ESD S6.1-2009, Grounding
- .3 FloorScore
 - .1 FloorScore Certified Flooring Products tested to meet SCS-EC10.2-2001 Environmental Certification Program for Indoor Air Quality Performance
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113, Architectural Coatings. Rules in affect January 1, 2004
 - .2 SCAQMD Rule 1168, Adhesives and Sealants Applications. Amended January 7, 2005; Rules in affect July 1 2005

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Where integral bases are scheduled to be installed on gypsum board partitions ensure joints are taped and fitted properly and that gypsum board is installed to the floor line to ensure adequate bond of cove base material.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals:
 - .1 Shop Drawings: Submit seaming diagram indicating flooring type, seam locations, patterning, and roll direction. Include dimensions.
 - .2 Samples:
 - .1 Duplicate 300 mm long sample of edge protection strips, transition strip, each colour of welding rods, cove former, and cap strip.
 - .2 In manufacturer's standard size, but not less than 150 by 150 mm sections, duplicate samples of each different colour and pattern of floor covering required.
 - .3 Seam Samples: For heat- and cold-welded seams, and for each floor covering product, colour, and pattern required; with seam running lengthwise and in centre of 150 by 150 mm sample applied to a rigid backing and prepared by installer for this Project.
- .3 Informational Submittals:

- .1 Qualification Data: for installer.
- .2 Statement of material compatibility.

1.04 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
 - .1 Include recommended maintenance procedures, maintenance materials and suggested schedule for cleaning. Include detailed information regarding properties of stain resistance and procedures recommended for removal of spills and stains.

1.05 EXTRA STOCK MATERIALS

- .1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 – Closeout Submittals.
 - .1 Provide 2% of each colour, pattern and type of flooring material installed on project in full width rolls, and remnants over 1 square metre of each colour for maintenance use.
 - .2 Extra materials to be in one piece and from same production run as installed materials.
 - .3 Clearly identify each roll of sheet flooring.
 - .4 Deliver to Departmental Representative, upon completion of the work of this section.
 - .5 Store where directed by Departmental Representative.

1.06 QUALITY ASSURANCE

- .1 Installer: company or person specializing in resilient sheet flooring, with three years documented experience and approved by flooring manufacturer.
- .2 Source Limitations for Waterproofing Membrane: Obtain waterproofing membrane for use behind ceramic tile in bariatric shower and under resilient sheet flooring from one manufacturer.
- .3 Material Compatibility: Provide materials that are compatible with one another under conditions of service and application required.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .2 Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- .3 Store rolls in dry locations, stand rolls on end. Protect and secure rolls from falling.

1.08 WASTE MANAGEMENT AND DISPOSAL

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

1.09 ENVIRONMENTAL REQUIREMENTS

- .1 If storage temperature is below 21 deg C, move flooring products to warmer place and allow to acclimate before unrolling or installation.
- .2 Maintain air temperature and structural base temperature at flooring installation area between 21 deg and 26 deg C for 48 hours before, during and 48 hours after installation.

2 Products

2.01 PERFORMANCE REQUIREMENTS

- .1 Flooring: shall not require sealers, waxes or polishes. Maintenance requirement to be dry buffing, with no polish treatment, sealers, waxes or spray buff solutions.

2.02 FLOORING MATERIALS

- .1 Resilient Sheet (Rubber) Flooring (RSF): to ASTM F1859, Type I, smooth finish.
 - .1 Thickness: 2.0 mm
 - .2 Hardness: Shore type A, ≥ 92 to ASTM D 2240.
 - .3 Abrasion resistance: Taber abrasion test to ASTM D 3389, H-18 wheel, 500 gram load, 1000 cycles, gram weight loss ≤ 0.25 .
 - .4 Slip resistance: static coefficient of friction ≥ 0.96 (dry) and ≥ 0.85 (wet) to ASTM D 2047.
 - .5 Rolling load limit: 3100 kPa.
 - .6 Bacteria resistance: resistant to bacteria, fungi, and micro-organism activity to ASTM E 2180 and ASTM G21.
 - .7 Critical radiant flux: ≥ 0.45 W/cm² to ASTM E648.
 - .8 Surface burning Characteristics: Tested to CAN/ULC S102.2 with following performance values:
 - .1 Flame Spread: 125 maximum.
 - .2 Smoke Development: 450 maximum.
 - .9 Static Generation AATCC 134 (20% RH) <2000 volts.
 - .10 Colours: Allow for three colours selected by Departmental Representative from manufacturer's standard range.
 - .11 FloorScore Certified Flooring Products, or product must meet testing and product requirements of the California Department of Public Health Standard Practice for Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 addenda.

2.03 ACCESSORIES

- .1 Filler cove strips: required for specific material installation as recommended by manufacturer.
- .2 Welding rods: for sheet flooring, manufacturer standard for specific material joint treatment, colour matched to Departmental Representative approval.
 - .1 Colour: Allow for three colours of welding rods for rubber sheet flooring.

- .3 Sub-floor filler and leveler: trowelable, non-shrinking, water-resistant, alkali mould-resistant, cementitious underlayment, two component compound consisting of liquid latex and Portland cement base, both supplied by same manufacturer.
- .4 Primers and adhesives: water-resistant type recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .5 Sealants: as specified in Section 07 92 00 – Joint Sealants.

3 Execution

3.01 SITE VERIFICATION OF CONDITIONS

- .1 Inspect surfaces prepared to receive flooring and base.
- .2 Report defects, and unsuitable conditions.
- .3 Proceed only when defects, and unsuitable conditions corrected.
- .4 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.02 PREPARATION

- .1 Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
- .2 Concrete Substrates: Prepare according to ASTM F710.
 - .1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - .2 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - .3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - .4 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- .3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .4 Thoroughly clean surfaces of dust, dirt, grease, paint, other foreign material before installing flooring and base.
- .5 Fill cracks, other openings, depressions in substrate with sub-floor filler mix featheredged. Level uneven joints, rough areas. Apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .6 Sweep, vacuum floors clean.
- .7 Neutralize surface of concrete in accordance with manufacturer's printed instructions.

- .8 Prime concrete slab to resilient flooring manufacturer's printed instructions.
- .9 Where flooring of different thickness abut apply filler to build a smooth gradual ramping so top of finished flooring meets top of adjacent material.

3.03 APPLICATION: FLOORING

- .1 Flooring manufacturer's technical Departmental Representative shall on a periodic basis conduct site consultations on matters relating to products and installation procedures.
- .2 Install flooring and accessories in accordance with manufacturer's written installation instructions.
- .3 Unroll floor coverings and allow them to stabilize before cutting and fitting.
- .4 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to the outside. Do not let contaminated air recirculate through building air distribution system.
- .5 Protect areas of flooring subject to direct sunlight during installation and for 72 hours after installation in accordance with manufacturer's instructions.
- .6 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .7 Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- .8 Lay flooring with seams parallel to building lines to produce minimum number of seams. Border widths minimum 1/3 width of full material.
- .9 Run sheets in direction of traffic. Double cut sheet joints and continuously heat weld according to manufacturer's printed instructions.
- .10 Lay material full width in corridors. Where corridors are wider than sheet material, lay full width down centre of corridor with equal border on each side unless otherwise specified.
- .11 Seaming: Prepare, cut and finish seams, in accordance with manufacturer's printed instructions, and as follows:
 - .1 Cold weld seams of sheet rubber flooring.
 - .2 Hot weld seams of sheet vinyl flooring.
 - .3 Neatly trim welding thread and leave flush with surface of material.
- .12 As installation progresses, and after installation roll flooring with minimum 45 kg roller to ensure full adhesion. Weight seams as required until suitable bond is established.
- .13 Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, wall and corner guard aluminum retainers, and door frames
- .14 Install floor patterning where indicated. Fit joints tightly.

- .15 Extend floor coverings into toe spaces, door reveals, closets, and similar openings. Continue flooring over areas which will be under built-in furniture.
- .16 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .17 Install edge strips at unprotected or exposed edges where flooring terminates unless otherwise noted.

3.04 INTEGRAL FLASH COVE BASE

- .1 Where base material is indicated as "INTEG" in Room Finish Schedule cove base sheet flooring material up vertical surfaces.
- .2 Cove floor coverings 150 mm up vertical surfaces where indicated, including architectural woodwork base cabinets.
- .3 Extend cove flooring base minimum 150 mm onto horizontal surface of flooring.
- .4 Support floor coverings at horizontal and vertical junction by cove strip.
- .5 Apply small continuous bead of mildew-resistant paintable silicone sealant along top edge of integral base.
- .6 At flush door frames and other projections, taper cove former 300 mm back from frame to provide flush cove at face of frame.
- .7 Sheet Rubber Flooring Corners: Fabricate corners using boot method in accordance with manufacturer's instructions. Cold-weld joints.

3.05 CLEANING

- .1 Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
- .2 Perform the following operations immediately after completing floor covering installation:
 - .1 Remove excess adhesive from floor, base and wall surfaces without damage.
 - .2 Sweep and vacuum floor coverings thoroughly.
 - .3 Damp-mop floor coverings to remove marks and soil.

3.06 PROTECTION

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit foot traffic on floor for 48 hours after installation. Prohibit rolling traffic on floor for minimum 72 hours after installation.

END OF SECTION

1 General

1.01 REFERENCES

- .1 American Association of Textile Chemists and Colorists (AATCC)
 - .1 AATCC Test Method 134-2006, Electrostatic Propensity of Carpets.
- .2 Carpet and Rug Institute (CRI)
 - .1 CRI Green Label Plus Indoor Air Quality Testing Program.
 - .2 CRI Test Method 101 Assessment of Carpet Surface Appearance Change
 - .3 CRI-104-Sept 2015, Standard for Installation of Commercial Carpet

1.02 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 Review installation and substrate conditions.
 - .3 Co-ordination with other construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit product data sheet for each carpet, carpet protection and subfloor patching compound. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
 - .2 Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colours, and methods of installation.
 - .3 Submit 2 copies of WHMIS MSDS.
 - .2 Shop Drawings:
 - .1 Information on shop drawings to indicate:
 - .1 Carpet tile type, color, and dye lot.
 - .2 Type of subfloor.
 - .3 Type of installation.
 - .4 Type, colour, and location of edge, transition, and other accessory strips.
 - .5 Transition details to other flooring materials.
 - .6 Seam locations, types, and methods.

- .7 Submit carpet schedule using same room number designations indicated on drawings.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work. Submit duplicate samples of each type of carpet tile specified and duplicate tiles for each colour selected.
- .3 Informational Submittals:
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions.
 - .2 Manufacturers Reports:
 - .1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance with specifications.
 - .4 Qualification Statements:
 - .1 Tested to 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.

1.04 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.

1.05 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 of 1 full box of each colour, pattern and type of carpet tile.
 - .2 Delivery, storage and protection: comply with Departmental Representative's requirements for delivery and storage of extra materials.

1.06 QUALITY ASSURANCE

- .1 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 Responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturer's written instructions.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Comply with CRI 104.
- .2 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 Storage and Handling Requirements:
 - .1 Store materials indoors 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 carpet and adhesive at minimum temperature of 18 degrees C and relative humidity of maximum 65% for minimum of 48 hours before installation.
 - .5 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.
 - .6 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
 - .7 Replace defective or damaged materials with new.
- .5 Waste management and disposal requirements: Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.08 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 Co-ordinate operation of ventilation system during installation of carpet.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .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.

2 Products

2.01 MATERIALS

- .1 CPT1 (tone on tone geometric pattern)
 - .1 Face Construction
 - .1 Construction: Tufted Textured Loop.
 - .2 Face weight: min. 678 g/m²
 - .3 Machine Gauge: 50.4 ends / 10 cm.
 - .4 Stitches: 34.3 ends / 10 cm.
 - .5 Pile Height: 4.1 mm
 - .6 Finished Pile Thickness: 3 mm
 - .7 Pile Density: minimum 226 g/m²
 - .8 Fiber System: 100% type 6 nylon.
 - .9 Recycled Content: 100%
 - .10 Dimensions: 500 x 500 mm
 - .11 Dye Method: 100% solution dyed
 - .12 Soil/Stain resistant protection.
 - .13 Primary Tufting Substrate: Synthetic, non-woven
 - .14 Static Performance: To AATCC-134, under 3.5 KV
 - .15 Fibre Modification Ratio: 1.9 to 2.2
 - .16 Recycled Content (nominal): 70% total - 60% post industrial, 10% post consumer.
 - .17 Colour and pattern: Include single colour and pattern selected by Departmental Representative based on following:
 - .1 Colour: Product range to include a minimum of five options in medium value taupes and greys.
 - .2 Pattern: Product range to include minimum three fine linear groove patterns defined by colour alternation in specified colour range. Allow for selection of one pattern from range by Departmental Representative

2.02 ACCESSORIES

- .1 Trowellable Sub floor Filler and Leveller: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- .2 Resilient base: to ASTM F1861, Type TS (rubber), Group I (solid homogeneous), in coils of manufacturer's standard lengths. Outside and inside corners: job-formed.
 - .1 Style: Standard no toe, 3.2 mm thick exposed face height: 101.6 mm.
 - .2 Colour: Selected by Departmental Representative from manufacturer's full range. Allow up to four colours.
- .3 Tile/Carpet Transition: 25 mm exposed width 6 mm high.
 - .1 Colour: Selected by Departmental Representative from manufacturer's full range. Allow up to four colours.

- .4 Adhesive: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
- .5 Carpet protection: non-staining heavy duty kraft paper.

3 Execution

3.01 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.

3.02 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 Prepare floor surfaces in accordance with CRI Carpet Installation Standard and as follows:
 - .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
 - .2 Trowel and float sub floor filler to leave smooth, flat, hard surface. Prohibit traffic until filler cured.
 - .3 Thoroughly clean surfaces of dust, dirt, grease, paint, other foreign material before installing flooring and base.
 - .4 Neutralize surface of concrete in accordance with manufacturer's printed instructions.
 - .5 Prime concrete slab to flooring manufacturer's printed instructions.
- .3 Tile Carpeting Preparation: Pre-condition carpeting following manufacturer's written instructions.

3.03 INSTALLATION

- .1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI Carpet Installation Standard
- .2 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.
- .3 Install carpet tile after finishing work is completed but before furniture is installed.

- .4 Install carpet tile in quarter turn layout.
- .5 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.
- .6 Apply thin film of pressure-sensitive adhesive according to manufacturer's recommendations.
- .7 Ensure finished installation presents smooth wearing surface free from conspicuous seams, burring and other faults.
- .8 Use material from same dye lot.
 - .1 Ensure colour, pattern and texture match within visual areas.
 - .2 Maintain constant pile direction.
- .9 Fit around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.
- .10 Extend carpet tiles into toe spaces, door reveals (to centreline beneath doors), closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- .11 Install carpet tiles smooth and free from bubbles, puckers, and other defects.
- .12 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

3.04 BASE APPLICATION

- .1 Lay out base to keep number of joints at minimum. Base joints at maximum length available or at internal corners.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Adhesive application:
 - .1 Porous wall surfaces: apply adhesive to back of base.
 - .2 Non-porous wall surface: apply adhesive to wall surface and back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller. Roll back to starting point.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions.
- .7 On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

- .8 Job-Formed Corners:
 - .1 Use straight pieces of maximum lengths possible.
 - .2 Wrap base minimum 300 mm beyond corners. No joint at corners permitted.
 - .3 Outside corners: Form without producing discolouration (whitening) at bends. Scribe back of base at bend locations and remove strips perpendicular to length of base that are only deep enough to produce snug fit, without removing more than half wall base thickness.
 - .4 Inside corners: Form by cutting inverted V-shape notch in toe of wall base at point where corner is formed. Scribe back of base where necessary to produce snug fit to substrate.
- .9 Install toeless type base before installation of carpet on floors.

3.05 FIELD QUALITY CONTROL

- .1 Site Tests and Inspections:
 - .1 Co-ordinate site test with Section 01 45 00 - Quality Control.

3.06 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.

3.07 PROTECTION

- .1 Protect installed carpet to comply with CRI 104, "Protecting Indoor Installations."
- .2 Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.
- .3 Repair damage to adjacent materials caused by tile carpeting installation.

END OF SECTION

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1 General

1.01 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .2 ASTM E-136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - .3 ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .4 ASTM C 612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product data: manufacturer's printed literature demonstrating selected options, and compliance with specified design and performance properties.
 - .1 Include detailed instructions for proper handling and installation to minimize health concerns.
 - .2 Samples:
 - .1 Submit duplicate memo size sample of acoustical unit.

1.03 QUALITY ASSURANCE

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct one representative mock-up of acoustical product.
 - .3 Construct mock-up 10 m²minimum to indicate method of assembly, installation and fixing.
 - .4 Construct mock-up where directed.
- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.
- .6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.04 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.

1.05 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.

1.06 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Provide acoustical units for maintenance use amounting to 2% of gross wall area for each pattern and type required for project.
 - .3 Extra materials from same production run as installed materials.
 - .4 Identify each package of acoustical units including type.
 - .5 Deliver to Departmental Representative, upon completion of the work of this section.
 - .6 Store where directed by Departmental Representative.

2 Products

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 Hazardous Materials: Provide materials that are not required to be labelled as poisonous, corrosive, flammable or explosive under Consumer Chemical and Container Regulations of the Hazardous Products Act.

2.02 MATERIALS

- .1 Flexible semi-rigid acoustical fiberglass insulating board with vapour barrier facing, for use in ceiling plenum.
- .2 Acoustic units: to ASTM E-84, ASTM E-136, ASTM C 423, and ASTM C 612
 - .1 Foil Scrim Kraft (FSK) finish material both sides, i.e. use two panels back to back.
 - .2 Non-combustible.
 - .3 Flame spread rating of 25 or less.
 - .4 Smoke developed 50 or less.
 - .5 Noise reduction coefficient (NRC) designation 0.75
 - .6 Size 610 x 1219 x 51 mm thick.
 - .7 Shape flat.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install two layers back to back acoustic units friction fit in plenum above partitions, plumb and aligned.

3.03 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.04 PROTECTION

- .1 Protect finished acoustical wall treatment from damage.
- .2 Remove protection prior to Substantial Performance of Work.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).
- .3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .4 National Fire Code of Canada (NFCC).
- .5 Green Seal
 - .1 Standard GS-11, 1993, Standard for Paints and Coatings
 - .2 Standard GC-03, 1997, Anti-Corrosive Paints
- .6 South Coast Air Quality Management District
 - .1 Rule 1113 Architectural Coatings, July 2007. Rules in affect January 1 2004.

1.02 QUALITY ASSURANCE

- .1 Painting contractor must be a member of the Accredited Quality Assurance Association.
- .2 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .3 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .4 Conform to latest MPI requirements for painting work including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used. Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements.
- .7 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1 000 mm at 90 degrees to surface.
 - .2 Ceilings: No defects visible from floor at 450 to surface when viewed using final lighting source.

- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.03 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Provide paint products meeting the following environment performance requirements:
 - .1 VOC emissions from paints must not exceed the limits of Green Seal's Standard GS-11, 1993.
 - .2 The VOC content of anti-corrosive coatings must not exceed limits of Green Seal's Standard GC-03, 1997.
 - .3 For interior paints and coatings not covered by GS-11 and GS-03, the VOC content of all primers, under-coatings, sealers and clear wood finishes must be less than VOC content limits of South Coast Air Quality Management District Rule #1113, January 2004.

1.04 SUBMITTALS

- .1 Product Data:
 - .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
 - .3 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .4 Submit manufacturer's installation and application instructions.
- .2 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.05 SAMPLES

- .1 Submit three drawdowns of each product and colour combination with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards, size 100 x 150 mm, mounted on 216 x 280 mm sheets, submitted on the following substrate materials:
 - .1 Drawdowns of opaque finishes shall be applied using 4 mil WFT drawdown bar on Leneta form WD plain white coated cards
 - .2 3 mm plate steel for finishes over metal surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
- .2 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
- .3 Label each card with the following:

- .1 Job name.
 - .2 Date.
 - .3 Product name.
 - .4 Product number.
 - .5 Colour number as stated in the colour schedule.
 - .6 Name, address, and phone number of the supplying facility.
- .4 Submit full range of available colours where colour availability is restricted.

1.06 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Submit one - four litre can of each type and colour of primer finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Deliver and store where directed.

1.07 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.
- .2 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Provide and maintain dry, temperature controlled, secure storage.
- .5 Observe manufacturer's recommendations for storage and handling.
- .6 Store materials and supplies away from heat generating devices.
- .7 Store materials and equipment in a well ventilated area with temperature range 7 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.

1.08 SITE REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Coordinate use of existing ventilation system and ensure its operation during and after application of paint as required.
 - .4 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .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.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved, 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 manufacturers prescribed limits.
 - .4 The relative humidity is above 85% or when the dew point is less than 3 degrees C variance between the air/surface temperature.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
 - .1 12% for concrete walls and masonry (concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .4 1.36 kg of water per 92.9 sq. m in 24 hours for concrete floors
 - .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride".
 - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.

- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
 - .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
- .5 Additional Exterior Application Requirements:
 - .1 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - .2 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.
 - .3 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.
 - .4 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
 - .5 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

1.09 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate waste materials for recycle or disposal 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 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 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.

2 Products

2.01 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL), most recent edition, are acceptable for use on this project.
- .2 Grade: MPI Premium Grade coating systems.
- .3 Paint materials for paint systems shall be products of a single manufacturer.
- .4 Conform to latest MPI requirements for all painting work including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.): in accordance with MPI - Architectural Painting Specification Manual "Approved Product" listing.
- .6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0 degrees C or greater.
- .8 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.

2.02 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of three base colours and three accent colours. No more than six colours will be selected for entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturer's full range of colours.
- .4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .5 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.03 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written instructions. On-site tinting of painting materials allowed only with Departmental Representative's written permission.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's written 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.

2.04 GLOSS/SHEEN RATINGS

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

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein.

2.05 INTERIOR PAINTING SYSTEMS

- .1 Non-insulated metal pipes conduit, valves, fittings and equipment:
- .1 INT 5.1Q, G2 finish.
 - .1 Maximum VOC Content: 150 g/L (less water).
 - .2 Plastic: Piping
 - .1 INT 6.8AA - High performance architectural latex (over w.b. bonding primer), G2 finish.
 - .1 Maximum VOC Content: 150 g/L (less water).
 - .3 Plaster and gypsum board:
 - .1 INT 9.2B - High performance architectural latex G4 finish, except G2 at ceilings.
 - .1 Maximum VOC Content: 150 g/L (less water)
 - .4 Canvas and cotton covering:
 - .1 INT 10.1A - Latex – no sheen finish.
 - .1 Maximum VOC Content: 150 g/L (less water).

2.06 INTERIOR REPAINTING SYSTEMS

- .1 Plaster and Gypsum Board: (gypsum wallboard, drywall, and "sheet rock type material").
 - .1 RIN 9.2B - High performance architectural latex (over latex primer sealer).

3 Execution

3.01 GENERAL

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual except where specified otherwise.

- .3 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.02 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted.
 - .1 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".
 - .1 Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.03 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking.
 - .1 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, and general public in and about the building.

3.04 PREPARATION

- .1 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.
 - .1 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 As painting operations progress, place "WET PAINT" signs in occupied areas.
- .2 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.
- .3 For existing surfaces, assess degree of surface deterioration in accordance with MPI Maintenance Repainting Manual.
 - .1 Include costs of repair of DSD-1 through DSD-3 defects in the Work.
 - .2 Do not repaint surfaces until DSD-4 defects have been corrected.

- .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.
 - .1 Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .5 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.
- .6 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.
- .7 Touch up of shop primers with primer as specified.
- .8 Do not apply paint until prepared surfaces have been accepted by Departmental Representative

3.05 APPLICATION

- .1 Method of application to be as approved by Departmental Representative. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .3 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .4 Sand and dust between coats to provide adequate adhesion for next coat and to remove defects visible from a distance of 1 000 mm.
- .5 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.
- .6 Finish closets and alcoves as specified for adjoining rooms.
- .7 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.06 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 Unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks unless required for service identification specified elsewhere.
- .3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
 - .1 Do not paint over nameplates.
 - .2 Do not paint transformers and substation equipment.

- .3 Keep sprinkler heads free of paint.
- .4 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .6 Paint both sides and edges of backboards for telephone and electrical equipment before installation.
- .1 Leave equipment in original finish except for touch-up as required.

3.07 EXISTING WORK

- .1 Preparation of previously painted surfaces:
 - .1 Remove loose or flaked paint or paper.
 - .2 Remove dirt, dust, grease, oil, etc.
 - .3 Dull glossy areas with sandpaper.
 - .4 Fill minor cracks with plaster patching compound. Sand smooth and wipe clean.
 - .5 Spot prime patched areas with finishing coat.
 - .6 Finish as specified for new work.
- .2 Wherever painting of existing walls is scheduled or indicated, paint both sides of doors and frames, or other items requiring painting which occur within that wall.
- .3 Painting of patchwork shall include for painting of existing surfaces up to nearest change in direction or surface interruption (example: door jamb, corner, bulkhead). Make neat termination, match paint as closely as possible.
- .4 Paint both sides of new doors and frames, screens, windows or any other items requiring painting which are installed in existing walls. Remove doors before repainting to paint bottom and top edges.

END OF SECTION

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1 General

1.0 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 10-2012, Standard for Portable Fire Extinguishers.

1.01 ACTION AND INFORMATIONAL 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.

1.02 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.0 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

- .1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
 - .1 Minimum size 3A:B:C.

2.01 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 Size 4.5 kg 2B:C.

2.02 EXTINGUISHER BRACKETS

- .1 Type recommended by extinguisher manufacturer.

2.03 IDENTIFICATION

- .1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10, CAN/ULC-S508.
- .2 Attach bilingual tag to extinguishers, indicating month and year of installation. Provide space for service dates.

3 Execution

3.0 MANUFACTURER'S INSTRUCTIONS

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

3.01 INSTALLATION

- .1 Install or mount extinguishers on brackets as indicated.
- .2 Provide fire extinguisher location sign protruding from wall directly above unit to NFPA 10 requirements.

3.02 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

1.01 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 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 Saskatchewan, Canada.
 - .2 Drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 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.
 - .4 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.

1.02 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 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.
 - .3 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.
- .4 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.
- .5 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.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 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.
- .8 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.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.03 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

- .1 Not Used

3 Execution

3.01 EXAMINATION

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

3.02 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.

3.03 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.04 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 - 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.

3.05 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.

3.06 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] [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.

3.07 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 General

1.01 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-, 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 B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .6 National Research Council (NRC)/Institute for Research in Construction
 - .1 National Plumbing Code of Canada (NPC) -.
- .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.02 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.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

1.04 SUSTAINABLE REQUIREMENTS

- .1 Construction:
 - .1 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 Specification text to ensure that project will comply with PWGSC green design process and sustainability requirements.
 - .3 Administrative, temporary and procedural requirements for the use of materials and methods of construction.

2 Products

2.01 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

2.02 FITTINGS

- .1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .2 Cast copper, solder type: to ANSI/ASME B16.18.
- .3 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .4 NPS 1 and smaller : wrought copper to ANSI/ASME B16.22; with 301stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.03 JOINTS

- .1 Rubber gaskets, latex-free: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.04 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and Bunan seat, steel lever.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.
 - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and Bunan seat, steel lever .

3 Execution

3.01 APPLICATION

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

3.02 INSTALLATION

- .1 Install in accordance with Provincial Plumbing Code.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.03 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.

3.04 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.

3.05 FLUSHING AND CLEANING

- .1 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 Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.06 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.

3.07 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.

3.08 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 Sterilize HWS and HWC systems for Legionella control.
 - .2 Verify performance of temperature controls.
 - .3 Verify compliance with safety and health requirements.
 - .4 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.

3.09 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 General

1.01 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).
- .2 Canadian Standards Association (CSA International).
 - .1 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.

1.02 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.

1.03 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

2.01 SUSTAINABLE MATERIAL

2.02 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary and vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.3.
 - .2 Wrought copper: to CAN/CSA-B125.3.
 - .2 Solder: t95:5, type TA, to ASTM B32.

2.03 CAST IRON PIPING AND FITTINGS

- .1 Above ground sanitary 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

3.01 APPLICATION

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

3.02 INSTALLATION

- .1 Install in accordance with Provincial Plumbing Code.

3.03 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.04 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 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.05 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 General

1.01 REFERENCES

- .1 ASTM International
 - .1 ASTM A126-04(2014), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08 (R2013), Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10 (R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101-R2012, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with 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 building construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.03 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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:

- .1 Indicate on drawings to indicate materials, finishes, dimensions, construction and assembly details.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
 - .1 Wall Access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor Access: round, cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.02 WATER HAMMER ARRESTORS

- .1 Stainless steel construction, bellows type: to PDI-WH201.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialties and accessories 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.

3.02 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.

3.03 INSTALLATION

- .1 Install in accordance with local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.04 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.05 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures.

3.06 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13- General Commissioning (Cx) Requirements : General Requirements, supplemented as specified.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .4 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.

- .5 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.

3.07 CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

3.08 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.

3.09 PROTECTION

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

END OF SECTION

1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
 - .2 CAN/CSA-B125.3-05, Plumbing Fittings.

1.02 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.

1.03 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.

1.04 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

2.01 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.
- .5 Fixtures to be product of one manufacturer.
- .6 Trim to be product of one manufacturer.
- .7 Stainless steel counter-top sinks.
 - .1 SK-1: single compartment, ledge-back.
 - .1 From 1.2 mm thick type 304 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 520 x 410 x 200 mm.

- .2 Trim: ASME A112.18.1, NFS 61 lead free compliant, 3-hole 208mm spacing, chrome plated cast brass body, with 220mm long swing spout, aerator, single lever handle, washerless controls with ceramic cartridge, accessories to limit maximum flow rate to 5.7 litres/minute at 413 kPa.
- .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
- .8 Fixture piping:
 - .1 Hot and cold water supplies to each fixture:
 - .1 Chrome plated rigid copper supply pipes each with screwdriver stop, reducers, escutcheon.
 - .2 Waste:
 - .1 Brass P trap with clean out on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

3 Execution

3.01 APPLICATION

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

3.02 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

3.03 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
 - .1 Aerators: operation, cleanliness.

3.04 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.01 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 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 Saskatchewan, Canada.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 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.
 - .4 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.

1.02 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 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.
 - .3 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.
- .4 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.
- .5 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.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 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.
- .8 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.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.03 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.04 DELIVERY, STORAGE AND HANDLING

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

2 Products

2.01 NOT USED

3 Execution

3.01 EXAMINATION

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

3.02 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.

3.03 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.04 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.

3.05 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: 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.

3.06 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B139-15, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada (NFCC 2015)
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2010, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.02 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, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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

- .1 Not used.

3 Execution

3.01 APPLICATION

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

3.02 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

3.03 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada, CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.04 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.05 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.06 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .8 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .9 Group piping wherever possible.
- .10 Ream pipes, remove scale and other foreign material before assembly.

- .11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .12 Provide for thermal expansion as indicated.
- .13 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Use ball valves at branch take-offs for isolating purposes except where specified.

3.07 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.08 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.09 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.

- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.11 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.12 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] [recycling] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal .

END OF SECTION

1 General

1.01 REFERENCES

- .1 ASTM International
 - .1 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.
- .2 Factory Mutual (FM)
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2009, 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.
- .4 Underwriter's Laboratories of Canada (ULC)

1.02 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.
 - .2 .

1.03 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.04 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.

2 Products

2.01 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.

2.02 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

2.03 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 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 to MSS SP69.
- .3 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 rod.
- .4 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .5 Adjustable clevis: material to MSS SP69, 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.
- .6 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .7 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: epoxy coated.
- .8 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.04 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ 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.

2.05 EQUIPMENT SUPPORTS

- .1 Equipment supports to be provided by the manufacturer.

2.06 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
 - .2 .
- .2 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .3 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .4 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.
- .5 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.

3.03 HANGER SPACING

- .1 Plumbing piping: to authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.

- .4 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.
- .5 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	

- .6 Pipework greater than NPS 12: to MSS SP69.

3.04 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.

3.05 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.

3.06 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.

3.07 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
 - .2 Sustainable requirements for construction and verification.

1.02 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-12, Identification of Piping Systems.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2016, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2016, Standard for the Installation of Standpipe and Hose Systems.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data to include paint colour chips, other products specified in this section.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.04 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.05 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: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Dispose of unused material at official hazardous material collections site approved by Departmental Representative.

- .3 Do not dispose of unused material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

2 Products

2.01 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.02 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick [laminated plastic] [white anodized aluminum], matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.
- .5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: size #9.
 - .2 Source and Destination identifiers: size #6.
 - .3 Terminal cabinets, control panels: size #5.
 - .3 Equipment elsewhere: sizes as appropriate.

2.03 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.04 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive plastic-coated cloth with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from Departmental Representative.
 - .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC

Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT

2.05 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.06 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.07 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.08 LANGUAGE

- .1 Identification in English.
- .2 Use one nameplate and label.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 TIMING

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.03 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

3.04 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.

- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.05 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.06 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.07 FIELD QUALITY CONTROL

- .1 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.

3.08 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

1.01 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.

1.02 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 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.

1.03 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.

1.04 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.05 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.

1.06 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.07 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.

1.08 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.

1.09 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 Fire, smoke, volume control dampers installed and open.
- .6 Coil fins combed, clean.
- .7 Access doors, installed, closed.
- .8 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.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 5 %, minus 5 %.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format in accordance with referenced standard.

- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent TAB standards of AABC.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.
- .5 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.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.

END OF SECTION

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1 General

1.01 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 C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .3 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .4 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .5 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .6 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal 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.
 - .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
 - .5 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.

1.02 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.03 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

2.01 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.02 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.

2.03 ELASTOMERIC CELLULAR THERMAL DUCT LINER

- .1 Manufacturers:
 - .1 Armacell AP Armaflex Sheets
 - .2 Other acceptable manufacturers offering equivalent products.
- .2 Insulation: Flexible, closed-cell elastomeric insulation in sheet form meeting ASTM C 534,
 - .1 'ksi' ('K') value : ASTM C177, 0.039 at 24 degrees C (0.27 at 75 degrees F).
 - .2 Maximum service temperature: 105 degrees C (220 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C423,
 - .1 0.35 for 32 mm (1-1/4 inches) thickness
- .3 Elastomeric Foam Adhesive
 - .1 Manufacturers:

- .1 Armstrong 520 adhesive.
- .2 Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

- .1 Lagging adhesive: compatible with insulation.

2.05 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .5 Contact adhesive: quick-setting
- .6 Tie wire: 1.5 mm stainless steel.
- .7 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .8 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face of insulation.
- .9 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

3 Execution

3.01 APPLICATION

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

3.02 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.03 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 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.

3.04 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	None.	No	32
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Supply, return and exhaust ducts exposed in space being served	none		
Acoustically lined ducts	none	No	32

.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:

TIAC Code		
	Rectangular	Round
Indoor, concealed	none	none

3.05 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.02 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, 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 C335-17, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C411-17, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .3 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .4 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 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-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.03 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.

1.04 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.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
- .5 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.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.05 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.

1.06 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.

2 Products

2.01 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.02 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.
 - .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.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.

2.03 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.

2.04 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.05 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 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.

3.03 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.04 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 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.

Applica-tion	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)										
Domestic	[A-1]	25	25	25	38	38	38						

HWS														
Domestic CWS	[A-3]	25	25	25	25	25	25							

- .5 Finishes:
 - .1 Concealed, indoors: canvas on valves, fittings. No further finish.
 - .2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .3 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.05 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.

3.06 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

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1 General

1.01 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
 - .1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.

1.02 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 [metal ducts] 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 Saskatchewan, Canada.
- .4 Test and Evaluation Reports:
 - .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.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect metal ducts from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

2 Products

2.01 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

- .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 and water tight with sealant. Longitudinal seams unsealed. Ensure economical and quiet performance of system.
 - .4 Unsealed seams and joints.

2.02 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.

2.03 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: short radius with single thickness turning vanes.
 - .2 Round: smooth radius, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with 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 As indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.04 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Fire stopping material and installation must not distort duct.

2.05 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA .

2.06 HANGERS AND SUPPORTS

- .1 Hangers and Supports:.
 - .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 SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA or the following table, which ever is more stringent:

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.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct 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.

3.02 GENERAL

- .1 Do work in accordance with SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.03 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.04 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA.
- .2 Prior to application, ductwork to be dry and free of grease, etc.
- .3 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.
- .4 Use 6mm bead of material along joints. Material, when dry, to have 3.2mm depth extending 25mm on each side of joint or seam.
- .5 Sealant shall be inspected by the departmental representative prior to insulating of ductwork. Any defects, if any, shall be remedied at no additional cost to the owner.

3.05 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.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.02 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 air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Instrument test ports.

1.03 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: 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.02 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

2.03 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

- .2 Gaskets: neoprene.
- .3 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks complete with safety chain
 - .2 Hold open devices.

2.04 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories 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.

3.02 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air VAVs.
 - .2 Inlets and outlets of exhaust air fans.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Locations:
 - .1 Control dampers.
- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.

- .3 Install insulation port extensions as required.
- .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.

3.03 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.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.02 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 dampers and include product characteristics, performance criteria, physical size, finish and limitations.

1.03 CLOSEOUT SUBMITTALS

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

1.04 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: 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 GENERAL

- .1 Manufacture to SMACNA standards.

2.02 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.
- .3 Locking quadrant.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

3.02 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 Departmental Representative.

3.03 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.

END OF SECTION

1 General

1.01 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S112, Standard Test Method of Fire Test of Fire Damper Assemblies.
 - .2 CAN/ULC-S112.2, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
 - .3 ULC-S505, Standard for Fusible Links for Fire Protection Service.

1.02 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 [fire and smoke dampers] and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Smoke dampers.
 - .3 Fire stop flaps.
 - .4 Operators.
 - .5 Fusible links.
 - .6 Design details of break-away joints.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.03 CLOSEOUT SUBMITTALS

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

1.04 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.05 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: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect fire dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B, listed ULC, meet requirements of authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
 - .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
 - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Top hinged: offset single damper, round or square; multi-blade hinged interlocking type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 Retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damper HVAC and in manufacturer's instructions for fire dampers shall be followed.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 INSTALLATION

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Co-ordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

3.03 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.

END OF SECTION

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1 General

1.01 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 2005.
- .4 Underwriters' Laboratories (UL)
 - .1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S110, Standard Methods of Tests for Air Ducts.

1.02 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 flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.

1.03 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: 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, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

2 Products

2.01 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.

2.02 NON-METALLIC - UNINSULATED

- .1 Non-collapsible, coated mineral base fabric type, mechanically bonded to, and helically supported by, external steel wire.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for flexible ducts installation in accordance with manufacturer's written instructions.

3.02 DUCT INSTALLATION

- .1 Install in accordance with: SMACNA
- .2 Maximum installed length: One continuous length at 1500 mm (5'-0"). Use standard sheetmetal elbows at drop points to outlets.

3.03 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.

END OF SECTION

1 General

1.01 REFERENCES

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .2 International Organization of Standardization (ISO)
 - .1 ISO 3741-2010, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-18, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .4 Underwriter's Laboratories (UL)
 - .1 UL 181-2005(R2008), Factory-Made Air Ducts and Air Connectors.

2 Products

2.01 VARIABLE VOLUME BOXES

- .1 Pressure independent reset to air flow between minimum and maximum air volume. Low Pressure bypass to direct excess air flow to ceiling plenum.
- .2 Controls Contractor shall verify site conditions prior to providing any equipment or controls shop drawings.
- .3 Sizes, capacities, differential pressures and sound ratings: as indicated.
- .4 Differential pressure not to exceed 25 Pa at inlet air velocity of 10 m/s.
- .5 Complete with:
 - .1 Operator and controller: connect into existing controls system.
 - .2 Sound attenuator: 4 foot in length.
 - .3 Multiport outlet adapter: as indicated.
- .6 Minimum 35 kPa reset span.
- .7 Adjustable reset start point.
- .8 Casing: constructed of galvanized steel, internally lined with 25 mm, 0.7 kg density fibrous glass, to UL181 and NFPA 90A. Mount control components inside protective metal shroud.
- .9 Damper: 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.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air terminal units installation in accordance with manufacturer's written instructions.

3.02 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.

3.03 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.

END OF SECTION

1 General

1.01 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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.02 MAINTENANCE MATERIAL SUBMITTALS

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

1.03 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: 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, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 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.

2.02 GENERAL

- .1 To meet capacity, as scheduled.
- .2 Frames:

- .1 Full perimeter gaskets.
- .2 Countersunk screwholes.
- .3 Colour: Pre-finished white.

2.03 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.04 DIFFUSERS

- .1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.
- .2 Type S-, S-2 and S-3: steel, square plaque type, having fixed pattern, lay-in mounted. Finish: white.

2.05 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 Type R-1 and R-2: Aluminum, 19 mm border, 25 x 25 mm egg crate type face bars. Finish: baked enamel, white.
- .2 Type R-3: Steel, 19 mm border, single blade 45 degrees deflection, horizontal face bars. Finish: baked enamel, white.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.

3.02 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.

3.03 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.

END OF SECTION

1 General

1.01 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
 - .1 Start-up testing and verification of systems.
 - .2 Check out demonstration or proper operation of components.
 - .3 On-site operational tests.

1.02 DEFINITIONS

- .1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
- .2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - .1 Outage of main power supply in excess of back-up power sources, provided that:
 - .1 Automatic initiation of back-up was accomplished.
 - .2 Automatic shut-down and re-start of components was as specified.
 - .2 Failure of communications link, provided that:
 - .1 Controller automatically and correctly operated in stand-alone mode.
 - .2 Failure was not due to failure of any specified EMCS equipment.
 - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
 - .1 System recorded said fault.
 - .2 Equipment defaulted to fail-safe mode.
 - .3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.03 DESIGN REQUIREMENTS

- .1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.
- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01330 - Submittal Procedures.
- .2 Final Report: submit report to Departmental Representative.
 - .1 Include measurements, final settings and certified test results.
 - .2 Bear signature of commissioning technician and supervisor

- .3 Report format to be approved by Departmental Representative before commissioning is started.
- .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals.
- .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.05 CLOSEOUT SUBMITTALS

- .1 Provide documentation, O M Manuals, and training of O M personnel for review of Departmental Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.06 COMMISSIONING

- .1 Do commissioning in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.
- .2 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative.
- .3 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:
 - .1 Location and part of system to be tested or commissioned.
 - .2 Testing/commissioning procedures, anticipated results.
 - .3 Names of testing/commissioning personnel.
- .4 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.
- .5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .6 Load system with project software.
- .7 Perform tests as required.

1.07 COMPLETION OF COMMISSIONING

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.08 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

2 Products

2.01 EQUIPMENT

- .1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

- .2 Instrumentation accuracy tolerances : higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.
- .4 Locations to be approved, readily accessible and readable.
- .5 Application: to conform to normal industry standards.

3 Execution

3.01 PROCEDURES

- .1 Test each system independently and then in unison with other related systems.
- .2 Commission each system using procedures prescribed by the Departmental Representative .
- .3 Commission integrated systems using procedures prescribed by Departmental Representative.
- .4 Debug system software.
- .5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.02 FIELD QUALITY CONTROL

- .1 Pre-Installation Testing.
 - .1 General: consists of field tests of equipment just prior to installation.
 - .2 Testing may be on site or at Contractor's premises as approved by Departmental Representative .
 - .3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.
 - .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
 - .5 Additional instruments to include:
 - .1 DP transmitters.
 - .2 VAV supply duct SP transmitters.
 - .3 DP switches used for dirty filter indication and fan status.
 - .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.
 - .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.
 - .8 Departmental Representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".
 - .9 Transmitters above 0.5% error will be rejected.

- .10 DP switches to open and close within 2% of setpoint.
- .2 Completion Testing.
 - .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
 - .2 Include following activities:
 - .1 Test and calibrate field hardware including stand-alone capability of each controller.
 - .2 Verify each A-to-D convertor.
 - .3 Test and calibrate each AI using calibrated digital instruments.
 - .4 Test each DI to ensure proper settings and switching contacts.
 - .5 Test each DO to ensure proper operation and lag time.
 - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
 - .7 Test operating software.
 - .8 Test application software and provide samples of logs and commands.
 - .9 Verify each CDL including energy optimization programs.
 - .10 Debug software.
 - .11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
 - .12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. This document will be used in final startup testing.
 - .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative provide:
 - .1 Technical personnel capable of re-calibrating field hardware and modifying software.
 - .2 Detailed daily schedule showing items to be tested and personnel available.
 - .3 Departmental Representative's acceptance signature to be on executive and applications programs.
 - .4 Commissioning to commence during final startup testing.
 - .5 O M personnel to assist in commissioning procedures as part of training.
 - .6 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.
 - .7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
 - .8 Operate systems as long as necessary to commission entire project.
 - .9 Monitor progress and keep detailed records of activities and results.
 - .4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
 - .1 Tests to include:
 - .1 Demonstration of correct operation of monitored and controlled points.

- .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
- .2 System will be accepted when:
 - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
 - .2 Requirements of Contract have been met.
- .3 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .4 Correct defects when they occur and before resuming tests.
- .5 Departmental Representative to verify reported results.

3.03 ADJUSTING

- .1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.04 DEMONSTRATION

- .1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00 - Demonstration and Training.

END OF SECTION

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1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

1.02 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.

1.03 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.

1.04 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 25character 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.

1.05 SYSTEM DESCRIPTION

- .1 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
 - .1 Extending the existing Prairie Controls EMCS.
 - .2 Relocating/reprogramming existing controls components as required.
 - .3 Building Controllers.
 - .4 Control devices as listed in I/O point summary tables.
 - .5 Data communications equipment necessary to effect EMCS data transmission system.
 - .6 Field control devices.
 - .7 Software/Hardware complete with full documentation.
 - .8 Extending/updating existing user graphical interface.
 - .9 Complete operating and maintenance manuals.
 - .10 Training of personnel.
 - .11 Acceptance tests, technical support during commissioning, full documentation.
 - .12 Wiring interface co-ordination of equipment supplied by others.
 - .13 Miscellaneous work as specified in these sections and as indicated.
- .2 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of new and existing 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 Metric references: in accordance with CAN/CSA Z234.1.
- .3 Language Operating Requirements:
 - .1 Provide English operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.

- .3 Operating system executive: provide primary hardware-to-software interface with associated documentation to be in English.
- .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
- .5 Include, in English:
 - .1 Input and output commands and messages from operator-initiated functions, field related changes, alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
 - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in both languages.
 - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.06 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make 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 Submit for review:
 - .1 Equipment list with systems manufacturers.
 - .2 List existing field control devices to be re-used.

1.07 QUALITY ASSURANCE

- .1 Ensure qualified supervisory personnel continuously direct and monitor Work.

1.08 EXISTING- CONTROL COMPONENTS

- .1 Utilize existing control wiring piping where applicable.
- .2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.
 - .1 Do not modify original design of existing devices without written permission from Departmental Representative.
 - .2 Provide for new, properly designed device where re-usability of components is uncertain.
- .3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
 - .1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.
 - .2 Failure to produce test report will constitute acceptance of existing devices by contractor.
- .4 Non-functioning items:

- .1 Provide with report specification sheets or written functional requirements to support findings.
- .2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.
- .5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.
 - .1 Be responsible for items repaired or replaced by Departmental Representative.
 - .2 Be responsible for repair costs due to negligence or abuse of equipment.
 - .3 Responsibility for existing devices terminates upon final acceptance of applicable portions of EMCS as approved by Departmental Representative.
- .7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

2 Products

2.01 EQUIPMENT

- .1 Provide necessary controls equipment as required to extend/complete the existing Prairie Controls EMCS.

2.02 ADAPTORS

- .1 Provide adaptors between metric and imperial components.

3 Execution

3.01 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation: to manufacturer's recommendations.

3.02 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.

3.03 FIELD QUALITY CONTROL

- .1 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.

END OF SECTION

1 General

1.01 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.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1-15, The Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations.

1.03 DEFINITIONS

- .1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.04 SYSTEM DESCRIPTION

- .1 Language Operating Requirements: provide identification for control items in English.

1.05 ACTION AND INFORMATIONAL 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

2.01 NAMEPLATES FOR PANELS

- .1 Identify by Plastic laminate, 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.

2.02 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by 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.

2.03 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.

2.04 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.

2.05 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.

2.06 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 during "Preliminary Design Review".

3 Execution

3.01 NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.02 EXISTING PANELS

- .1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

1 General

1.01 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).
- .2 References.
 - .1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.
 - .2 Canadian Standards Association (CSA International).
 - .1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings.

1.02 DEFINITIONS

- .1 BC(s) - Building Controller(s).
- .2 OWS - Operator Work Station.
- .3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit detailed preventative maintenance schedule for system components to Departmental Representative.
- .3 Submit detailed inspection reports to Departmental Representative.
- .4 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:
 - .1 Point name and location.
 - .2 Device type and range.
 - .3 Measured value.
 - .4 System displayed value.
 - .5 Calibration detail
 - .6 Indication if adjustment required,
 - .7 Other action taken or recommended.
- .5 Submit network analysis report showing results with detailed recommendations to correct problems found.
- .6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Maintain records and logs of each maintenance task on site.
 - .2 Organize cumulative records for each major component and for entire EMCS chronologically.
 - .3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

- .7 Revise and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.04 MAINTENANCE SERVICE DURING WARRANTY PERIOD

- .1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.
- .2 Emergency Service Calls:
 - .1 Initiate service calls when EMCS is not functioning correctly.
 - .2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
 - .3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.
 - .4 Service personnel to be on site ready to service EMCS within 2 hours after receiving request for service.
 - .5 Perform Work continuously until EMCS restored to reliable operating condition.
- .3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.
- .4 Work requests: record each service call request, when received separately on approved form and include:
 - .1 Serial number identifying component involved.
 - .2 Location, date and time call received.
 - .3 Nature of trouble.
 - .4 Names of personnel assigned.
 - .5 Instructions of work to be done.
 - .6 Amount and nature of materials used.
 - .7 Time and date work started.
 - .8 Time and date of completion.
- .5 Provide system modifications in writing.
 - .1 No system modification, including operating parameters and control settings, to be made without prior written approval of Departmental Representative.

2 Products

2.01 NOT USED

- .1 Not Used.

3 Execution

3.01 FIELD QUALITY CONTROL

- .1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Departmental Representative as described in Submittal article.

- .2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.
- .3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:
 - .1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
 - .2 Check and Calibrate each field input/output device in accordance with Canada Labour Code - Part I.
 - .3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.
- .4 Minor inspections to include, but not limited to:
 - .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
 - .2 Check equipment cooling fans as required.
 - .3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.
 - .4 Review system performance with Departmental Representative to discuss suggested or required changes.
- .5 Major inspections to include, but not limited to:
 - .1 Minor inspection.
 - .2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
 - .3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
 - .4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.
 - .5 Provide mechanical adjustments, and necessary maintenance on printers.
 - .6 Run system software diagnostics as required.
 - .7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.
 - .1 Perform network analysis and provide report as described in Submittal article.
- .6 Rectify deficiencies revealed by maintenance inspections and environmental checks.
- .7 Continue system debugging and optimization.
- .8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.
 - .1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

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1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for building automation controllers including:
 - .1 Local Control Unit (LCU).
 - .2 Equipment Control Unit (ECU).
 - .3 Terminal Control Unit (TCU).

1.02 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/doccentre/mechanical/me214-e.pdf>

1.03 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.04 DESCRIPTION

- .1 General: Existing network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be extended 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.

1.05 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 5amps 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.

1.06 ACTION AND INFORMATIONAL 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.

1.07 MAINTENANCE

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

2 Products

2.01 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.

2.02 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.
 - .5 Controller to connect into and fully integrate with existing EMCS.

2.03 POINT NAME SUPPORT

- .1 Controllers (MCU, LCU) to support PWGSC point naming convention as defined in Section 25 05 01 - EMCS: General Requirements. Integrate with existing.

3 Execution

3.01 LOCATION

- .1 Location of Controllers to be approved by Departmental Representative.

3.02 INSTALLATION

- .1 Install Controllers in secure locking enclosures as directed by Departmental Representative.
- .2 Provide necessary power from local 120V 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

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1 General

1.01 SUMMARY

- .1 Section Includes:
 - .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): sensors, controls, switches, low voltage current transformers.

1.02 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-C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

1.03 DEFINITIONS

- .1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.05 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.
- .3 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

2 Products

2.01 GENERAL

- .1 Control devices of each category to be of same type and manufacturer (match existing).
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight 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 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.

2.02 TEMPERATURE SENSORS

- .1 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.
 - .2 Room temperature sensors.
 - .1 Wall mounting, in slotted type covers having brushed aluminum, with guard.
 - .2 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.

2.03 ELECTROMECHANICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.
 - .2 Coils: rated for 120V AC/24V DC. Other voltage: provide transformer.
 - .3 Contacts: rated at 5 amps at 120 V AC.
 - .4 Relay to have visual status indication

2.04 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.

2.05 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.

2.06 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.

2.07 PANELS

- .1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

- .2 Multiple panels as required 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.

2.08 WIRING

- .1 In accordance with Section 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.
 - .2 Analog input and output: shielded #18 minimum solid copper.

3 Execution

3.01 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, 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 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
 - .3 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.
 - .4 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.

3.02 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.

3.03 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.

3.04 IDENTIFICATION

- .1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.05 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

END OF SECTION

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1 General

1.01 SEQUENCING

- .1 Variable Air Volume Terminal Unit – Bypass Configuration (Temperature only)
 - .1 Dual temperature thermostat set at 19-24 degrees C (66-75 degrees F) maintains constant space temperature by modulating variable volume damper operator during the day and 8 degrees C (15 degrees F) during night setback.
 - .1 Alarms shall be provided as follows:
 - .1 High zone temp: If zone temperature is higher than heating setpoint by a user definable amount.
 - .2 Low zone temp: If zone temperature is less than heating setpoint by a user definable amount.
 - .2 Variable Air Volume Terminal Unit – Bypass Configuration (Temperature and CO2)
 - .1 Dual temperature thermostat set at 19-24 degrees C (66-75 degrees F) maintains constant space temperature by modulating variable volume damper operator during the day and 8 degrees C (15 degrees F) during night setback.
 - .2 When in occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations, overriding the normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).
 - .1 Alarms shall be provided as follows:
 - .1 High zone temp: If zone temperature is higher than heating setpoint by a user definable amount.
 - .2 Low zone temp: If zone temperature is less than heating setpoint by a user definable amount.
 - .3 High zone CO2 concentration: If zone CO2 concentration is greater than 1000 ppm (adj.)
 - .3 Photocopier and kitchenette Inline Transfer Air Fan
 - .1 Transfer air fan shall run continuously during occupied hours.
 - .2 The controller shall monitor the fan status.
 - .1 Alarms shall be provided as follows:
 - .1 Fan Failure: Commanded on, but the status is off.
 - .2 Fan in Hand: Commanded off, but the status is on.
 - .4 Telecom Room Inline Transfer Air Fan
 - .1 Thermostat shall be set to 30 Degrees C (86 Degrees F)
 - .1 If space temperature rises above setpoint, transfer fan shall be energized. Fan shall be de-energized once space temperature setpoint is reached.
 - .2 The controller shall monitor the fan status.
 - .1 Alarms shall be provided as follows:
 - .1 Fan Failure: Commanded on, but the status is off.
 - .2 Fan in Hand: Commanded off, but the status is on.

.5 Perimeter Force Flow Units

- .1 Units shall operate based on existing controls sequence. (relocation of thermostats only)

2 Products

2.01 NOT USED

- .1 Not Used.

3 Execution

3.01 NOT USED

- .1 Not Used.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Definitions:
 - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Reference Standards:
 - .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2
 - .3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Certificates:
 - .1 Provide CSA certified equipment.
 - .2 Where CSA certified equipment is not available, submit such equipment to inspection authorities for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for lighting, lighting controls, fire alarm, access control, and intrusion alarm for incorporation into manual.
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
 - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
 - .4 Post instructions where directed.
 - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
 - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.04 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: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English.

2.02 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.03 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with mechanical specifications and drawings.

2.04 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Decal signs, minimum size 175 x 250 mm.

2.05 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.06 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [_____]" as directed by Departmental Representative.

- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.

2.07 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.08 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
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

3 Execution

3.01 EXAMINATION

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

3.02 INSTALLATION

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

3.03 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.04 CONDUIT AND CABLE INSTALLATION

- .1 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.05 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.06 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.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm to top edge.
 - .2 Wall receptacles:
 - .1 General: 400 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 Telephone and data outlets: 400 mm.
 - .4 Fire alarm stations: 1200 mm to top edge.
 - .5 Fire alarm horn/strobe: 2100 mm.

3.07 FIELD QUALITY CONTROL

- .1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .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 Systems: fire alarm.
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Check resistance to ground before energizing.
- .2 Carry out tests in presence of Departmental Representative.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.08 SYSTEM STARTUP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

3.09 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.

END OF SECTION

1 General

1.01 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

1.03 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: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for aluminum sheathed cable and flexible conduit as required to: CAN/CSA-C22.2 No.18.

3 Execution

3.01 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
- .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

3.02 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.

END OF SECTION

1 Products

1.01 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.

1.02 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Connectors: anti short connectors.

1.03 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath : thermoplastic jacket, and armour of closely wound aluminum wire.

2 Execution

2.01 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

2.02 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

2.03 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

2.04 WIRING METHODS

- .1 Concealed Dry Interior Locations: Use only building wire in raceway. Armoured cabling may be used for individual drops to equipment and devices only.
- .2 Exposed Dry Interior Locations: Use only building wire in raceway.
- .3 Above Accessible Ceilings: Use only building wire in raceway. Armoured cabling may be used for individual drops to equipment and devices only.

2.05 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.

2.06 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

1 General

1.01 REFERENCES

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.04 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: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 EQUIPMENT

- .1 Grounding conductors: bare stranded copper.
- .2 Insulated grounding conductors: green, copper conductors.
- .3 Ground bus: copper complete with insulated supports, fastenings, connectors.

3 Execution

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.

3.02 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both 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 Bond single conductor, metallic armoured cables to cabinet at supply end.

3.03 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.04 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.05 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.06 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.07 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.

END OF SECTION

1 General

1.01 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.01 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

3 Execution

3.01 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .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 900mm 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

1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 22nd Edition.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

2 Products

2.01 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat turned edge covers.
- .4 All covers for junction and pull boxes with a dimension larger than 250mm shall have hinged covers.

3 Execution

3.01 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.02 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 22nd Edition.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

2 Products

2.01 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

2.02 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished walls.

2.03 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

3 Execution

3.01 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003). Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

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

2 Products

2.01 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

2.02 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 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 900mm on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.03 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Set-screws connectors and couplings for EMT.

2.04 FISH CORD

- .1 Polypropylene.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Use electrical metallic tubing (EMT).
- .4 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures, and work in movable metal partitions.
- .5 Minimum conduit size for lighting and power circuits: 21 mm.
- .6 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Install fish cord in empty conduits.
- .9 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .10 Dry conduits out before installing wire.

3.03 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.04 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.

3.05 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

1 General

1.01 SECTION INCLUDES

- .1 Wall switches.
- .2 Wall dimmers.
- .3 Receptacles.
- .4 Device plates and decorative box covers.
- .5 Floor box service fittings.

1.02 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.
 - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.03 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 wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.04 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: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 Products

2.01 WALL SWITCHES

- .1 General-use snap switch:
 - .1 Grade: Commercial Specification Grade CSA-C22.2 No. 111

- .2 Style: White decora.
- .3 Device Body: White nylon toggle.
- .4 Ratings: single pole, double pole, three-way, four-way match branch circuit and load characteristics. Amperage rating shall be marked on body of switch.
- .5 Terminal holes approved for No. 10 AWG wire.
- .6 Silver alloy contacts.
- .7 Urea or melamine moulding for parts subject to carbon tracking.
- .8 Suitable for back and side wiring.
- .2 Sensor switch:
 - .1 Grade: Commercial Specification Grade CSA-C22.2 No. 111
 - .2 Description: Push button on/off with integral dual tech motion sensor.
 - .3 Body and Handle: White with push button control.
 - .4 Voltage: 120 volts.
 - .5 Power Rating: Match load as required for circuits controlled.
- .3 Sensor dimmer witch:
 - .1 Grade: Commercial Specification Grade CSA-C22.2 No. 184.1
 - .2 Description: Push button dimmer with integral dual tech motion sensor.
 - .3 Body and Handle: White with push button control.
 - .4 Voltage: 120 volts.
 - .5 Power Rating: Match load as required for circuits controlled.
- .4 Room lighting controller:
 - .1 Grade: Commercial Specification Grade CSA-C22.2 No. 184.1
 - .2 Style: Graphical wall pod
 - .3 Description: Full color touch screen with On/Off/Dim controls, scene setting, multi-zone control.
 - .4 Color: White
 - .5 Voltage: 24 volts.
 - .6 Relay power packs: as required.
 - .7 Programming: user programmable.
- .5 Switches of one manufacturer throughout project.

2.02 CEILING SENSOR

- .1 Occupancy sensor:
 - .1 Description: Ceiling/surface mount small motion 360° coverage dual tech occupancy sensor.
 - .2 Color: White
 - .3 Voltage: 24 volts.
 - .4 Relay power packs: as required.
 - .5 Configuration: wire with room lighting controller to function as one unit.

2.03 RECEPTACLES

- .1 Duplex receptacles with following features:
 - .1 Configuration: Type as specified and indicated.

- .1 General: CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42
- .2 20A: CSA type 5-20R, 125V, 20 A, U ground to CSA C22.2 No. 42.
- .3 GFCI: Duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements complete with steady-on "Green-Power-On" and steady-on "Red-Power-Tripped Off" LED indicator lights.
- .2 Specification grade.
- .3 White urea moulded housing.
- .4 Suitable for No. 10 AWG for back and side wiring.
- .5 Break-off links for use as split receptacles.
- .6 Eight back wired entrances, four side wiring screws.
- .7 Triple wipe contacts and rivetted grounding contacts.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

2.04 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

2.05 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

2.06 FLOOR BOX

- .1 Overfloor Raceway:
 - .1 System: Provide surface raceway systems for branch circuit and data network voice, video and other low-voltage wiring. Surface raceway system shall consist of raceway bases, covers, pre-divided raceway bases, appropriate fittings and device mounting plates necessary for a complete installation.
 - .2 Configuration: Raceways shall be multi-piece design with metal base and screw-on metal covers. Assembled base and cover is 7" [178mm] wide by 1/2" [13mm] high. Height of assembled base and cover increases from 0" at edge to 1/2" with a slope of no less than 1:2. Base shall have 4 wiring channels, separated by 3 integral dividers. Base shall be suitable for mounting directly to bare concrete or floor coverings.
 - .3 Fittings: Fittings shall include flat, internal and external elbows, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Where required, provide tamper-resistant form, dividable with barriers and matching the size of the accompanying raceway base. Provide full capacity corner elbows and tee fittings to maintain a controlled 2" [51mm] cable bend radius, meeting the specification for Fiber Optic and UTP cabling and exceeding the TIA/EIA-569-A requirements for communications pathways.
 - .4 Device Brackets and Plates: Provide in sizes to match raceway width and with mounting holes located to ensure proper mounting of devices in up to 4 compartments. Device plates shall be available in any length from 6" to 60" [152mm to 1524mm], with cutouts to accommodate various combinations of power and communications devices in up to 4 compartments. Provide 6" and

- 12" [152mm and 305mm] long device plates with a flange to overlap the joint of adjacent cover as applicable.
- .5 Communications Devices and Accessories: Raceway shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 6) and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.
 - .6 Raceway and system components shall be UL and CUL listed.
 - .7 Surface raceways shall be suitable for use in dry interior locations only.

3 Execution

3.01 INSTALLATION

- .1 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .3 Install GFI type receptacles as indicated.
 - .4 Do not install devices back-to-back in wall.
- .2 Floor box:
 - .1 Strictly comply with manufacturer's installation instructions and recommendations and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.
 - .2 Mechanical Security: Raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.
 - .3 Electrical Security: Metal raceway shall be electrically continuous and bonded in accordance with the National Electric Code for proper grounding.
 - .4 Accessories: Provide accessories as required for a complete installation, including insulated bushings and inserts where required by manufacturer.
 - .5 Unused Openings: Close unused raceway openings using manufacturer's recommended accessories.
- .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .4 Label:
 - .1 Label all electrical devices with its circuit number.

3.02 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.

3.03 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

1 General

1.01 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4-02(R2007), Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 Underwriters' Laboratories of Canada (ULC)

1.02 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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials 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 Divert unused metal materials from landfill to metal recycling facility.
- .4 Disposal and recycling of fluorescent lamps as per local regulations.
- .5 Disposal of old PCB filled ballasts.

2 Products

2.01 LED LUMINAIRES AND DRIVERS

- .1 All Luminaires
 - .1 Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
 - .2 Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.

- .3 LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
- .4 LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
- .5 LED luminaires shall deliver a minimum of 60 lumens per watt.
 - .1 LED's shall be "Bin No. 1" quality.
- .6 Drivers shall be solid state and accept 120 VAC at 60 Hz input.
- .7 The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
- .8 LED color temperatures: CRI 85, 3500K as noted +/- 275K.
- .9 Luminaires shall have internal thermal protection.
- .10 Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
- .11 Color spatial uniformity shall be within .004 of CIE 1976 diagram.
- .12 Color maintenance over rated life shall be within .007 of CIE 1976.
- .13 Indoor luminaires shall have a minimum CRI of 85.
- .14 Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
- .15 LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
- .16 Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
- .2 Power Supplies and Drivers
 - .1 Power Factor: 0.90 or higher
 - .2 Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
 - .3 Output operating frequency: 60Hz.
 - .4 Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
 - .5 Total Harmonic Distortion Rating: 20% Maximum.
 - .6 Meet electrical and thermal conditions as described in LM-80 Section 5.0.
 - .7 Primary Current: Confirm primary current with Drawings.
 - .8 Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
 - .9 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
 - .10 Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.
- .3 Controller and Control System
 - .1 System electronics driver / controller to use coordinated communication protocols: 0-10V, or proprietary as required.
 - .2 The Contractor to ensure that external control equipment is compatible with LED control requirements

- .3 Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
- .4 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers

2.02 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.03 LUMINAIRES

- .1 As indicated in drawing or approved equal.

3 Execution

3.01 INSTALLATION

- .1 Locate, relocate, and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

3.02 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install flexible or rigid conduit for luminaires as indicated.

3.03 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.04 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.05 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
 - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2006, Life Safety Code.

1.02 ACTION AND INFORMATIONAL 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 Products

2.01 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: satin aluminum enamel finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: LED.
- .5 Pictogram.
- .6 Face plate to remain captive for relamping.
- .7 Supply voltage: 120 V, ac.
- .8 Operating time: 30 minimum.
- .9 Recharge time: 12 hours
- .10 Battery: sealed, maintenance free.
- .11 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .12 Solid state transfer circuit.
- .13 Signal lights: solid state, for 'AC Power ON' condition.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

3.03 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

1 General

1.01 ACTION AND INFORMATIONAL SUBMITTALS

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

2 Products

2.01 SYSTEM DESCRIPTION

- .1 Telecommunications raceways system consists of outlet boxes, cover plates, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, and service fittings.
- .2 Overhead cable tray distribution system.

2.02 MATERIAL

- .1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Cable trays: BASKET TRAY
 - .1 Description: CSA-22.2 No. 126.1, Nema 12C continuous rigid welded steel wire mesh cable management system.
 - .2 Material: Carbon Steel Wire complete with Electroplated Zinc Plating
 - .3 Inside Width: 305 mm(12 inches)
 - .4 Inside Depth: 102 mm(4 inches)
 - .5 Manufacturer's standard couplings, clamps, hangers, stabilizers, end caps, brackets, wall brackets, splice plates, reducer plates, blind ends, connectors, floor supports, rung caps, cable drop outs, and grounding straps.
 - .6 Cable drop outs, at all vertical cable transition areas.
 - .7 Barrier Strips where indicated.
 - .8 Covers and Bottom Inserts: Solid, where indicated.
- .3 Indoor service poles: provided by others.
- .4 Smoke & Acoustical Pathway:
 - .1 Description: The smoke and acoustical pathway shall contain a built-in sealing system and shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall acoustical materials. The pathway shall provide an achievable STC rating of greater than or equal to the STC rating of the specific underlying construction.
 - .2 Material: Flame Retardant Polypropylene with Low Smoke Silicone Seal.
 - .3 Pathway adjusts to accommodate wall and floor thicknesses between 4" (102 mm) & 8" (203 mm)
 - .4 Total Cable Loading Area: minimum 9000mm²(14 inch²) unless otherwise specified.
 - .5 Single-gang and Multi-gang mounting hardware as required.
- .5 Fire Rated Pathway:

- .1 Description: The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479) & CAN/ULC-S115.
- .2 Material: Galvanized steel.
- .3 Pathway adjusts to accommodate wall and floor thicknesses between 4" (102 mm) & 8" (203 mm)
- .4 Total Cable Loading Area: minimum 9000mm²(14 inch²) unless otherwise specified.
- .5 Single-gang and Multi-gang mounting hardware as required.
- .6 Fish wire: polypropylene type.

3 Execution

3.01 INSTALLATION

- .1 Modify and extend existing raceway system, including overhead distribution system, fish wire, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.

3.02 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.

3.03 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

Approved: 2006-09-30

1 General

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-568-B.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - .2 TIA/EIA-568-B.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - .3 TIA/EIA-568-B.3-(2000), Optical Fiber Cabling Components Standard.
 - .4 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.

2 Products

- .1 Not in contract

3 Execution

3.01 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

- .1 Not in contract

3.02 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

- .1 Not in contract

END OF SECTION

1 General

1.01 REFERENCES

- .1 ICES-003 (Industry Canada): Interference-Causing Equipment Standard.
- .2 IEC 60065: Standard for Audio, Video and Similar Electronic Apparatus – Safety Requirements.
- .3 UL 1310: Standard for Class 2 Power Units.
- .4 UL 2043: Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; 1996
- .5 UL 6500: Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use.

1.02 SUBMITTALS

- .1 Product Data: Submit for each system component specified.
 - .1 Manufacturer Instructions: Provide manufacturer's manuals for installation, startup and commissioning.
 - .2 Shop Drawings: Provide the system design on an architectural floor plan showing the quantity, type and location of components, cabling and accessories.
 - .3 Compliance Statement: Provide a signed document from an executive officer of the supplier stating that the system as proposed meets the Design and Performance Requirements.

1.03 CLOSEOUT SUBMITTALS

- .1 Warranty Documentation. Provide warranty documentation, with start date(s) and service contact(s).
- .2 Record Documentation: Provide the as-built system design on an architectural floor plan showing the quantity, type and location of components, cabling and accessories.
- .3 System Reports:
 - .1 Provide reports in electronic form.
 - .2 Report an inventory of electronic system components, including model number, serial number, and firmware version.
 - .3 Report the verified quantity of speakers installed per local control zone.
 - .4 Report all system settings.
 - .5 Report testing and commissioning data.
 - .1 System Settings Backup: Provide an electronic backup file of all system settings.
- .4 Security Items:
 - .1 Provide one set of keys for each locked equipment enclosure.
 - .2 Provide passwords to access control functions for hardware and software user interfaces.

1.04 QUALITY ASSURANCE

- .1 Obtain required permits.

- .2 Follow applicable codes, including regulatory testing and certifications.
- .3 Source all sound masking equipment from a single supplier.
- .4 Have the system designed by an authorized manufacturer representative.
- .5 Ensure supplementary materials meet applicable standards.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Protect equipment from moisture during shipping, storage and handling.
- .2 Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels legible and intact.
- .3 Inspect manufacturer's packages upon receipt.
- .4 Handle packages carefully.

1.06 WARRANTY

- .1 Provide a written product warranty covering sound masking components for defects in parts or assembly for a 5-year period from date of system startup.
- .2 Provide a written 1-year installation warranty.

2 Products (performance specification)

2.01 REGULATORY TESTING AND CERTIFICATIONS

- .1 Safety and Electrical: IEC 60065
- .2 Electromagnetic Interference (EMI): ICES-003
- .3 Low Voltage Power Supplies: UL 1310

2.02 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 System Architecture
 - .1 Provide a networked-decentralized system with addressable masking devices installed alongside the loudspeakers throughout the system area.
- .2 System Design
 - .1 Design system in accordance with manufacturer's specifications.
 - .2 Design local control zones based on:
 - .1 Drawing plan ES2.1 with all loudspeakers in one (1) zone.
- .3 System Control
 - .1 Provide digital controls for all system settings.
 - .2 Provide a networked user interface for controlling and reviewing all system settings.
- .4 Masking Sound Generation
 - .1 Provide a sound masking generator for each local control zone.
 - .2 Provide a random masking sound generator. Alternatively, provide a pseudo-random generator with a cycle exceeding 24 hours and no noticeable repetitive pattern.
- .5 Sound Masking Control

- .1 Provide each local control zone with independent control over the sound masking signal, including:
 - .1 An equalizer with at least 21 third-octave bands from 100 to 10,000 Hz.
 - .2 A volume control with 0.5 dBA increments over a range of 35 to 85 dBA, measured at a distance of one meter.
- .6 System Diagnostics
 - .1 Include the capability of identifying masking devices that are not functioning.
- .7 System Reporting
 - .1 Provide a user interface for reading and displaying all current system settings.
 - .2 Include the ability to generate detailed reports of all system settings.
- .8 Physical and Electronic Security
 - .1 House below-ceiling electronic components in a locked metal enclosure.
 - .2 Password protect access to system control functions.
 - .3 Allow all settings to be backed up to an electronic storage medium.

3 Execution

3.01 EXAMINATION

- .1 Ensure that the site is at a stage suitable for the system installation.
- .2 Ensure that the site is constructed according to plans including wall locations, ceiling types and plenum barriers.
- .3 Ensure planned power sources have been provided.
- .4 Ensure planned space is available for centrally located components.
- .5 Ensure third-party components interfacing with the system have been provided.

3.02 INSTALLATION

- .1 Follow manufacturer's installation manual.
- .2 Follow the system design for location of system components and wiring.
- .3 Record any necessary changes to the system design on the plan.

3.03 SITE QUALITY CONTROL

- .1 Ensure plenum height meets manufacturer's minimum specifications.
- .2 Ensure the distance between the top of the loudspeaker and the deck meets manufacturer's minimum specifications.
- .3 Suspend loudspeakers in a level manner.
- .4 Minimize obstructions to loudspeakers.
- .5 Support cables properly in the ceiling.
- .6 Securely terminate cables.

3.04 SYSTEM STARTUP AND COMMISSIONING

- .1 Commissioning requirements
 - .1 The commissioning agent who is the manufacturer representative schedules functional tests through general contractor and subcontractor. Under the supervision of the commissioning agent, the installing subcontractor performs the hardware and/or software manipulations required for the testing. The consultant may be present to witness, owner maintenance staff may also be present in order to assist in system observations.
 - .2 Section 01 91 13 – General Commissioning Requirements
 - .3 Section 01 91 33 – Commissioning Forms
 - .4 Commissioning form sample attached.
- .2 Follow manufacturer's manuals for system startup.
- .3 Follow manufacturer's manuals for configuration of system, according to Owner requirements, including timer, audio, occupant controls, diagnostic, and security functions.
- .4 Commission the sound masking system with
 - .1 Ceilings fully installed,
 - .2 All furnishings in place,
 - .3 Mechanical systems operating at normal daytime levels,
 - .4 No occupant noise during measurements.
- .5 Select a commissioning location within each local control zone.
 - .1 Mark the commissioning location precisely on the as-built system design.
 - .2 Assign the commissioning location an alphanumeric ID.
- .6 Conduct third-octave sound level measurements:
 - .1 Use an ANSI Type 1 or 2 third-octave sound level analyzer.
 - .2 Set analyzer for A-weighted equivalent average level (Leq).
 - .3 Set analyzer for fast response.
 - .4 Hold the analyzer microphone oriented upwards at a height between 1.2 to 1.4 meters (4 to 4.7 feet) from the floor.
 - .5 Move the analyzer through a slow horizontal arc of at least 60 centimeters (2 feet) during the measurement period.
 - .6 Keep the analyzer at least 1 meter (3.3 feet) away from vertical or horizontal surfaces.
 - .7 Measure for at least 15 seconds.
- .7 Conduct a third-octave sound level measurement with the sound masking deactivated to document existing conditions at each commissioning location.
 - .1 Identify any third-octave band in existing conditions that exceeds the target band level for that location.
- .8 Adjust the sound masking at each commissioning location to conform to the sound masking curve and overall volume for that location, such that:
 - .1 The volume in each third-octave band from 100 Hz and 5000 Hz inclusive is within plus or minus two decibels (+/- 2 dB) of the target band level.
 - .1 Unless existing conditions exceed the maximum limit for the band.

- .2 The overall volume is within plus or minus one half decibel (+/- 0.5 dBA) of the overall volume.
 - .1 Unless existing conditions cause overall volume to exceed tolerances.
- .3 If the sound masking curve and overall volume requirements are not met at a commissioning location, modify the system design, installation or commissioning, at the supplier's expense, until conformance is achieved.
 - .1 Unless deviation can be shown to be due to existing conditions.
- .9 Provide an electronic report of testing and commissioning data, including:
 - .1 As-built system design(s) showing all commissioning locations with ID references and local control zones.
 - .2 A table and graph of commissioned sound masking measurements for each commissioning location, including:
 - .1 Third-octave levels for bands within the sound masking curve.
 - .2 Overall volume level.
 - .3 The sound masking curve, overall volume and tolerances specified for that location.
 - .3 Explanation of any sound masking measurements which exceed tolerances for the sound masking curve or overall volume with a table and graph of existing conditions measurements for each such commissioning location, including:
 - .1 Third-octave levels for bands within the sound masking curve.
 - .2 Overall volume level.

3.05 CLEANING AND WASTE MANAGEMENT

- .1 Remove empty packaging and other material waste.
- .2 Clean system components where required.

3.06 CLOSEOUT ACTIVITIES

- .1 Demonstrate operational system and train owner's representative in accordance with Section 01 79 00 – Demonstration & Training.
- .2 Review closeout submittals with Owner representative.
- .3 Review service and support contacts.

END OF SECTION

1 General

1.01 REFERENCES

- .1 Government of Canada
 - .1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
 - .2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-2001, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525-1999, Audible Signal Device for Fire Alarm Systems.
 - .3 CAN/ULC-S526-2002, Visual Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC-S527-1999, Control Units.
 - .5 CAN/ULC-S528-1991, Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC-S529-2002, Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S530-M1991, Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .8 CAN/ULC-S531-2002, Standard for Smoke Alarms.
 - .9 CAN/ULC-S536-S537-2004, Burglar and Fire Alarm Systems and Components.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Include:
 - .1 Layout of equipment.
 - .2 Zoning.
 - .3 Complete wiring diagram, including schematics of modules.
- .3 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
 - .2 Submit following:
 - .1 Manufacturer's Data for:
 - .1 Open-area smoke detectors.
 - .2 System wiring diagrams:

- .1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
- .3 Design data: Power Calculations:
 - .1 Submit design calculations for new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.
 - .2 Show comparison of detector power requirements per zone versus control panel smoke detector power output per zone in both standby and alarm modes.
 - .3 Show comparison of notification appliance circuit alarm power requirements with rated circuit power output.
- .4 Test Reports:
 - .1 Open-area 2-wire smoke detectors.
 - .2 Preliminary testing:
 - .1 Final acceptance testing.
 - .2 Submit for inspections and tests specified under Field Quality Control.

1.03 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in fire alarm system installations approved by manufacturer with minimum 5 year experience.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
- .3 System:
 - .1 To TB OSH Chapter 3-04.
 - .2 Subject to Fire Commissioner of Canada (FC) approval.
 - .3 Subject to FC inspection for final acceptance.

1.04 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 Products

2.01 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Visual signal devices: to CAN/ULC-S526.
- .3 Smoke detectors: to CAN/ULC-S529.

2.02 SYSTEM OPERATION

- .1 Maintain and extend existing FA system to accommodate revised architectural layouts.
- .2 Existing fire alarm control panel Notifier AM2020.

2.03 AUTOMATIC ALARM INITIATING DEVICES

- .1 Combination Fixed Temperature Rate-Of-Rise Detectors (Spot Type): designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections.
 - .1 Contacts: self-resetting after response to rate-of-rise actuation
 - .2 Operation under fixed temperature actuation to result in external indication.
 - .3 Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes to operate on fixed temperature principle only.
- .2 Mount detectors at underside of ceiling or deck above unless otherwise indicated.
- .3 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.
- .4 Provide detectors with terminal screw type connections.
- .5 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

2.04 VISUAL ALARM SIGNAL DEVICES

- .1 Flush-mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuits.
- .2 Appliances: minimum of 15 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location as shown.
- .3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12 mm high.
- .4 Provide visible appliances as indicated.
- .5 Visible appliances may be part of audio-visual assembly, where more than two appliances are located in same room or corridor.

2.05 CONDUIT

- .1 Electrical Metallic Tubing (EMT):

2.06 WIRING

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.
- .2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor
- .3 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.
- .4 Wire for connection to base telegraphic alarm loop: No. 12 AWG minimum solid copper conductor.
- .5 Insulation 90 degrees C minimum with nylon jacket.
- .6 Colour code wiring.

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.
- .2 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .3 Connect signalling circuits to main control panel.

3.03 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.
 - .2 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, smoke detectors transmit alarm to control panel and actuate general alarm.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
 - .4 Class A circuits.
 - .1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .5 Class B circuits.
 - .1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .3 Maintenance Manuals:
 - .1 All new equipment shall be added to building maintenance manuals including.
 - .1 Revised wiring schematics
 - .2 Equipment cut sheets

3.04 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