schoeler & heaton architects inc.

PARKS CANADA

FORT WELLINGTON VISITOR CENTRE PUBLIC WASHROOM UPGRADES

Fort Wellington National Historic Site
Prescott, Ontario

Re-issued for Tender

May 6th, 2019

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1 GENERAL

1.1 TAXES

.1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.2 FEES, PERMITS, AND CERTIFICATES

.1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.3 CONSTRUCTION PROGRESS SCHEDULE

.1 Submit to the Departmental Representative within 5 working days of Award of Contract bar chart construction schedule for work, indicating anticipated progress stages within Construction Time. When the Departmental Representative has reviewed schedule, take necessary measures to complete work within scheduled time. Do not change schedule without notifying the Departmental Representative.

.2 Schedule and execute work with least possible interference or disturbance to the normal use of premises and site.

.3 Submit schedule updates bi-weekly and, when requested by the Departmental Representative, due to changing project conditions. Provide a narrative explanation of necessary changes and schedule revisions at each update.

.4 Carry out Work during “regular hours” Monday to Friday between the hours of 8:00-16:00.

.5 Carry out weekend work after May 20th, 2019.

.6 Provide a minimum of 24 hours’ notice for work extending outside “regular” hours and Saturdays, Sundays and statutory holidays.

- .1 All workers performing work on-site outside of “regular” hours require a security clearance.
- .2 Comply with Municipal bylaws related to time limitations for noise generating work.

.7 Building will be occupied during “regular hours” for the duration of the project and open to visitors to the facility starting on May 18th, 2019.

- .1 The public will not have access to or through construction area.

1.4 REGULATORY REQUIREMENTS

.1 References and Codes:

- .1 Materials shall be new and work shall conform to the minimum applicable standards of the "References" indicated in the specification sections, the National Building Code of Canada 2015 (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

.2 Building Smoking Environment:
.1 Smoking is not permitted on all Federal Sites. Obey smoking restrictions on building property.

.3 Hazardous Material Discovery:
.1 Stop work immediately when material resembling spray or trowel-applied asbestos, Polychlorinated Biphenyl (PCB), mould or other designated substance or hazardous substance is encountered during demolition work.
.1 Take preventative measure and promptly notify the Departmental Representative.
.2 Do not proceed until written instructions have been received from the Departmental Representative.

1.5 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 Before welding, soldering, grinding and/or cutting work, obtain a permit as directed by the Departmental Representative. Store flammable liquids in approved CSA containers.
.2 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.
.3 "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.

1.6 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.

1.7 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 the Departmental Representative one week notice for work involving hazardous substances (Canada Labour Code Part II Section 10), and before painting, caulking, installing carpet or using adhesives and other materials, that cause off gassing.

1.8 TEMPORARY UTILITIES

.1 Existing services required for work, excluding power required for space temporary heating may be used by the Contractor without charge. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.

.2 Maximum power supply of 120 V, single phase, 60 Hz is available and will be provided at no cost. Connect to existing power supply in accordance with Canadian Electrical Code.

.3 Water Supply. Departmental Representative will provide continuous supply of potable water for construction use. Requests must be made to Departmental Representative 5 working days prior to use for every new or changed location.

.4 Notify the Departmental Representative and utility companies of intended interruption of services and obtain requisite permission.

.5 Give the Departmental Representative 5 working days' notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Keep duration of these interruptions to a minimum.

1.9 EXAMINATION and PREPARATION

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

.2 Before commencing work, establish location and extent of services lines in area of work and notify Departmental Representative of findings.

1.10 EXECUTION

.1 Cut, Patch and Make Good:
- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove all items so shown or specified.
- .3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.

1.11 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.

.2 On acceptance of cost breakdown and approved construction schedule submit estimated monthly cash flow for the duration of the work.

1.12 TEMPORARY HEATING AND VENTILATION

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

.4 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.5 Provide temporary heat and ventilation in enclosed areas as required to:
- .1 Facilitate progress and protect Work against dampness and cold.
- .2 Prevent moisture condensation on surfaces.
- .3 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .4 Provide adequate ventilation to meet health regulations for safe working environment.

.6 Maintain temperatures of minimum 10 degrees C where construction is in progress.

.7 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

.8 Permanent heating system of building not to be used unless written permission is provided from Departmental Representative. Be responsible for damage to heating system if use is permitted. Pay costs for maintaining temporary heat when using permanent heating system.

.9 On completion of Work for which permanent heating system is used, replace filters and clean all equipment, ductwork, and plenums to “as new” condition.

.10 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.

.11 Pay costs for maintaining temporary heat.

.12 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.

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

1.13 PRECEDENCE

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

2 PRODUCTS

2.1 NOT USED

.1 Not used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 ADMINISTRATIVE

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

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

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

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

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

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

.7 Verify field measurements and affected adjacent Work are coordinated.

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

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Prepare a shop drawing log and maintain the log during the complete construction period. Submit draft Shop Drawing log within 10 working days of contract award and update log weekly or more frequently as directed by Departmental Representative. Present updated log at each project meeting.

.2 Log to include a comprehensive schedule for the submission of all shop drawings required for the execution of the work. Provide for a review time by Departmental Representative for each submission as appropriate for construction element and as approved by Departmental Representative.

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

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

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

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

.7 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.

.8 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.

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

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

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

.12 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

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

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

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

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

.17 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

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

.19 Submit electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.20 Delete information not applicable to project.

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

.22 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, a marked up electronic 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.

.23 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

1.3 SAMPLES

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

.2 Deliver samples prepaid to Departmental Representative's business address.

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

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

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

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

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

1.4 MOCK-UPS

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

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

.1 Province of Ontario
- .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.O.1, as amended and O. Reg. 213/91 as amended - Updated 2017.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
- .1 Results of site specific safety hazard assessment.
- .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 – Submittal Procedures.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 working days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 working days after receipt of comments from Departmental Representative.

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

.9 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.

.10 Departmental Representative will provide details of on-site Contingency and Emergency Response Plan. Address standard operating procedures to be implemented during emergency situations as directed by Departmental Representative.

1.3 FILING OF NOTICE

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

.2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

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

1.6 GENERAL REQUIREMENTS

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

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

1.7 RESPONSIBILITY

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

.2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

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

1.8 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

1.9 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 of Ontario and advise Departmental Representative verbally and in writing.

1.10 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
   .1 Have site-related working experience specific to activities associated with hazardous materials as identified.

.2 Have working knowledge of occupational safety and health regulations.
.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
.5 Be on site during execution of Work.

1.11 POSTING OF DOCUMENTS

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

1.12 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.

1.13 POWDER ACTUATED DEVICES

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

1.14 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 PRODUCTS

2.1 NOT USED

.1 Not used.

3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 00 - Cleaning.

1.2 REFERENCE STANDARDS

.1 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.

1.3 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review Departmental Representative.

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

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

.5 Include in Environmental Protection Plan:

.1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan.

.2 Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from site.

.3 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations and OPSS.MUNI 805.

.4 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas,

structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.5 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.

.1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.7 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.10 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

1.5 FIRES

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

.2 Where fires or burning is permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved.

.1 Restore, clean and return to new condition stained or damaged work.

.3 Provide supervision, attendance and fire protection measures as directed.

1.6 DRAINAGE

.1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Provide temporary drainage and pumping required to keep excavations and site free from water.

.3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.

.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as indicated.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and if asked by Departmental Representative, encase with protective wood framework from grade level to height of 1 m minimum.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

1.8 WORK ADJACENT TO WATERWAYS

.1 N/A

1.9 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed.

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

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures where directed by Departmental Representative.

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

1.10 HISTORICAL/ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

.3 If archaeological features (i.e., structural remains and/or artifact concentrations) are encountered during construction activities, excavation should cease in the immediate area, and Parks Canada be informed.

1.11 NOTIFICATION

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

regulations, permits, and other elements of Contractor's Environmental Protection plan.

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

.1 Take action only after receipt of written approval by Departmental Representative.

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.

.3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 GENERAL

1.1 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative, unless indicated otherwise.

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

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

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

1.2 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.

1.3 PROCEDURES

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

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

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

1.4 REPORTS

.1 Submit electronic copy of inspection and test reports to Departmental Representative.

.2 Provide copy to subcontractor of work being inspected or tested, or manufacturer or fabricator of material being inspected or tested.

1.5 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

1.6 MOCK-UPS

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

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

.3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.

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

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

1.7 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.8 EQUIPMENT AND SYSTEMS

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

.2 Refer to appropriate specification sections for definitive requirements.

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)
- .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-S269.2-16, Access Scaffolding for Construction Purposes.
- .3 CAN/CSA-Z797-09 (R2014) - Code of Practice for Access Scaffold

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

.1 In areas indicated, prepare a site plan indicating location and dimensions of area to be fenced and used, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

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

.5 Remove from site all such work after use.

1.4 SITE STORAGE/LOADING

.1 Confine work and operations of employees to within “Limits of Site”. Do not unreasonably encumber premises with products.

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

1.5 CONSTRUCTION PARKING

.1 Parking will not be permitted within designated visitor parking.
- .1 Street parking is available.
- .2 Contractor to follow all street parking bylaws.

.2 Provide and maintain adequate access to project site.

.3 Clean roadways daily where used by Contractor's equipment.

1.6 OFFICES

.1 Locate all Contractor Site Offices and trailers within the Limits of the staging area as indicated.
- .1 If space outside the allotted staging area is required, Provide in writing to the Departmental Representative:
  - .1 a request to expand or relocates the site staging area.

.2 Site plan and dimensions of proposed location showing temporary facilities.
.3 Approval from departmental representative is required prior to locating offices or other site construction facilities outside of the indicated location.

.2 If providing a temporary Contractor's Site Office, provide per below:
.1 Inside dimensions minimum 15.2 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 operable windows and one lockable door.
.2 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
.3 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
.4 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.
.5 Provide private washroom facilities (one for each sex) adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
.6 Maintain in clean condition.
.7 Provide marked and fully stocked first-aid case in a readily available location.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.10 SANITARY FACILITIES

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

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

1.11 CONSTRUCTION SIGNAGE

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

.2 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.

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control: adequate to ensure safe operation at all times.

.11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

.12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.13 Provide snow removal during period of Work.

.14 Remove, upon completion of work, haul roads designated by Departmental Representative.

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

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

END OF SECTION

1 GENERAL

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 HOARDING

.1 Provide one lockable truck entrance gate and at least one pedestrian door in each hoarded area as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.2 Erect temporary site enclosure around the Limits of Site.
- .1 Staging area: : use 2.4 m high modular welded wire panel fencing with posts spaced at 2.4 m on centre.. Provide one lockable truck gate. Maintain fence in good repair.
- .2 Building site: use 2.4 m high modular welded wire panel fencing with posts spaced at 2.4 m on centre. Provide lockable truck gates as required to accommodate construction activities on site. Maintain fence in good repair.

.3 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRICADES

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

1.4 DUST TIGHT SCREENS

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

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

1.5 ACCESS TO SITE

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

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.8 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.

1.9 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

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

1.10 WASTE MANAGEMENT AND DISPOSAL

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

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

.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.

.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 born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality 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 any dispute 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.

1.3 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

1.4 TRANSPORTATION

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

.2 Unload, handle and store products supplied by Departmental Representative.

1.5 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 will establish course of action.

1.6 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.

1.7 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.8 CONCEALMENT

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

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

1.9 REMEDIAL WORK

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

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

1.10 LOCATION OF FIXTURES

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

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

1.11 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.

1.12 FASTENINGS - EQUIPMENT

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

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

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

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

1.13 PROTECTION OF WORK IN PROGRESS

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

1.14 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, to occupants of adjacent buildings and to pedestrian and vehicular traffic.

.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.

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 ACTION AND 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.

1.2 MATERIALS

.1 Required for original installation.

1.3 PREPARATION

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

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

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

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

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

1.4 EXECUTION

.1 Execute cutting, fitting, and patching, including excavation and fill, to complete Work.

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

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

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

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

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

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 CLEANING

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

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

.3 Clear snow and ice from access to building and from staging area and access road and remove from site.

.4 Do not burn waste materials on site.

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

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

.7 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.

.8 Dispose of waste materials and debris at designated dumping areas off site.

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

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

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

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

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

1.2 FINAL CLEANING

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

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

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

.4 Remove waste products and debris other than that caused by Departmental Representative.

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

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

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

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

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

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

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

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

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to sanitary condition; replace filters of mechanical equipment.

.18 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.19 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 WASTE MANAGEMENT GOALS

.1 Departmental Representative's waste management goal: to divert a minimum 85 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced. 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.

.3 Protect environment and prevent environmental pollution damage.

1.2 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.

1.3 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 A, B, and E completed for project.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Waste management to be carried as a line item in the Cost Breakdown, and to be billed against as work progresses. Detailed submittals will be required as back-up.

.3 Prepare and submit following prior to project start-up:
- .1 1 electronic copy of completed Waste Audit (WA)
- .2 1 electronic copy of completed Waste Reduction Workplan (WRW)
- .3 1 electronic copy of Cost/Revenue Analysis Workplan (CRAW)
- .4 1 electronic copy of Waste Source Separation Program (WSSP).

.4 Submit prior to final payment the following:
- .1 Waste Diversion Report, indicating final quantities in tones 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.
- .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.5 WASTE AUDIT (WA)

.1 Contractor to prepare WA 20 working days after contract award.

.2 WA provides detailed inventory, estimated quantities and types of waste materials that will be generated as well as their potential to be reused and/or recycled and project's waste diversion goals and objectives.

.3 After award of contract, contractor to review WA and confirm that anticipated quantities of waste generated are accurate and goals achievable.

.4 If after review, contractor determines that indicated quantities or opportunities in WA are not accurate or achievable, contractor to provide written details of discrepancies and revised quantities for areas of concern. Contractor to meet with Departmental Representative to review and justify revisions.

.5 Post on-site WA where contractor and sub-contractors are able to review content.

1.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare and submit WRW 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.
- .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 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.

1.7 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Prepare CRAW 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.

1.8 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 sub-contractors and workers in handling and separation of materials for reuse and/or recycling.

.7 Locate separated materials in areas which minimizes material damage.

.8 Clearly and securely label containers to identify types/conditions of materials accepted and assist sub-contractors and workers 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 unless authorized in writing by Departmental Representative and provided that site safety regulations and security requirements are adhered to.

1.9 USE OF SITE AND FACILITIES

.1 Execute Work with minimal interference and disturbance to normal use of premises.

.2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

1.10 WASTE PROCESSING SITES

.1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.11 QUALITY ASSURANCE

.1 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.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect structural components not removed and salvaged materials from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

.7 Protect surface drainage, mechanical and electrical from damage and blockage.

.8 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.9 Separate and store materials produced during project in designated areas.

.10 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.

1.13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

.3 Keep records of construction waste including:
- .1 Number and size of bins.
- .2 Waste type of each bin.
- .3 Total tonnage generated.
- .4 Tonnage reused or recycled.
- .5 Reused or recycled waste destination.

.4 Remove materials on-site as Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.14 SCHEDULING

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

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 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.

3.2 CLEANING

.1 Progress 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .2 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

.1 Separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
- .1 Mark containers or stockpile areas.
- .2 Provide instruction on disposal practices.

.2 On-site sale of salvaged materials is not permitted.

3.4 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.

3.5 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA)

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

3.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste	(4) Actual Reused Amount (units) Projected	(5) Actual Recycled Amount (units) Projected	(6) Material Destination
Wood and Plastics					
Off-cuts					
Warped					
Pallet					
Forms					
Plastic Packaging					
Cardboard Packaging					
Other					

3.7 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					
Other					
		(7) Cost (-) / Revenue (+)		$	$

3.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

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

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

END OF SECTION

1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, two draft copies of operating and maintenance manuals in English.

.3 Make revisions to operating and maintenance manuals as per comments provided by Departmental Representative. Submit 4 final copies of operating and maintenance manuals in English and one electronic copy each in English.

.4 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.5 Provide evidence, if requested, for type, source and quality of products supplied.

1.2 FORMAT

.1 Organize data as instructional manual.

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

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

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

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

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

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

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

1.3 CONTENTS - PROJECT RECORD DOCUMENTS

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

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

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

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

.5 Typewritten Text: as required to supplement product data.
- .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 appropriate Specification Sections.

1.4 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to 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.
- .1 Do not use record documents for construction purposes.

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

1.5 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.2 Record information concurrently with construction progress.
- .1 Do not conceal Work until required information is recorded.

.3 Contract Drawings and shop drawings: mark each item to record actual construction, including:
- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.

.5 Changes made by change orders.
.6 Details not on original Contract Drawings.
.7 Referenced Standards to related shop drawings and modifications.

.4 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.

.5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, and other documentation required by individual specifications sections.

.6 Provide digital photos, if requested, for site records.

1.6 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system 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.

.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 Contractor's co-ordination drawings, with installed colour coded piping diagrams.

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

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

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning (Cx) Requirements.

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

1.7 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .1 Provide information for re-ordering custom manufactured products.

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

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

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

1.8 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.
- .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 completion.

.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.
- .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 completion.

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

1.9 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 for review by Departmental Representative.

1.10 WARRANTIES

.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 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 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.

.6 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 fire protection, alarm systems, sprinkler systems, and lightning protection 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 4 and 9 month post-construction warranty inspections.
.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.

.7 Respond in timely manner to oral or written notification of required construction warranty repair work.

1.11 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.

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection.

.2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.

.3 Preparation:

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

.2 Verify designated personnel are present.

.3 Ensure equipment has been inspected and put into operation in accordance with manufacturer’s recommendations.

.4 Ensure testing, adjusting, and balancing have been performed in accordance with Section 01 91 13- General Commissioning (CX) Requirements and equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, times, at the agreed upon date and time for all new mechanical equipment and control systems.

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

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

.4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

.5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:

.1 Provide one (1) 4 hour training sessions for plumbing fixtures. Coordinate with Departmental Representative for time, location and date. Training must be done after the first bathroom substantial completion.

.2 Provide one (1) 4 hour training sessions for all other pieces of equipment including electrical equipment and exhaust fans.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 10 - General Requirements.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

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

.4 Give time and date of each demonstration, with list of persons present.

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

1.3 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

.1 Instruct Owner's personnel.

.2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

.2 Acronyms:

.1 AFD - Alternate Forms of Delivery, service provider.

.2 BMM - Building Management Manual.

.3 CX - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 O&M - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 CX is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. CX is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff. Provide 1hr of bilingual training for each exhaust fan.

.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.

.4 AFD managed projects the term Departmental Representative in CX specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

.1 CX to be a line item of Contractor's cost breakdown.

.2 Provide CX for each space including, without limitation, exhaust fans, plumbing fixtures, light fixtures.

.3 CX activities supplement field quality and testing procedures described in relevant technical sections.

.4 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 include transfer of critical knowledge to facility operational personnel.

.5 Departmental Representative will issue Interim Acceptance Certificate when:

.1 Completed CX documentation has been received, reviewed for suitability and approved by Departmental Representative.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during CX, correct deficiencies, re-verify equipment and components within the functional 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 done by Contractor.

1.5 FACTORY ACCEPTANCE TEST

.1 N/A.

1.6 PRE-CX REVIEW

.1 Before Construction:

.1 Review Contract Documents, confirm by writing to Departmental Representative:

.1 Adequacy of provisions for CX.

.2 Aspects of design and installation pertinent to success of CX.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for CX.

.3 Before start of CX:

.1 Have up-to-date CX Plan completed.

.2 Ensure installation of related components, equipment, sub-systems, and systems are 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.

1.7 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 00 10- General Instructions:

.1 Submit no later than 4 weeks after award of Contract:

.1 Name of Contractor's CX agent.

.2 Draft CX documentation.

.3 Preliminary CX schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of CX.

.3 Submit proposed CX procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of CX.

.4 Provide additional documentation relating to CX process required by Departmental Representative.

1.9 COMMISSIONING DOCUMENTATION

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

.2 Departmental Representative to review and approve CX documentation.

.3 Provide completed and approved CX documentation to Departmental Representative.

1.10 COMMISSIONING SCHEDULE

.1 Provide detailed CX schedule as part of construction schedule. Provide bar GANTT chart within two weeks of kick off meeting outlining the intended commencement and completion of commissioning.

.2 Provide adequate time for CX activities prescribed in technical sections and commissioning sections including:

.1 Approval of CX reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.11 COMMISSIONING MEETINGS

.1 Convene CX meetings following project meetings as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to CX.

.3 At 60% 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.

.4 Thereafter CX meetings to be held until project completion and as required during equipment start-up and functional testing period.

.5 Contractor must assume separate CX activites for each washroom.

.6 Meeting will be chaired by Contractor, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent CX meetings and as required.

1.12 STARTING AND TESTING

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

1.13 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days’ notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Contractor's CX Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and CX.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document requires tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by 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 (Commissioning Brief)

.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.

.6 Performance testing by factory ARI testing.

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 PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify Departmental Representative at least 21 days prior to start of CX.

.2 Start CX after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out CX:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 CX procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

.1 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 EXTENT OF VERIFICATION

.1 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.

.2 Perform additional commissioning until results are acceptable to Departmental Representative.

1.24 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fails to receive Departmental Representative's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.25 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.

1.26 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.

1.27 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.

1.28 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.

1.29 TRAINING

.1 In accordance with Section 01 79 00 Demonstration and Training.

1.30 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.31 OCCUPANCY

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

1.32 INSTALLED INSTRUMENTATION

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

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.33 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.34 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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.2 National Fire Protection Association (NFPA)

.1 NFPA-13-02, Installation of Sprinkler Systems Handbook.

.2 NFPA-14-02, Automatic Sprinkler Systems Handbook.

.3 NFPA-20-03, Standard for the Installation of Stationary Fire Pumps for Fire Protection.

.3 Public Works and Government Services Canada (PSPC)

.1 PSPC - Commissioning Guidelines CP.4 -3rd edition-03.

.4 Underwriters' Laboratories of Canada (ULC)

1.3 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 O&M personnel have been fully trained in aspects of installed systems.

.3 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O&M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.

.2 BMM - Building Management Manual.

.3 EMCS - Energy Monitoring and Control Systems.

.4 MSDS - Material Safety Data Sheets.

.5 PI - Product Information.

.6 PV - Performance Verification.

.7 TAB - Testing, Adjusting and Balancing.

.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Consultant 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 BGIS 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.

.2 Consultant 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.

.3 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 PSPC Cx Manager for administrative and coordination purposes.

.4 Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

.5 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.

1.5 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 Changes to EMCS control strategies beyond level of training provided to O& M personnel.

.7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 1 month prior to starting date of Cx for review and approval.

1.6 EXTENT OF CX

.1 Commission mechanical systems and associated equipment:

.1 Plumbing systems:

.1 Domestic CWS and HWS.

.2 Regular sanitary waste systems.

.3 Plumbing fixtures and piping accessories

.2 HVAC and exhaust systems:

.1 Bathroom exhaust systems and related systems

.2 Fire dampers

.3 Fire and life safety systems:

.1 Wet pipe sprinkler systems.

.4 Seismic restraint and control measures.

.1 Seismic bracing

.5 EMCS:

.1 EMCS

.2 Commission electrical systems and equipment:

.1 Fire alarm systems.

.2 Low voltage below 750 V:

.1 Low voltage equipment.

.2 Low voltage distribution systems.

.3 Lighting systems:

.1 Lighting equipment.

.2 Distribution systems.

.3 Emergency lighting systems, including battery packs.

.4 Fire exit emergency signage.

.4 Other systems and equipment:

.1 Door operators

1.7 DELIVERABLES RELATING TO O& M PERSPECTIVES

.1 General requirements:

.1 Compile Bilingual documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.
.2 Project record documentation.
.3 Inventory of spare parts, special tools and maintenance materials.
.4 Maintenance Management System (MMS) identification system used.
.5 WHMIS information.
.6 MSDS data sheets.
.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.8 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 Training Plans.
.10 Cx Reports.
.11 Prescribed activities during warranty period.

.4 Consultant to witness and certify tests and reports of results provided to Departmental Representative.

.5 Departmental Representative to participate.

1.9 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:

.3 Consultant 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.

.2 Use procedures modified generic procedures to suit project requirements.

.3 Consultant to witness and certify reported results using approved PI and PV forms.

.4 Consultant to approve completed PV reports and provide to Departmental Representative.

.5 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.10 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section01 91 33- Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.11 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.

1.12 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.

1.13 CX SCHEDULES

.1 Prepare detailed Cx Schedule and submit to Consultant 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 Cx procedures: 1 month after award of contract.

.3 Cx Report format: 1 month after contract award.

.4 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.5 Identification of deferred Cx.

.6 Implementation of training plans.

.7 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

1.14 CX REPORTS

.1 Include completed and certified PV reports in properly formatted Cx Reports.

.2 Before reports are accepted, reported results to be subject to verification by Consultant.

1.15 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:

.1 Fine tuning of HVAC systems.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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Part 1 General

1.1 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.

1.2 PRODUCT INFORMATION (PI) REPORT FORMS

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

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.3 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and Departmental Representative's approval.

1.4 SAMPLES OF COMMISSIONING FORMS

.1 Contractor to provide commissioning forms for review.

.2 Revise items on Commissioning forms to suit project requirements.

.3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.5 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.

1.6 LANGUAGE

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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1 GENERAL

1.1 REFERENCE STANDARDS

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

.2 National Research Council Canada (NRC)
- .1 National Building Code of Canada 2015 (NBC).
- .2 National Fire Code of Canada 2015 (NFC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .1 Construction Waste Management:
  - .1 Submit detailed project Waste Reduction Workplan in accordance with Section 01 74 19 – Waste Management and Disposal highlighting recycling and salvage requirements.

.2 Submit pre-demolition audit and deconstruction / disassembly plan prior to starting work.

.3 Before proceeding with demolition of load bearing walls or other walls and where required by authority having jurisdiction, submit for review by Departmental Representative shoring and underpinning drawings prepared by Qualified Professional Engineer registered or licensed in the Province of Ontario, showing proposed method.

1.3 QUALITY ASSURANCE

.1 Ensure Work is performed in compliance with CSA S350 and applicable provincial regulations.

.2 Prior to start of Work arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work.

.3 Notify Departmental Representative before disrupting building access or services.

.4 Submit pre-demolition audit and deconstruction / disassembly plan prior to starting work.

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

.6 Divert excess materials from landfill to site approved by Departmental Representative.

1.4 SITE CONDITIONS

.1 Review "Designated Substance Report" and take precautions to protect environment

.2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
- .1 Proceed only after receipt of written instructions have been received. Refer to Section 01

35 29.06 – Health and Safety Requirements.

.3 Remove, protect and store salvaged items as directed by Departmental Representative.

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

.5 Turn over to owner items as indicated below but not limited to:
.1 Barrier free door actuators and operators.

2 PRODUCTS

2.1 NOT USED

.1 Not used.

3 EXECUTION

3.1 EXAMINATION

.1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing construction zone in operating condition.

3.2 PREPARATION

.1 Protection of In-Place Conditions:
.1 Prevent movement, settlement, or damage to adjacent rooms, utilities, and adjacent walls to remain in place. Provide bracing and shoring as required.
.2 Protect building systems, services and equipment.
.3 Provide temporary dust screens, covers, railings, supports and other protection as required.
.4 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Removal of portions of concrete slab:
.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
.2 Protect adjacent joints and load transfer devices.
.3 Protect underlying and adjacent granular materials.
.2 Remove parts of existing building as indicated to permit new construction.
.3 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.3 REMOVAL FROM SITE

.1 Transport material designated for alternate disposal to approved facilities, or receiving organizations listed in waste reduction workplan and in accordance with applicable regulations.

Do not deviate from facilities or receiving organizations listed in waste reduction workplan without prior written authorization from Departmental Representative.

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

3.3 CLEANING

.1 Progress 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 Refer to drawings and specifications for items to be salvaged for reuse.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Waste Management and Disposal.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-place Concrete.

1.2 REFERENCE STANDARDS

.1 American Concrete Institute (ACI)
- .1 SP-66-04, ACI Detailing Manual 2004.

.2 ASTM International
- .1 AASHTO M 32M/M 32-09 (R2013), Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .2 AASHTO M 55M/M 55-09 (R2013), Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .3 ASTM A 143/A 143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
- .4 ASTM A 775/A 775M-17, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

.3 CSA International
- .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete, Includes Update No. 1 (2015).
- .2 CAN/CSA-A23.3-14, Design of Concrete Structures.
- .3 CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement, Includes Update No. 1 (2012).
- .4 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
- .5 CAN/CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .6 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)
- .1 RSIC, Reinforcing Steel Manual of Standard Practice (2009).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in the province of Ontario, Canada.
  - .1 Indicate placing of reinforcement and:
    - .1 Bar bending details.

.2 Lists.
.3 Quantities of reinforcement.
.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

1.4 QUALITY ASSURANCE

.1 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 – Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

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

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Cold-drawn annealed steel wire ties: to AASHTO M 32M/M 32-09.

.5 Deformed steel wire for concrete reinforcement: to AASHTO M 32M/M 32-09.

.6 Welded steel wire fabric: to AASHTO M 55M/M 55-09.
.1 Provide in flat sheets only.

.7 Welded deformed steel wire fabric: to AASHTO M 55M/M 32-09
.1 Provide in flat sheets only.

.8 Epoxy Coating of non-prestressed reinforcement: to ASTM A 775/A 775M.

.9 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating [610] g/m².
- .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
- .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
  - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
- .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
  - .1 In this case, no restriction applies to temperature of solution.
- .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
  - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.10 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.11 Mechanical splices: subject to approval of Departmental Representative.

.12 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

Ship epoxy coated bars in accordance with ASTM A 775A/A 775M.

3 EXECUTION

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.
- .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by

Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel in accordance with CSA-A23.1/A23.2.

.2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Protect epoxy coated portions of bars with covering during transportation and handling.

3.4 FIELD TOUCH-UP

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

3.5 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 35 00 – Concrete Finishing

1.3 REFERENCE STANDARDS

.3 ASTM International
- .1 ASTM C 260/C 260M-10a (2016), Standard Specification for Air-Entraining Admixtures for Concrete.
- .2 ASTM C 309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C 494/C 494M-17, Standard Specification for Chemical Admixtures for Concrete.
- .4 ASTM C 1017/C 1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .5 ASTM D 1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.4 CSA International
- .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete, Includes Update No. 1 (2015).
- .2 CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories, Includes Update No. 1 (2007).
- .3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014), Update No. 3 (2014), Update No. 4 (2016).

1.4 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
- .1 Type GU, GUb and GUL - General use cement.
- .2 Type MS and MSb - Moderate sulphate-resistant cement.
- .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
- .4 Type HE, HEb and HEL - High early-strength cement.
- .5 Type LH, LHb and LHL - Low heat of hydration cement.
- .6 Type HS and HSb - High sulphate-resistant cement.

.2 Fly ash:
- .1 Type F - with CaO content less than 15%.
- .2 Type CI - with CaO content ranging from 15 to 20%.
- .3 Type CH - with CaO greater than 20%.

.3 GGBFS - Ground, granulated blast-furnace slag.

1.4 CERTIFICATES

.1 Provide certification that mix proportions selected will produce concrete of specified quality and that yield strength will comply with CAN/CSA-A23.1, Clause 4.4.6.

.2 Provide certification that plant, equipment and materials to be used in concrete comply with the requirements of CAN/CSA-A23.1.

1.5 QUALITY ASSURANCE

.1 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:
  .1 Concrete hauling time: deliver to site of Work and discharged within [120] minutes maximum after batching.
    .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative [laboratory representative] and concrete producer as described in CSA A23.1/A23.2.
    .2 Deviations to be submitted for review by Departmental Representative.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate a cleaning area for tools to limit water use and run-off and initiate a waste reduction workplan.

.4 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.5 Choose least harmful, appropriate cleaning method which will perform adequately.

2 PRODUCTS

2.1 DESIGN CRITERIA

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

.1 Portland Cement: to CSA A3001, Type GU.

.2 Water: to [CSA A23.1].

.3 Premoulded joint filler: Bituminous impregnated fibreboard; to ASTM D 1751

.4 Sealer: Proprietary poly-siloxane resin blend

.5 Other concrete materials to CSA A23.1/A23.2

.6 Polyethylene film: 0.381 mm thickness to CAN/CGSB-51.34.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
- .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
- .2 Provide concrete mix to meet following hard state requirements:
  - .1 Durability and class of exposure: N.
  - .2 Compressive strength at 28 day age: 35Mpa minimum.
  - .3 Intended application: Interior slab on grade patches: N.
  - .4 Aggregate size 20mm maximum.
- .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

3 EXECUTION

3.1 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete.
- .1 Provide 24 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:
- .1 Development of cold joints not allowed.
- .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
- .1 Place steel dowels and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.

.11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/ APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Finishing and curing:
- .1 Finish concrete to CSA A23.1/A23.2.
- .2 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces.
- .4 Provide scratch finish where floor tile is to be applied.
- .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.3 Joint fillers:
- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
- .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .3 Locate and form isolation, construction and expansion joints as indicated.
- .4 Install joint filler.
- .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.4 Dampproof membrane:
- .1 Install dampproof membrane under concrete slabs-on-grade inside building.
- .2 Lap dampproof membrane minimum 150 mm at joints and seal.
- .3 Seal punctures in dampproof membrane before placing concrete.
- .4 Use patching material at least 150mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1

3.4 FIELD QUALITY CONTROL

.2 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .1 Concrete pours.
- .2 Slump.
- .3 Air content.
- .4 Compressive strength at 7 and 28 days.
- .5 Air and concrete temperature.

.3 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.

.4 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.

.5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

3.5 CLEANING

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

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
- .2 Provide appropriate area on job site where concrete trucks and be safely washed.
- .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
- .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
- .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
- .7 Dispose of waste in accordance with applicable local, Provincial and National regulations.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete.

.2 Section 07 92 00 – Joint Sealants.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM).
- .1 ASTM C779/C779M-12. Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
- .2 ASTM D2047-17. Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

.2 CSA International
- .1 CAN/CSA-A23.1-09/A23.2-09 (R2014), Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete, Includes Update No. 1 (2011).

.3 National Floor Safety Institute (NFSI).
- .1 NFSI Test Method 101-A. Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

.4 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.

1.3 SYSTEM DESCRIPTION

.1 Proprietary materials and application processes for a dry system of finishing and polishing concrete floors. Process is to result in a smoothed, polished and densified concrete floor slab to create a polished and hardened surface that is durable, dustproof, reflective, impervious and slip resistant. System is to use Non-film forming compounds.

.2 Provide a range of systems classified as Medium gloss, High Gloss and Very High gloss. Gloss level to be determined by degree of polishing.

1.4 DESIGN REQUIREMENTS

.1 Performance Requirements.
- .1 Abrasion Resistance: to ASTM C779. Method A. High resistance, no more than 0.20 mm wear in 30 minutes.
- .2 Co-efficient of Friction: to ASTM D2047. rated as non-slip. Minimum: 0.5. Static co-efficient of Friction: Wet, Minimum 0.6.
- .3 Traction Rating: to NFSI 101-A, non-slip properties. High traction.
- .4 Reflectivity: increase of 35% for Medium gloss system, 60% for High gloss system or 80% for Very High gloss system as measured by standard gloss meter.
- .5 Waterproof Properties: 70% or greater reduction in absorption.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
  - .1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.
  - .2 Include application instructions for concrete floor treatment.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting:
- .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.

.2 Electrical power:
- .1 Provide sufficient electrical power to operate equipment normally used during construction.

.3 Work area:
- .1 Make work area water tight protected against rain and detrimental weather conditions.

.4 Temperature:
- .1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

.5 Moisture:
- .1 Ensure concrete substrate is within moisture limits prescribed by manufacturer.

.6 Safety:
- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:
- .1 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.
- .2 Provide continuous ventilation during and after coating application.

1.5 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.

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

2 PRODUCTS

2.1 MATERIALS

.1 Provide all concrete finishing components and materials are from single manufacturer.

.2 Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe.

.3 Hardener, Sealer, Densifier: Proprietary silicate based system. Water based, odourless liquid, Zero VOC. Environmentally safe chemical hardening solution leaving no surface fil

.4 Joint Sealant: control and expansion joint filler: semi-rigid, 2-component, self-levelling, 100% solids, rapid curing, polyurethane sealant. Minimum hardness: Shore A 80.

.5 Floor Sealer: oil repellent. Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odour. VOC compliant and compatible with chemically hardened floors.

.6 Finish: Medium gloss system (800 grit).
- .1 Matching existing polished concrete system.

3 EXECUTION

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and elevations are as recommended by manufacturer's written instruction].

3.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

.3 Scrub floor with machine scrubber capable of high pressure water application equipped with black scrubber pads. Apply cleaner and mechanically scrub entire area without squeegee or vacuum. On second pass remove soap / water solution. Rinse and repeat as necessary to remove all traces of soap residue and to obtain clean and uniform surface.

.4 Do work in accordance with Section 01 35 29.06 - Health and Safety Requirements.

3.3 APPLICATION

.1 Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.

.2 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant in accordance with Section 07 92 00 – Joint Sealants.

.3 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.4 Clean over spray. Clean sealant from adjacent surfaces.

3.4 CLEANING

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

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

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

3.5 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 – Miscellaneous Rough Carpentry.

.2 Section 06 40 00 – Architectural Wood Work

.3 Section 09 91 23 - Interior Painting.

1.2 REFERENCE STANDARDS

.1 Aluminum Association (AA).
- .1 DAF 45-03. Designation System for Aluminum Finishes.

.2 ASTM International
- .1 ASTM A 53/A 53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A 307-14e1, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.3 CSA International
- .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
- .2 CAN/CSA G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA S16-14, Design of Steel Structures, Includes Update No. 1 (2016).
- .4 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).

.4 Underwriters Laboratories / EcoLogo Product Certification
- .1 UL 2768, Architectural Surface Coatings.
- .2 UL 2760, Surface Coatings - Recycled Water-borne.

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

.6 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

2 PRODUCTS

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.

.2 Steel pipe: to ASTM A 53/A 53M galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A 307. Provide bolts, washers, and nuts where indicated.

.6 Stainless steel tubing: to ASTM A 269, Type 302 seamless welded with AISI No. 4 finish.

.7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Weld connections where possible, otherwise bolt connections. Use self-tapping shake-proof oval headed screws on items requiring assembly by screws or as indicated. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour, and finish as base material on which they occur.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 Fabricate items to receive galvanized finish in largest practical sizes. Do not field weld galvanized items.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: MPI- INT 5.1B.

.4 Zinc primer: zinc rich, ready mix in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a.

2.4 ISOLATION COATING

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

2.5 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to CCD-047a.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

3 EXECUTION

3.1 EXAMINATION

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

3.2 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16 or Weld field connection.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
- .1 Primer: maximum VOC limit 250 g/L.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
- .1 Primer: maximum VOC limit 250 g/L.

3.9 CLEANING

.1 Progress 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 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

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

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 06 40 00 – Architectural Wood Work.

.3 Section 07 92 00 – Joint Sealants

.4 Section 08 11 00 – Flush Wood Doors.

.5 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 CSA International
- .1 CSA O112.9-10 (R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure), Includes Update No. 1 (2011).
- .2 CSA O121-17, Douglas Fir Plywood.
- .3 CAN/CSA O122-16, Structural Glued-Laminated Timber.
- .4 CSA O141-05 (R2014), Softwood Lumber.
- .5 CSA O151-17, Canadian Softwood Plywood.
- .6 CSA O153-13 (R2017), Poplar Plywood.
- .7 CSA O325-16, Construction Sheathing.
- .8 CAN/CSA-Z809-16, Sustainable Forest Management.

.2 National Lumber Grades Authority (NLGA)
- .1 Standard Grading Rules for Canadian Lumber 2017.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:
- .1 Wood Certification: submit vendor's or manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809.
- .2 Low-Emitting Materials:
  - .1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.
  - .2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 QUALITY ASSURANCE

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

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

.3 Sustainable Standards Certification:
- .1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

2 PRODUCTS

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

.1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Glued end-jointed (finger-jointed) lumber NLGA Special Products Standard (SPS), are acceptable for concealed applications.

.3 Glulam in accordance with Structural Glued-Laminated Timber CAN/CSA-O122.

.4 Structural Composite Lumber (SCL) in accordance with ASTM D 5456.

.5 Framing and board lumber: in accordance with National Building Code of Canada (NBC).

.6 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
- .1 S2S is acceptable for temporary and concealed work.
- .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.

.7 Douglas fir plywood (DFP): to CSA O121, standard construction.

.8 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.9 Poplar plywood (PP): to CSA O153, standard construction.

.10 Interior mat-formed wood particleboard: to ANSI/NPA 208.1.

.11 Mat-formed structural panelboards (OSB wafer): to CAN O437.

.12 Glass fibre board sheathing: non-structural, rigid, faced, fiberglass, insulating exterior sheathing board.

2.2 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.4 Nailing discs: flat caps, minimum 38 mm diameter, minimum 0.4 mm thick, polymer, formed to prevent dishing. Bell or cup shapes not acceptable.

.5 Fastener Finishes:
.1 Galvanizing: to ASTM A 123/A 123M, use galvanized fasteners for all work.

.6 Wood Preservative:
.1 Preservative: in accordance with manufacturer's recommendations for surface conditions:

3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

3.3 MATERIAL USAGE

.1 Miscellaneous backing and vanity construction:
  .1 Douglas Fir Plywood (DFP) to CSA O121, standard construction. G1S where indicated for interior use.

3.4 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

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

.3 Install furring and blocking as required to space-out and support casework, cabinets, electrical equipment mounting boards, TV locations, AV equipment locations, white boards, acoustic panels, grab bars, handrails, washroom accessories and other work as required.

.4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.

.6 Install sleepers as indicated.

.7 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.8 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.9 Countersink bolts where necessary to provide clearance for other work.

3.5 CLEANING

.1 Progress 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.

3.6 PROTECTION

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

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

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications.

.2 Section 06 10 53 – Miscellaneous Rough Carpentry

.3 Section 09 21 16 – Gypsum Board Assemblies

.4 Section 09 22 16 – Non-Structural metal Framing

.5 Section 10 28 00 – Toilet and Bath Accessories

.6 Division 22 - Plumbing

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI) / Composite Panel Association
- .1 ANSI A208.1-2016, Particleboard.
- .2 ANSI A208.2-2016, Medium Density Fibreboard (MDF) for Interior Applications.

.2 American National Standards Institute (ANSI) / Decorative Hardwood Association
- .1 ANSI/HPVA HP-1-2016, Standard for Hardwood and Decorative Plywood.

.3 ASTM International
- .1 ASTM E 1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
- .2 ASTM D 2832-92 (R2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
- .3 ASTM D 5116-17, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.4 Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI)
- .1 NAAWS 3.1 (2017), North American Architectural Woodwork Standards.

.5 CSA International
- .1 CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure), Includes Update No. 1 (2010), Update No. 2 (2010).
- .2 CSA O121-17, Douglas Fir Plywood.
- .3 CSA O141-05 (R2014), Softwood Lumber.
- .4 CSA O151-17, Canadian Softwood Plywood.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets. Include

product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, 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 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate samples solid surfaces: sample size 600 x 600 mm or 600 mm long.

.4 Submit duplicate samples of laminated plastic for colour selection.

.5 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.5 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

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

.2 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

.3 Plywood, particleboard, and wood based composite panels to CSA and ANSI standards.

.4 Mock-ups:

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

.1 Shop prepare one counter top and apron complete with shop applied finishes, and install where directed by Departmental Representative.

.2 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with Work.

.3 When accepted, mock-up will demonstrate minimum standard for Work.

.4 Do not proceed with work prior to receipt of written acceptance of mock-up by Departmental Representative.

.5 Approved mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging,

labelled with manufacturer's name and address.
- .1 Protect millwork against dampness and damage during and after delivery.
- .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect architectural woodwork from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 7 % or less in accordance with following standards:
- .1 AWMAC premium grade, moisture content as specified.

.2 Machine stress-rated lumber is acceptable for all purposes.

.3 Hardwood lumber: moisture content 7 % or less in accordance with following standards:
- .1 National Hardwood Lumber Association (NHLA).
- .2 AWMAC premium grade, moisture content as specified.

.4 Baltic Birch plywood (CSP): to CSA O151, of thickness indicated and as follows
- .1 AWS premium grade, for transparent finish.
- .2 Grading Standard: A/A, graded for exterior use.
  - .1 Minimum 150 mm flitch width.
  - .2 Continuous across face of panel, no end matching allowed.
  - .3 Baltic Birch, rotary-cut, single sheet match and symmetry.
  - .4 Minimum veneer thickness, 0.50 mm.
  - .5 Vertical grain direction.
- .3 Core Construction: Baltic birch veneer, cross-banded and laminated with exterior grade glue.
- .4 Panel Edge: Exposed
- .5 Grade stamp, non-exposed, marked on the edge of each panel, indicating cut, species and grade, and manufacturer’s name.
- .6 Flame spread: not greater than 150, to CAN/ULC S102.

.5 Solid polymer (solid Surface): homogeneous filled acrylic or filled polyester and acrylic; not coated, laminated or of composite construction. To ANSI Z124.3 and ANSI Z124.6.
  - .1 Specific Gravity: 1.7 min.
  - .2 Tensile Strength: 41.4 kPa min to ASTM D638.
  - .3 Flexural Strength: 68.9 kPa min to ASTM D790.
  - .4 Tensile Elongation: 0.4% min to ASTM D638.

.5 Hardness: 56. Barcol Impressor minimum to ASTM D2583.

.6 Color Stability: No change at 100 hours minimum to NEMA LD3.

.7 Wear and Cleanability: Passes ANSI Z124.3.

.8 Stain Resistance: sheets pass ANSI Z124.3 and Z124.6.

.9 Abrasion Resistance: No loss of pattern maximum weight loss (1000 cycles): 0.9g to NEMA LD3.

.10 Weatherability: No change. Minimum 1000 hours to ASTM D1499.

.11 Boiling Water Resistance: no visible change to NEMA LD 3. Method 3.5.

.12 Light Resistance: (Xenon Arc) no effect to NEMA LD 3. Method 3.3.

.13 High Temperature Resistance: no change to NEMA LD 3. Method 3.6.

.14 Ball Impact: no fracture. .227 kg ball to NEMA LD 3.

.15 Water Absorption: Long-term to ASTM D570. 0.4% at 19 mm thickness.

.16 Superficial damage to a depth of 0.25 mm shall be repairable by sanding and polishing.

.17 Colour: three colours, patterns and styles will be selected by Departmental Representative from multiple manufacturers of solid surfacing products and selected from complete and extended range of products including granite patterns and colours.

.6 Nails and staples: to CSA B111.

.7 Wood screws: brass, stainless steel, plated steel galvanized, type and size to suit application.

.8 Splines: wood.

.9 Sealant: mildew resistant in accordance with Section 07 92 00 - Joint Sealants.

2.2 MANUFACTURED UNITS

.1 Casework:

.1 Counter tops, returns and aprons: solid polymer as indicated.

2.3 FABRICATION

.2 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.3 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.4 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.5 Apply laminated plastic liner sheet to plywood substrates.

.6 Solid polymer surface:

.1 Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

.2 Finish: all surfaces shall have uniform finish. Provide matte finish with a gloss rating of 5 - 20. Allow for a minimum of three counter colour selections:

.1 Lavatory tops rooms 113, 114 and 117: 19 mm thick countertop of solid polymer material. Edge details and thickness as indicated on the Drawings. Adhere to continuous 19 mm thick plywood supporting substrate per manufacturer's written instructions.

3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

.1 Do architectural woodwork to Quality Standards of AWMAC.

.2 Install prefinished millwork at locations shown on drawings.
- .1 Position accurately, level, plumb straight.

.3 Fasten and anchor millwork securely.
- .1 Supply and install heavy duty fixture attachments for wall mounted cabinets and wall panels.

.4 Use draw bolts in countertop joints.

.5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.6 Install wall panels in pattern indicated. Provide 25 mm concealed vertical wood battens over wall substrate to accommodate exposed fastener pattern. 12 mm vertical and horizontal reveals.

.7 At junction of vanity and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.

.8 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.9 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

3.3 CLEANING

.1 Progress 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.

.1 Clean millwork and cabinet work, including inside cupboards and drawers, and outside surfaces.

.2 Remove excess glue from surfaces.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

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

3.4 PROTECTION

.1 Protect work from damage until final inspection.

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

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

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies

.2 Section 09 22 16 - Non-Structural Metal Framing

1.2 REFERENCE STANDARDS

.1 CSA Group
- .1 CSA B149-15 PACKAGE, Special Package: B149.1-15, Natural Gas and Propane Installation Code and B149.2-15, Propane Storage and Handling Code.

.2 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.
- .2 CAN/ULC-S702.1-14/S702.2-15, Standard for Mineral Fibre Insulation for Buildings Part 1: Material Specification / Part 2: Installation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for blanket insulation and include product characteristics, performance criteria, physical size, finish and limitations.

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

.4 Test Reports:
- .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 INSULATION

.1 Acoustic batt and blanket mineral fibre: to CAN/ULC-S702.
- .1 Type: 1.
- .2 Thickness: to suit cavity wall stud depth and as indicated.

2.2 ACCESSORIES

.1 Wire stays: as recommended by manufacturer.

3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation 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.

3.2 INSULATION INSTALLATION

.1 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA B149.1 and CSA B149.2 Type B and L vents.

.2 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 CLEANING

.1 Progress 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 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies

.2 Section 09 22 16 – Non-Structural Metal Framing

.3 Division 25

.4 Division 26

.5 Division 27

1.2 REFERENCE STANDARDS

.1 National Research Council Canada (NRC)
- .1 National Building Code of Canada (NBC), 2015.

.2 Underwriter's Laboratories of Canada (ULC)
- .1 ULC-S115-11 (R2016), Fire Tests of Firestop Systems.

1.3 DEFINITIONS

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

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

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

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1(1) 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.

1.4 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 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.3 Shop Drawings:

.1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 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 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

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

1.5 QUALITY ASSURANCE

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

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:

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

.2 Replace defective or damaged materials with new.

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

2 PRODUCTS

2.1 MATERIALS

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

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

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

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

.5 Proprietary modular fire stopping and smoke seal pathways at openings intended for ease of re-entry such as cables:
.1 Automatically adjustable mechanical seal: intumescent seal.
.2 Shell: 1.5 mm galvanised steel shell.
.3 Fire resistance rating: 1 hour
.4 Allowable cable filling: 100% visual.
.5 Volume expansoion 800%

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

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

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

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

.10 Sealants for vertical joints: non-sagging.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

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

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

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

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

3.3 INSTALLATION

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

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

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

.4 Tool or trowel exposed surfaces to neat finish.

.5 Install proprietary modular fire stopping and smoke seal pathways where cabling infrastructure intersects fire rated wall construction and where indicated on drawings. Follow manufactures written instruction for installation.

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

.7 Install firestop insulation as required and where indicated to form complete firestop and smoke seal. Install as backup material where required to areas receiving firestop sealant.

.8 Install firestop sealant to areas indicated, ensure full depth of joint filled with material, remove excess immediately.

.9 Seal around electrical boxes and outlets with sealing putty in accordance with manufacturer's instructions.

3.4 SEQUENCES OF OPERATION

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

.2 Install floor fire stopping before interior partition erections.

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

3.5 FIELD QUALITY CONTROL

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

3.6 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.

3.7 SCHEDULE

.1 Fire stop and smoke seal at:

- .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
- .2 Top of fire-resistance rated masonry and gypsum board partitions.
- .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
- .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
- .6 Openings and sleeves installed for future use through fire separations.
- .7 Around mechanical and electrical assemblies penetrating fire separations.
- .8 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete

.2 Section 03 35 00 – Concrete Finishing.

.3 Section 06 10 53 – Miscellaneous Rough Carpentry

.4 Section 06 40 00 – Architectural Wood Work

.5 Section 08 11 00 – Metal Doors and Frames.

.6 Section 08 11 16 – Flush Wood Doors

1.2 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C 919-12 (2017), Standard Practice for Use of Sealants in Acoustical Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's product to describe:
  - .1 Caulking compound.
  - .2 Primers.
  - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Samples:
- .1 Submit 2 samples of each type of material and colour.
- .2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:
- .1 Submit instructions to include installation instructions for each product used.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Ambient Conditions:

- .1 Proceed with installation of joint sealants only when:
  - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
  - .2 Joint substrates are dry.
  - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

- .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

- .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

.2 Operate ventilation system on maximum outdoor air and exhaust during installation of caulking and sealants.

2 PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Colours: multiple colours of each type of sealant will be selected by Departmental Representative. Colours will be selected from full and extended range of available and custom colours to match adjacent surfaces as closely as possible

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Sealant TYPE A: one-component, medium-modulus, neutral cure silicone. To ASTM C920, Type S, Grade NS, Class 50. Use NT, M, G, A and O..

.2 Sealant TYPE C: multi-component or single component, self-levelling or slope grade polyurethane. To ASTM C920, Type M, Grade P, Class 100/50. Use T, M, A and O.

.3 Sealant TYPE D: multi-component, chemical curing, polyurethane. To ASTM C920, Type M, Grade P, Class 25. Use T, M, A and O.

.4 Sealant TYPE E: one-component, solvent release, acrylic latex. To CAN/CGSB-19.17.

.5 Sealant TYPE F: one-component, acetoxy silicone containing non-toxic fungicidal agents. To ASTM C920, Type S, Grade NS, Class 25. Use NT, G, A and O.

.6 Sealant TYPE H: to ASTM C919. One-component, non-skinning, non-hardening, butyl rubber acoustic.

.7 Preformed compressible and non-compressible back-up materials:

- .1 Polyethylene, urethane, neoprene or vinyl foam:
  - .1 Extruded closed cell foam backer rod.
  - .2 Size: oversize 30 to 50 %.
- .2 Neoprene or butyl rubber:
  - .1 Round solid rod, Shore A hardness 70.
- .3 High density foam:
  - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond breaker tape:
  - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant TYPE A.

.2 Coping joints and coping-to facade joints: Sealant TYPE C.

.3 Exterior joints in horizontal wearing surfaces (as itemized): Sealant TYPE C or D.

.4 Seal interior perimeters of exterior openings as detailed on drawings: Sealant TYPE A.

.5 Interior control and expansion joints in floor surfaces: Sealant TYPE C.

.6 Perimeters of interior frames, as detailed and itemized: Sealant TYPE D.

.7 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant TYPE D.

.8 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): Sealant TYPE F.

.9 Exposed interior control joints in drywall: Sealant TYPE E

.10 Perimeter of interior gypsum board partitions: Sealant TYPE H: to achieve STC rating noted in drawings.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant:

- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.7 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.8 PROTECTION

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

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 08 71 00 – Door Hardware.

.2 Section 08 80 00 – Glazing.

.3 Section 09 21 16 – Gypsum Board Assemblies.

.4 Section 09 91 23 – Interior Painting.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 653/A 653M-17, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B 29-14, Standard Specification for Refined Lead.
- .3 ASTM B 749-14, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .4 ASTM E90 – 09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 Canadian Standards Association (CSA International)
- .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.3 Canadian Steel Door Manufacturers' Association (CSDMA)
- .1 CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products, 2006.
- .2 CSDMA, Recommended Selection and Usage Guide, 2009.

.4 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition.
- .2 NFPA 252, Standard for Fire Doors and Other Opening Protectives, 2017 Edition.

.5 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S701.1: 2017, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .2 CAN/ULC-S702.1-14/ULC-S702.2-15, Standard for Thermal Insulation, Mineral Fibre, for Buildings. Part 1: material Specification / Part 2: Installation
- .3 CAN/ULC-S704.1: 2017, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
- .5 CAN/ULC-S105: 2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 for ratings specified or indicated.

.2 Install conduits and channels as required for installation of electronic hardware as indicated on electrical drawings.

.3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and listed by nationally recognized agency having factory inspection services.

.4 Acoustic Performance: minimum Sound Transmission Class (STC) 50, tested to ASTM E90.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

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

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

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware fire rating, and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.

.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.5 Submit one 300 x 300 mm corner sample of each type of frame.

.1 Show butt cutout and glazing stops.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

2 PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Interior Doors: honeycomb 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.

.2 Prepare door for installation of electronic hardware as indicated on electrical drawings.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

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

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: steel, spot welded in place.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Metallic paste filler: to manufacturer's standard.

.5 Acoustic Seals: provide perimeter and bottom seals, tested as part of the ASTM E90 assembly to meet the specified STC rating, and as described in Section 08 71 00 – Door Hardware.

.6 Fire labels: metal rivited.

.7 Sealant: one part silicone to CAN/CGSB-19.13.

.8 Glazing: as specified in Section 08 80 00 - Glazing .

.9 Make provisions for glazing as indicated and provide necessary glazing stops.
  .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
  .2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.6 mm welded type construction with door frame reinforcement plate welded inside the frame.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Frame reinforcement: weld a 6.4 mm x 25 mm x 610mm steel plate to the inside of the frame and align centre with the lock bolt. Refer to Hardware Schedule for applicable doors.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare door frames as follows:
- .1 ANSI strike.
- .2 Reinforcing at head for door closer.
- .3 Heavy or standard weight template hinges, 1.5 or 2 pair.
- .4 Auxiliary deadbolt.
- .5 Guard boxes at strike and hinge locations.

.8 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.9 Prepare frame for installation of electronic hardware as indicated on electrical drawings.

.10 Manufacturer's nameplates on frames and screens are not permitted.

.11 Conceal fastenings except where exposed fastenings are indicated.

.12 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld a 6.4 mm x 25 mm x 610mm steel plate to the inside of the frame and align centre with the lock bolt. Refer to Hardware Schedule for applicable doors.

.7 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

.8 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Interior Doors: hollow steel construction, reinforced. Non-thermally broken. Form each face sheet for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Doors: manufacturers' construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketting and hardware in accordance with ASTM E90 to provide STC 50 minimum.

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-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.

.10 Manufacturer's nameplates on doors are not permitted.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Install frames by building-in as indicated on drawings. Wall constructions are to be seated to the backside of the rabbet or anchor plate in steel stud assemblies.

.4 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.5 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.6 Caulk perimeter of frames between frame and adjacent material.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

- .1 Hinge side: 1.0 mm.
- .2 Latchside and head: 1.5 mm.
- .3 Finished floor, top of carpet, sill and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 00 - Glazing.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 – Miscellaneous Rough Carpentry.

.2 Section 07 92 00 – Joint Sealants

.3 Section 08 11 00 – Metal Doors and Frames

.4 Section 08 71 00 – Door Hardware.

.5 Section 09 21 16 – Gypsum Board Assemblies

.6 Section 09 22 16 – Non-Structural Metal Framing

1.2 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI).
- .1 Architectural Woodwork Standards, 2nd Edition

.3 Canadian Standards Association (CSA International).
- .1 CSA A440.2-14/a440.3-14, Fenestration Energy Performance/ User Guide to CSA A440.2-14, Includes Update No.1 (2015).
- .2 CSA Certification Program for Windows and Doors.

.4 Underwriters Laboratories / EcoLogo Product Certification.
- .1 UL 2761 , Sealants and Caulking Compounds.
- .2 UL 2762 , Adhesives.

.5 National Fire Protection Association (NFPA).
- .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition.
- .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2017 Edition.

.6 Underwriters' Laboratories of Canada (ULC).
- .1 CAN/ULC-S104-15,Standard Method for Fire Tests of Door Assemblies Fire Tests of Door Assemblies.
- .2 CAN/ULC-S105:2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  .1 For caulking materials during application and curing.
  .2 For door materials and adhesives.

.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Indicate door types and cutouts for lights, sizes, core construction, and cutouts.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit one 300 x 300 mm corner sample of each type wood door.

.3 Show door construction, core, glazing detail and faces.

.4 Manufacturer's Instructions:
  .1 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:
  .1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements, including acoustic requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials in accordance with site waste management program.

.2 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.3 Divert unused adhesive material from landfill to official hazardous material collections site.

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

2 PRODUCTS

2.1 WOOD FLUSH DOORS

.1 Solid core:
- .1 Construction:
  - .1 Solid particleboard core: hardwood stile and rail frame bonded to particleboard core with wood lock blocks wood blocking, minimum 5-ply construction.
- .2 Face Panels:
  - .1 Hardwood; veneer grades: Grade I (Premium), walnut veneer both sides.
- .3 Adhesive: Type II (water resistant) for interior doors.
- .4 Edge strips: walnut to match face veneer.
- .5 Acoustic Performance: minimum Sound Transmission Class (STC) 50, tested to ASTM E90.

2.2 GLAZING

.1 Glass and accessories: 6 mm tempered glass as per Section 08 80 00 - Glazing.

2.3 FABRICATION

.1 Vertical edge strips to match face veneer to all exposed door edges.

.2 Prepare doors for glazing. Provide solid hardwood glazing stops with mitred corners. To match face veneer.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.4 Prepare frame for installation of electronic hardware as indicated on electrical drawings.

2.4 FINISHING

.1 Shop apply finishes to wood veneer doors as follows:
- .1 Sand with progressively finer grits up to 220 grit sandpaper.
- .2 Spray apply sanding sealer, then sand with 180 grit sandpaper.
- .3 Spray apply catalyzed lacquer diluted 20% with lacquer thinner.
- .4 Seal top and bottom before delivery to site and immediately after any site adjustments.

.2 Provide consistently smooth and even surfaces with no "orange peel", runs, sags, skips, drips, rough areas, pinholes, bubbles, or embedded grit.

.3 Wood grain and finish of solid wood doors to be the same as solid wood frame/sidelight unit finish.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

.2 Adjust hardware for correct function.

.3 Install glazing in accordance with Section 08 80 50 - Glazing.

.4 Install glazing stops.

.5 Secure side panels by means of concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

3.3 ADJUSTMENT

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

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

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

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 08 11 00 - Metal Doors and Frames

.2 Section 08 14 16 – Flush Wood Doors

.3 Division 26 - Electrical

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
- .1 ANSI/BHMA A156.1-2016, Butts and Hinges.
- .2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.3-2014, American National Standard for Exit Devices.
- .4 ANSI/BHMA A156.4-2013, Door Controls - Closers.
- .5 ANSI/BHMA A156.5-2014, Cylinders and Input Devices for Locks.
- .6 ANSI/BHMA A156.6-2010, Architectural Door Trim.
- .7 ANSI/BHMA A156.8-2010, Door Controls - Overhead Stops and Holders.
- .8 ANSI/BHMA A156.10-2011, Power Operated Pedestrian Doors.
- .9 ANSI/BHMA A156.12-2017, Interconnected Locks and Latches.
- .10 ANSI/BHMA A156.13-2017, Mortise Locks.
- .11 ANSI/BHMA A156.15-2015, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
- .12 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
- .13 ANSI/BHMA A156.18-2016, Materials and Finishes.
- .14 ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power - Operated Doors.
- .15 ANSI/BHMA A156.21-2009, Thresholds
- .16 ANSI/BHMA A156.22-2017, Door Gasketing and Edge Seal Systems
- .17 ANSI/BHMA A156.26-2017, Continuous Hinges.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
- .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
- .1 Submit for review and acceptance of each unit.
- .2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:

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

.2 Tools:

.1 Supply 2 sets of wrenches for door closers, locksets, and exit hardware.

1.6 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.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect door hardware from nicks, scratches, and blemishes.
.3 Protect prefinished surfaces with wrapping or strippable coating.
.4 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 HARDWARE ITEMS

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

2.2 DOOR HARDWARE

.1 Contractor must install all door hardware and assure the door frames and doors are prepared and reinforced to receive specified hardware.

.2 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. Locking functions to be supplied less cylinder
.2 Lever handles: flat face design complete with return to door.
.3 Roses: round.
.4 Normal strikes: box type, lip projection not beyond jamb.
.5 Finish as noted in the Hardware Schedule.

.3 Butts and hinges:
.1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
.2 Use non-removable pins (NRP) for all hinges.
.3 5 knuckle bearing.
.4 Finish as indicated in Hardware Schedule.

.4 Exit devices: to ANSI/BHMA A156.3, grade 1, modern flat touch bar design.
.1 No exposed touch bar fasteners. No exposed cavities when operated. Furnish strikes to suit door and frame material and application.
.2 Lever design on the trim to match exactly the lever design on mortised locksets.
.3 Exit devices are to be supplied less cylinder where applicable.
.4 Finish as indicated in Hardware Schedule.

.5 Door Closers and Accessories:
.1 Door closers: to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, complete with cast iron bodies, full rectangular cover plates, separate valves for sweep, latching and backcheck. Fully adjustable spring power.
.2 Closers for aluminum doors are to be narrow design body and cover designed to fit on the aluminum frame head section above the door where top jamb mounting is specified. Finish as indicated in Hardware Schedule.

.6 Door Operators:
- .1 Power assist and low energy electro-hydraulic operated doors: to ANSI/BHMA A156.19.
- .2 Electro-hydraulic, non-handed operator, powered by a 125 Watt motor. Spring shall be adjustable to compensate for different manual push forces required on varying door widths.
  - .1 Operator shall be capable of operating and controlling the following size doors:
    - .1 Pull Type Arm: Up to a 100 kg door 1400 mm in width.
    - .2 Push Type Arm: Up to a 100 kg door 1600 mm in width.
- .3 Surface Mounted Operator:
  - .1 Side Access Operator Housing: Operator is contained in an extruded aluminum housing with a removable cover.
  - .2 Surface Mounted Housing: Continuous for full width of door.
  - .3 Connecting Hardware: Surface mounted operators to have a steel arm from the operator, mounted to the top face of the swing door.
  - .4 UL Listed R-9469 Fire Door Operator with Automatic Closer when FRR indicated on schedule.
  - .5 Operator shall be field switchable between an ANSI/BHMA A156.19 and an ANSI/BHMA A156.10 compliant operator and vice versa.
  - .6 Operator Temperature Range: Capable of operating within temperature ranges of -30 degrees Celsius 50 degrees Celsius.
  - .7 Electrical Characteristics: Nominal current draw 222 watts (1.85 amps at 120 VAC), built-in thermal overload protection.
- .4 The operators and their related components are to be supplied and installed as a package by this section.
- .5 Actuators are to have logo only, no wording.
- .6 Finish is to be as noted in the hardware schedule.

.7 Restroom Control kit:
- .1 Push button system with integrated “PUSH TO LOCK” and barrier free actuator button complete with universal accessibility sign. in both official languages, and magnetic door contact.

.8 Emergency Call kit:
- .1 Bilingual universal emergency call kit for use with control kit, “PRESS FOR EMERGENCY ASSISTANCE” mushroom push button and LED annunciator with adjustable sounder.

.9 Auxiliary locks and associated products: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers [listed in Hardware Schedule. Finish as indicated in Hardware Schedule.

.10 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule.
- .1 Door protection plates: size as noted, 1.27 mm thick brushed stainless steel. Tape mounted.

.11 Auxiliary hardware: to ANSI/BHMA A156.16.
- .1 Floor stops shall be dome type, heavy-duty, stainless steel.
- .2 Wall stops shall be heavy duty, stainless steel c/w concave pad with no visible fasteners.

.12 Magnetic hold opens: to ANSI BHMA A156.15.
- .1 2 piece heavy duty surface mounted - Hold Open only
- .2 Grade 1
- .3 Finish 630

.13 Door bottom seal: heavy duty, door seal of extruded aluminum frame and closed cell neoprene weather seal, recessed in door bottom, closed ends, adjustable, clear anodized finish.

.14 Extruded aluminum interlocking full width of opening cut to fit around frame jambs, mill finish with hook strip installed on door full width.

.15 Weatherstripping and Acoustic Seals:
- .1 Head and jamb seal:
  - .1 All gasketing and seals shall be fire rated types where used on interior fire rated openings.
  - .2 Perimeter and bottom acoustic seals to meet ASTM E90 to achieve the specified STC rating.
  - .3 Extruded aluminum frame and solid closed cell neoprene insert, designed to be continuous under exit device strikes and closer brackets.
- .2 Door bottom seal:
  - .1 Extruded aluminum frame and closed cell neoprene sweep, clear anodized finish.

2.3 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.

2.4 KEYING

.1 All cylindrical locksets and exit device trim to have 6-pin Standard core cylinders to suit, keyed under the existing Parks Canada master key system. Locksets to be keyed differently, keyed alike, keyed alike in groups, master keyed or grandmaster keyed as directed. Prepare detailed keying schedule in conjunction with owner's representative.

.2 Provide three (3) change keys for every lock in this Contract.

.3 Provide three (3) Master keys for each MK level in this Contract.

3 EXECUTION

3.1 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.
- .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.7 Remove construction cores.

.8 Operation of Restroom Control and Emergency Call Kits:
- .1 Vacant state: electric strike is unlocked, lever set (always locked), exterior activation button enabled. Washroom can be accessed manually or electrically from the vacant state. When an individual is inside
- .2 Occupied state: press the 'Push To Lock' button to lock the electric strike and disable the exterior push button. The door can then be used manually or electrically to leave.
- .3 Emergency:
  - .1 In the event of distress, the emergency button is pressed. This will immediately put the system in vacant mode and energize the audible visual alert indicators for assistance.
  - .2 In the event where the individual can not press the emergency button, a key can be used with the storeroom function lever set to bypass the locked system.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

.4 Door Closers:
- .1 Confirm degree of swing for door closers.
- .2 Ensure that all adjustments have been made to sweep, latching and backcheck cycles for each closer.
- .3 Mount on room side of doors wherever possible.

3.3 CO-ORDINATION WITH DIVISION 26

.1 Ensure co-ordination with the Division 26.

.2 Provide all necessary information including templates to Division 26.

.3 Unless otherwise indicated, wiring including low voltage where indicated on schedule, electrical back boxes, conduits as required and fire alarm interface where required is to be supplied and installed by Division 26.

.4 Division 26 to supply switched line voltage to each power supply and each automatic operator in this contract.

.5 Low voltage wiring from hardware device to transformers is to be supplied and installed by the Division 26 where indicated in 3.8 Schedule.

.6 Low voltage wiring associated with access control devices is to be supplied and installed by the Departmental Representative where indicated in 3.8 Schedule.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 DEMONSTRATION

.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 fire exit hardware.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by door hardware installation.

3.7 LEGEND

.1	HM Dr:	Indicates hollow metal door. Paint
.2	IHM Dr:	Indicates insulated hollow metal door. Paint.
.3	PS Fr:	Indicates pressed steel frame. Paint.
.4	IPS Fr:	Indicates insulated pressed steel frame. Paint.
.5	LTS	Indicates Length to suit opening size.
.6	TB	Through Bolt
.7	MK	Master Keyed
.8	EXIST	Existing/Relocated

3.8 SCHEDULE

HG113

1	Sgl Dr	D113	Corridor to Female Washroom (113)	RH

Refer to Door Schedule on drawing A000

3	Ea	Hinges	A5111-5, 114 x 101		630
1	St	Push/Pull	J401 x 304mm x J501 x LTS	TB	630
1	Ea	Auto Operator		EXIST	
2	Ea	Actuator		EXIST	
2	Ea	Kick Plate	J102 250mm x LTS		630
1	Ea	Floor Stop	L02141		630
1	Ea	Power Supply	To suit to: ANSI/BHMA A156.19		

Note: 1) Line voltage, conduit as required and electrical back boxes by Division 26.
2) Barrier free actuators are existing / relocated.

HG114

1	Sgl Dr	D114	Corridor to Male Washroom (114)	LH

Refer to Door Schedule on drawing A000

3	Ea	Hinges	A5111-5, 114 x 101		630
1	St	Push/Pull	J401 x 304mm x J501 x LTS	TB	630
1	Ea	Door Seal	R0D156, LTS		
1	Ea	Door Sweep	R3B434 x door width		628
2	Ea	Kick Plate	J102 250mm x LTS		630
1	Ea	Floor Stop	L02141		630

HG116

1	Sgl Dr	D116	Corridor to Mechanical Room (116)	RH

Refer to Door Schedule on drawing A000

3	Ea	Hinges	A5111-5, 114 x 101		630
1	Ea	Lockset	F07 x Lever	MK	630
1	Ea	Door Closer	C02041		630
1	Ea	Door Seal	R0D156, LTS		
1	Ea	Door Sweep	R3B434 x door width		628
1	Ea	Floor Stop	L02141		630

Note: 1) Lockset function: Outside lever always rigid, operated by key. Inside lever loose with free exit.

HG117

1	Sgl Dr	D117	Corridor to Inclusive Washroom (117)	LHR

Refer to Door Schedule on drawing A000

3	Ea	Hinges	A5111-5, 114 x 101		630
1	Ea	Privacy Set	F02 x Lever		630
1	Ea	Electric Strike	E09641 x FS		
1	Ea	Auto Operator		EXIST	
1	Ea	Actuator		EXIST	
1	Ea	Restroom Control Kit			630
1	Ea	Emergency Call Kit			630
1	Ea	Transformer w/rectifier			
1	Ea	Door Seal	R0D156, LTS		
1	Ea	Door Sweep	R3B434 x door width		628
2	Ea	Kick Plate	J102 250mm x LTS		630
1	Ea	wall Stop	L52251		630
		Power Supply	To suit to: ANSI/BHMA A156.19		

Note: 1) Line voltage, conduit as required and electrical back boxes by Division 26.

HG118

1	Dbl Dr	D118	Main Museum to Corridor	LH/RH

Refer to Door Schedule on drawing A000

6	Ea	Hinges	A5111-5, 114 x 101		630
2	Ea	Exit Device	Type 7 LBR 02 F07 x Lever	MK	630
2	Ea	Door Closer / Hold open	C02051		630
2	Ea	Door Sweep	R3B434 x door width		628
2	Ea	Kick Plate	J102 250mm x LTS		630
2	Ea	wall Stop	L02141		630

Note: 1) Door Function:
Free to exit at all times, outside lever rigid unless actuating bar is locked down.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 08 14 16 – Flush Wood Doors.

.2 Section 10 28 00 – Toilet and Bath Accessories

1.2 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C 542-05 (2017), Standard Specification for Lock-Strip Gaskets.
- .2 ASTM D 790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- .3 ASTM D 1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics.
- .4 ASTM D 1929-16, Standard Test Method for Determining Ignition Temperature of Plastics.
- .5 ASTM D 2240-15e1, Standard Test Method for Rubber Property - Durometer Hardness.
- .6 ASTM E 84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .7 ASTM E 330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .8 ASTM F 1233-08 (2013), Standard Test Method for Security Glazing Materials and Systems.

.2 Underwriters Laborabories / EcoLogo Product Certification
- .1 UL 2761, Sealants and Caulking Compounds.

.3 Glass Association of North American (GANA)
- .1 GANA Glazing Manual, 50th Anniversary Edition - 2008.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:
- .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Contractor's Representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's written installation instructions and warranty requirements.

.2 Ensure site supervisor and subcontractor representatives attend.

1.4 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 glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Shop Drawings: Submit shop drawings.

.3 Samples:
.1 Submit for review and acceptance of each unit.
.2 Submit 300 x 300 mm size samples of glass and of glazing splines.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect glazing and frames from nicks, scratches, and blemishes.
.3 Protect prefinished aluminum surfaces with strippable coating.
.4 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 - Waste Management and Disposal.

1.8 AMBIENT CONDITIONS

.1 Ambient Requirements:
.1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

2 PRODUCTS

2.1 MATERIALS

.1 Flat Glass:
- .1 Silvered mirror glass: 6 mm thick.
  - .1 Type 1B-float glass for high humidity use. Type 3A-tempered.
- .2 GL01 Interior Glass: Safety glass: to CAN/CGSB-12.1, transparent, 6 mm thick.
  - .1 Type 2-tempered.
  - .2 Class B-float.
  - .3 Category 1.

.2 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

.3 Decorative Glazing Film: optically translucent, opaque, polyester - reinforced vinyl film. Abrasion resistant coating and release liner to the following properties:

- .1 Selected by Departmental Representative to provide a frosted glass appearance where final application looks like etched glass.
  - .1 Solar transmittance: 67%.
  - .2 Solar reflectance: 18%.
  - .3 Visible light transmittance: 69%.
  - .4 Visible light reflected. 20%.

2.2 ACCESSORIES

.1 Setting blocks: neoprene, EPDM, or silicone, 80-90 Shore A durometer hardness to ASTM D 2240, minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height.

.2 Spacer shims: neoprene or silicone, 50-60 Shore A durometer hardness to ASTM D 2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

.3 Glazing tape:
- .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D 2240; coiled on release paper; size as required for frame stop heights; black colour.
- .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2 %, designed for compression of 25 %, to effect an air and vapour seal; size as required for frame stop heights.

.4 Glazing splines: resilient polyvinyl chloride or silicone, extruded shape to suit glazing channel retaining slot, black colour. To approval of manufacturer of Curtain Wall System.

.5 Glazing clips: manufacturer's standard type.

3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- .3 Visually inspect substrate in presence of Departmental Representative.
- .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .5 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

3.5 INSTALLATION: MIRRORS

.1 Set mirrors with clips. Anchor rigidly to wall construction.

.2 Set in frame.

.3 Place plumb and level.

3.6 INSTALLATION: PLASTIC FILM

.1 Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

.2 Place without air bubbles, creases or visible distortion.

.3 Fit tight to glass perimeter with razor cut edge.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
  .1 Leave Work area clean at end of each day.
    .1 Remove traces of primer, caulking.
    .2 Remove glazing materials from finish surfaces.
    .3 Remove labels.
    .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
  .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.8 PROTECTION

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

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.
  .1 Do not mark heat absorbing or reflective glass units.

.3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 – Miscellaneous Rough Carpentry

.2 Section 06 40 00 – Architectural Woodwork

.3 Section 07 21 16 – Blanket Insulation

.4 Section 07 84 00 – Fire Stopping

.5 Section 09 22 16 – Non-Structural Metal Framing.

.6 Section 09 30 13 – Ceramic Tiling.

.7 Section 09 91 23 – Interior Painting.

.8 Section 10 26 00 – Wall and Door Protection

.9 Division 22 – Plumbing

1.2 REFERENCE STANDARDS

.1 Aluminum Association (AA)
- .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International
- .1 ASTM C 475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .2 ASTM C 840-17a, Standard Specification for Application and Finishing of Gypsum Board.
- .3 ASTM C 954-18, 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 C 1002-18, 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 C 1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .6 ASTM C 1280-13a, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- .7 ASTM C 1177/C 1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .8 ASTM C 1178/C 1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
- .9 ASTM C1288-17. Standard Specification for Fiber-Cement Interior Substrate Sheets.
- .10 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.

.3 Underwriter's Laboratory of Canada

.1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit for review and acceptance of each unit. Submit 300 mm long samples of corner bead, casing bead, vinyl mouldings, shadow mould, cornice cap, and insulating strip.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store gypsum board assemblies materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
.3 Protect from weather, elements and damage from construction operations.
.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
.5 Protect prefinished aluminum surfaces with wrapping strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
.6 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

2 PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C1396/C1396M. Type X, minimum 15.9 mm thick, 1200 mm wide x maximum practical length. Ends square cut, edges bevelled.

.2 Water resistant board: to ASTM C1396/C1396M. Water resistant gypsum board core surfaced both sides with water repellent paper bonded to the core. Type X, 15.9 mm thick, 1200 mm wide x maximum practical length.

.3 Glass mat water resistant gypsum backing board: to ASTM C1178/C1178M. Water resistant core with the face covered with a glass mat partially or completely embedded in the core and a water resistant coating on the back. 15.9 mm thick, 1200 mm wide x maximum practical length..

.4 Cement board: to ASTM C1288. Mixture of portland cement, aggregate, sand, selected filler and polymer coated glass fibre reinforcing mesh. 15.9 mm thick, 1200 mm wide x maximum practical length.

.5 Metal furring runners, hangers, tie wires, inserts, anchors: manufacturer’s standard profiles to suit specific requirements.

.6 Drywall furring channels: 0.5 mm core thickness, galvanized steel channels for screw attachment of gypsum board.

.7 Steel drill screws: for application of gypsum board with steel drill screws into heavier gauge steel studs: to ASTM C954.

.8 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc coated by electrolytic process. 0.5 mm base thickness, perforated flanges, one piece length per location.

.9 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.10 Acoustic sealant: as specified in Section 07 92 00 - Joint Sealants.

.11 Insulating strip: rubberized, moisture resistant, 6 mm thick closed cell neoprene strip, 19 mm wide, with self-sticking permanent adhesive on one face, continuous length.

.12 Joint compound: to ASTM C 475, asbestos free. Manufacturer’s premixed commercial grade compound.

.13 Shadow mould: 35 mm high, snap-on trim, of 0.6 mm base steel thickness galvanized sheet pre-finished in satin enamel black colour.

3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
  .1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, and audio-video mounting hardware.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.

.10 Furr openings and around built-in equipment, cabinets, and access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply single and double layer gypsum board to metal furring or framing using screw fasteners for first layer, and screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.

- .1 Single-Layer Application:
  - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840.
  - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .2 Double-Layer Application:
  - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
  - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
  - .3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply gypsum board to concrete and concrete block surfaces, where indicated, using laminating adhesive.
.1 Comply with gypsum board manufacturer's recommendations.
.2 Brace or fasten gypsum board until fastening adhesive has set.
.3 Mechanically fasten gypsum board at top and bottom of each sheet.

.4 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.

.5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and service penetrations, in partitions where perimeter sealed with acoustic sealant.

.6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.7 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.8 Install gypsum board with face side out.

.9 Do not install damaged or damp boards.

.10 Cement Board Application. Apply cement board to steel stud framing where indicated in the drawings and wherever Ceramic Tile wall finishes are to be applied. Use manufacturer’s proprietary screw fasteners, purpose made for attachment of cement board to steel framing. Apply multiple layers where indicated. In shower areas install waterproof membranes in acocordance with 09 30 13 – Ceramic Tiling.

.11 Apply water resistant gypsum board in washrooms and where indicated. Apply water resistant sealant to edges, ends, cut outs which expose gypsum core and to fastener heads.

.12 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints at changes in substrate construction and at approximate 10 m spacing on on long continuous walls and at approximate 15 m spacing on ceilings.

.9 Install control joints straight and true.

.10 Construct expansion joints, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Install access doors to electrical and mechanical fixtures specified in respective sections.
- .1 Rigidly secure frames to furring or framing systems.

.13 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.14 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
- .1 Levels of finish:
  - .1 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
    - .1 Use level 2 finish above ceiling height and in concealed spaces.
  - .2 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
    - .1 Use Level 5 finish on all visible walls and ceilings

.15 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.

.16 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.

.17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.18 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.19 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.20 Mix joint compound slightly thinner than for joint taping.

.21 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.22 Allow skim coat to dry completely.

.23 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

.1 Progress 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.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

3.7 SCHEDULES

.1 Construct fire rated assemblies where indicated.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 06 10 53 – Miscellaneous Rough Carpentry

.3 Section 06 40 00 – Architectural Woodwork

.4 Section 07 21 16 – Blanket Insulation.

.5 Section 07 84 00 – Fire Stopping

.6 Section 07 92 00 – Joint Sealants

.7 Section 08 11 00 – Metal Doors and Frames

.8 Section 08 14 16 – Flush Wood Doors

.9 Section 09 21 16 – Gypsum Board Assemblies

.10 Division 22 - Plumbing

1.2 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C 645-14e1, Standard Specification for Nonstructural Steel Framing Members.
- .2 ASTM C 754-18, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .3 ASTM F1267-18, Standard Specification for Metal Expanded Steel.
- .4 ASTM A627-03 (2011), Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional facilities the Design of Cold-Formed Steel Structural Members

.2 National Association of Architectural Metal Manufacturers (NAAMM)
- .1 EMMA 557-99, Expanded Metal Manufacturers Association Standards for Expanded Metal.

.3 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.
  - .1 MPI #26, Primer, Galvanized Metal, Cementitious.

.4 Canadian Standards Association (CSA International)
- .1 CAN/CSA-S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members

.5 Government of Canada
- .1 Lead Agency Security Publication G13-02, Secure Demise Wall (SDW):

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

.4 Develop Construction Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.

.5 Packaging Waste Management: remove for reuse packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C 645, stud size as indicated, roll formed from 0.91 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board.
- .1 Knock-out service holes at 460 mm centres.
- .2 Conform to engineering tables designed to meet CSA-S136-01, North American Specification for the Design of Cold-Formed Steel Structural Members for the wall heights indicated on plans.

.2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32 mm flange height.

.3 Metal channel stiffener: manufacturer’s standard size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.4 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.

.5 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

3 EXECUTION

3.1 EXAMINATION

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

3.2 ERECTION

.1 Install steel stud systems in accordance with ASTM C754 and manufacturers written instructions.

.2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.3 Flattened carbon steel mesh: Follow installation instructions and details identified in Lead

.4 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.5 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
- .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.6 Erect metal studding to tolerance of 1:1000.

.7 Attach studs to top track using screws.

.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 frames and special supports or anchorage for work specified in other Sections.

.10 Provide two studs extending from floor to ceiling 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 Install additional heavy gauge single jamb studs at openings.

.12 Erect track at head of door 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.

.13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.14 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.

.15 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.16 Extend all partitions to steel deck except where noted otherwise on drawings.

.17 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
- .1 Use 50 mm leg slotted ceiling track to provide slip joint.

.18 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.19 Install two continuous beads of acoustical sealant and insulating strip under top and bottom tracks.

3.3 CLEANING

.1 Progress 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 – Joint Sealants

.2 Section 09 21 16 – Gypsum Board Assemblies

.3 Section 10 21 13.19 – Plastic Toilet Compartments

.4 Section 10 28 00 – Toilet and Bath Accessories

.5 Division 22 - Plumbing

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
- .1 ANSI A108/A118 /A136.1:2017, American National Specifications for the Installation of Ceramic Tile.

.2 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014), Update No. 3 (2014), Update No. 4 (2016).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Include manufacturer's information on:
  - .1 Ceramic tile, marked to show each type, size, and shape required.
  - .2 Water resistant grouts (Epoxy).
  - .3 Divider strip.
  - .4 Elastomeric membrane and bond coat.
  - .5 Reinforcing tape.
  - .6 Levelling compound.
  - .7 Latex cement mortar.
  - .8 Slip resistant tile.
  - .9 Waterproofing isolation membrane.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Submit full size samples in duplicate for all specified tiles identified in Part 2.
- .2 Trim shapes, stainless steel bullnose edging.
- .3 Layout tiles as specified and adhere samples to 13 mm thick plywood and grout joints to represent project installation.

1.4 QUALITY ASSURANCE

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

.2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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

1.6 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.7 MAINTENANCE

.1 Extra Materials:
  .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  .2 Provide minimum of 1 unopened carton and no less than 5% of each type and colour of tile required for project for maintenance use. Store where directed.
  .3 Maintenance material same production run as installed material.

2 PRODUCTS

2.1 CT1: TYPICAL WALL TILE 1

.1 Locations:
  .1 Washrooms 113, 114 and 117
.2 Extent: From floor to above ceiling and as indicated.
.3 300 x 600 x 10mm thick (12 x 24 x 3/8” thick) porcelain tile
.4 Matte finish
.5 Straight-lay pattern
.6 Light Grey in colour with light surface pattern
.7 Grout to match tile colour

2.2 CT2: ACCENT WALL TILE 1

.1 Locations:
  .1 Washrooms 113, 114 and 117
.2 Extent: From base tile to above ceiling and as indicated.
.3 150 x 600 x 10mm thick (6 x 24 x 3/8” thick) porcelain tile
.4 Matte finish
.5 Straight-lay pattern
.6 Grey in colour with light surface pattern
.7 Same as CT1

2.1 CT3: VISUAL INDICATOR WALL TILE

.8 Locations:
  .1 Washrooms 114
.9 Extent: From base tile to above ceiling and as indicated.
.10 300 x 300 x 10mm thick (12 x 12 x 3/8” thick) porcelain tile
.11 Gloss finish
.12 Straight-lay pattern
.13 Charcoal in colour
.14 Same as CT1

2.5 PTF1: TYPICAL FLOOR

.1 Locations:
  .1 Washrooms: 113,114 and 117
.2 Extent: All floor areas.
.3 300 x 600 x 10mm thick (12 x 24 x 3/8” thick) porcelain tile
.4 Matte finish
.5 Straight-lay pattern
.6 Dark grey in colour with light surface pattern
.7 Grout to match tile colour

2.7 TRIM SHAPES

.1 Conform to applicable requirements of adjoining floor and wall tile.

.2 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.

.3 Internal and External Corners: provide trim shapes as follows and where indicated.
- .1 Bullnose shapes for external corners including edges.
- .2 Coved shapes for internal corners.
- .3 Special shapes for:
  - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
  - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
  - .3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
  - .4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.

2.8 MORTAR AND ADHESIVE MATERIALS

.1 Wall mortar: latex portland cement mortar: to ANSI A118.4. Two component, commercially prepared, composed of portland cement, selected inert fillers and specially formulated latex additives for increased bond strength and impact resistance. Minimum shear strength 2.6 MPa. Prepare mortar to manufacturer's instructions.

.2 Floor mortar: latex portland cement mortar: to ANSI A118.4. Two component, commercially prepared, composed of portland cement, selected inert fillers and specially formulated latex additives for increased bond strength and impact resistance. Minimum shear strength 2.6 MPa. Prepare mortar to manufacturer's instructions.

.3 Latex additive: formulated for use in cement mortar and thin set bond coat.

.4 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

2.9 WATERPROOFING MEMBRANE

.1 Waterproofing Membrane: to ANSI A118.10. Premixed ready to use trowel applied, flexible loadbearing membrane. For use in either mortar bed or thin set systems. Two component system consisting of an elastomeric, latex compound and reinforcing fabric. System to obtain the following physical properties when tested to ANSI A118.10.
- .1 Tensile Strength: 7 day dry / 21 days wet: 3.9 MPa.
- .2 Elongation: 7 day dry / 21 days wet: 657 %.
- .3 Permeability: 0.013.
- .4 Water vapour transfer: 0.085.
- .5 Hydrostatic resistance: passes.
- .6 Shear strength (28 days): 2.4 MPa.

.7 Dimensional Stability: 0.70% length change.

.2 Locations:
- .1 Washroom floors.
- .2 to 300 mm above floor.

2.10 GROUT

.1 Wall grout: to ANSI A-118.6. Commercially prepared, latex portland cement grout. Fast curing, high early strength, polymer modified, stain resistant. Departmental Representative will select a minimum of 3 colours from full range of standard available colours. Unsanded mix. Prepare grout to manufacturer's instructions.

.2 Floor grout: to ANSI A-118.6. Commercially prepared, latex portland cement grout. Fast curing, high early strength, polymer modified, stain resistant. Departmental Representative will select a minimum of 2 colours from full range of standard available colours. Sanded mix. Prepare grout to manufacturer's instructions.

.3 Colouring Pigments:
- .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C 979.
- .2 Colouring pigments to be added to grout by manufacturer.
- .3 Job coloured grout are not acceptable.
- .4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.

2.11 ACCESSORIES

.1 Transition Strips: purpose made metal extrusion; stainless steel type.

.2 Reducer Strips: purpose made metal extrusion; stainless steel type; maximum slope of 1:2.

.3 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.

.4 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

.5 Floor/grout sealer and protective coating: to tile and grout manufacturer’s recommendations.

.6 Thresholds: extruded aluminum or solid stainless steel. Beveled one side to finish flush with adjacent floor finishes. Polished finish to exposed surfaces, size to suit door opening and frame width.

2.12 MIXES

.1 Dry set mortar: mix to manufacturer's instructions.

.2 Mix bond and levelling coats, and grout to manufacturer's instructions.

.3 Adjust water volumes to suit water content of sand.

2.13 PATCHING AND LEVELLING COMPOUND

.1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

.2 Have not less than the following physical properties:
- .1 Compressive strength - 25 MPa.
- .2 Tensile strength - 7 MPa.
- .3 Flexural strength - 7 MPa.
- .4 Density - 1.9.

.3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.

.4 Ready for use in 48 hours after application.

2.14 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

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 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 Make joints between tile uniform, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Make internal angles square, external angles bull-nosed.

.9 Use round or bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.10 Install satin stainless steel divider strips at junction of tile flooring and dissimilar materials.

.11 Allow minimum 24 hours after installation of tiles, before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

3.3 WALL TILE

.1 Install wall tile in accordance with TTMAC Detail 305W-2012-2014. Tile Installed on Cementitious Backer Unit (Cement Board) - Thin Set Method / Walls. Detail A - Interior Wet / Dry areas.

.2 Apply slight leveling coat if required to achieve specified surface tolerances.

.3 Apply waterproofing membrane 1200mm up wall surfaces and as indicated. Ensure complete seal with waterproofing membrane in floors.

.4 Apply tile to prepared wall surface using a latex-portland cement mortar bond coat. Apply tile to bond coat with minimum 95% surface contact. Install commercial portland cement grout in accordance with TTMAC detail 305W-2012-2014.

3.4 FLOOR TILE

.1 Install floor tile in accordance with TTMAC Detail 311F-2012-2014. Tile Bonded to Concrete Slab - Thin Set Method, Detail A – Interior/Exterior.

.2 Construct slopes to drains with dry pack cement mortar bed as indicated in the drawings in accordance with TTMAC 310F 2012-2014

.3 Apply tile in showers, washrooms and other wet areas with full covering of waterproof membrane.

.4 Apply tile to prepared slab using a latex-portland cement mortar bond coat. Apply tile to bond coat with minimum 95 % surface contact. Install grout in accordance with TTMAC detail 311F-2012-2014.

3.5 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

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

3.7 CLEANING

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

END OF SECTION

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1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM C 423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .2 ASTM E 1264-14, Standard Classification for Acoustical Ceiling Products.
- .3 ASTM E 1477-98a(2017), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.2 Standards Council of Canada
- .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.3 Submit duplicate samples of each type of acoustical units.

1.3 QUALITY ASSURANCE

.1 Mock-up:
- .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up 10 m² minimum of each type acoustical tile ceiling including one inside corner and one outside corner.
- .3 Construct mock-up where directed.
- .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with ceiling work.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

.2 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store extra materials required for maintenance, where directed by Departmental Representative.

.3 Waste Management and Disposal:
- .1 Separate waste materials in accordance with Section 01 74 19 - Construction /Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials for recycling in accordance with Waste Management Plan (WMP).

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20-40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.6 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 5% of gross ceiling area for each pattern and type required for project.

.3 Ensure extra materials are from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

2 PRODUCTS

2.1 MATERIALS

.1 Type ACT1: Acoustic units for suspended ceiling system: to ASTM E 1264.
- .1 Type IX, Form 2.
- .2 Class A.
- .3 Cellulose fibre with minimum 56% recycled content.
- .4 Pattern G.
- .5 Textures: smooth, Unperforated.
- .6 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
- .7 Smoke developed 50 or less in accordance with CAN/ULC-S102.
- .8 Noise Reduction Coefficient (NRC) designation of 0.90.
- .9 Ceiling Attenuation Class (CAC) rating 33, in accordance with ASTM E 1264
- .10 Light Reflectance (LR) range of 0.55 to ASTM E 1477.
- .11 Edge type square.
- .12 Surface Finish: Factory applied latex paint.
- .13 Colour white.
- .14 Size 610 x 1220 x 16 mm thick.
- .15 Mould and mildew resistant
- .16 High-Washability

3 EXECUTION

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Departmental Representative.

3.2 INSTALLATION

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.

.2 Install acoustical panels and tiles in ceiling suspension system.

.3 Install aluminum panel units with directional pattern running in same direction.

.4 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

.5 Install prefinished metal trim at perimeter of field of metal panels as indicated in drawings.

3.3 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 acoustical ceiling components.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies.

.2 Section 09 51 13 – Acoustical Ceiling Assemblies

1.2 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C 635/C 635M-17, Standard Specifications for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
- .2 ASTM C 636/C 636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.3 SYSTEM DESCRIPTION

.1 TYPE ACT1:
- .1 Conventional 610 x 1220 mm grid.
- .2 Basic suspension system as indicated.

1.4 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 ceiling assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .2 Indicate layout of ceiling suspension systems, location and sizes of air diffusers, light fixture support method. Include insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions, locations and acoustical unit support at ceiling fixture, and indicate lateral bracing and accessories.

.4 Samples:
- .1 Submit samples of integrated ceiling components as follows:
  - .1 One representative model of each type of ceiling suspension system including trim moulding.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:
- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply and deliver 1 carton of at least 3 m of metal suspension components of each component installed.
.3 Supply maintenance materials of same production run as installed materials.
.4 Store maintenance materials where directed. Identify contents of cartons.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect ceiling assembly materials from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.3 Packaging Waste Management: remove for recycling as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Suspension system:

.1 Metal suspension: intermediate duty system to ASTM C 635.

.2 TYPE ACT. Basic materials for suspension system: commercial quality cold rolled steel, zinc coated, prefinished. Suspension system: non fire rated, two directional exposed tee bar.

.1 610 x 1220 mm exposed grid, two directional system. Exposed and concealed tee bar grid, components die cut. Main tee with double web, rectangular bulb and rolled cap on exposed face. Cross tee with rectangular bulb. Web extended to form positive interlock with main tee webs. Lower flange extended and offset to provide flush intersection.

.2 40 mm high main tee with 12.5 mm high top web and 24 mm exposed face. Shop painted. Colour: flat sheen white. Maximum 1200 mm hanger spacing. Provide matching perimeter wall angle.

.3 Perimeter trim, recessed shadow-profile providing a 12.7 mm x 12.7 mm reveal at the wall intersection.

.4 Hanger wire: galvanized soft annealed steel wire. 3.6 mm diameter.

.5 Hanger inserts: purpose made.

.6 Carrying channels: 38 x 65 mm channel, of 1.6 mm thick galvanized steel.

.7 Accessories: splices, clips, wire ties and retainers to complement new suspension system components, as recommended by system manufacturer.

.8 Shadow Mould: provide matching shadowline wall moulding to complement suspension system components, as recommended by system manufacturer.

.2 Light fixtures:
.1 Provide light fixtures compatible with integrated ceiling system and as described in the drawings.

.3 Air diffusion:
.1 Provide air diffusion as integral part of ceiling system and as specified in Division 23.

3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

.1 Install integrated ceiling suspension system to ASTM C 636 with hangers supported from building structural members at indicated heights.

.2 Do not erect ceiling suspension system until anchors, blocking, painting of plenum, sound or fire barriers, electrical and mechanical work above ceiling are inspected and approved by Departmental Representative.

.3 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.4 Layout centre line of ceiling both ways, to provide balanced borders at room perimeter no less than 1/2 tile, and according to reflected ceiling plan.

.5 Ensure suspended system is co-ordinated with location of related components.

.6 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles and speakers.

.7 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.8 Interlock cross member to main runner to provide rigid assembly.

.9 Frame openings for light fixtures, air diffusers, speakers, at changes in ceiling heights.

.10 Establish ceiling elevation using laser. Install wall mould to provide correct ceiling height.

.11 Install suspension assembly to manufacturer's written instructions and tested design requirements. Install lateral and diagonal hanger wires as indicated to prevent sway of free floating ceiling assemblies. Locate diagonal and lateral suspension wires to not be visible from below the ceilings and to approval of Departmental Representative.

.12 Fascia trim: install fascia trim sections to conceal exposed edges of free floating suspended ceiling systems and where indicated.

.13 Install electrical light fixtures and air diffusers to manufacturer's instructions. Provide stabilizing reinforcement as per manufacturer's instructions.

.14 Install acoustic units, sprinklers, detectors, speakers, light fixtures, in suspension system as per details.

.15 Ensure ceiling is free of finger marks and touch-up scratched surfaces with field painting to match as supplied by manufacturer.

3.3 CLEANING

.1 Progress 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.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by ceiling assemblies installation.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 06 40 00 – Architectural Wood Work

.3 Section 08 11 00 – Metal Doors and Frames

.4 Section 08 14 16 – Flush Wood Doors

.5 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

.1 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environment Canada (EC)
- .1 Analytical Methods for Determining Volatile Organic Compound Concentration and Other Parameters for the VOC Regulations.

.3 Master Painters Institute (MPI)
- .1 MPI Architectural Painting Specifications Manual, 2014.

.4 National Research Council Canada (NRC)
- .1 National Fire Code of Canada (NFC) 2015.

.5 Society for Protective Coatings (SSPC)
- .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual (PB-00802).

1.3 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 SCHEDULING

.2 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.3 Obtain written authorization from Departmental Representative for changes in work schedule.

.4 Schedule painting operations to prevent disruption of occupants.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit product data and instructions for each paint and coating product to be used.
- .2 Submit product data for the use and application of paint thinner.
- .3 Submit copy of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:
- .1 Submit full range colour sample chips to indicate where colour availability is restricted.
- .2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
  - .1 3 mm plate steel for finishes over metal surfaces.
  - .2 13 mm birch plywood for finishes over wood surfaces.
  - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
  - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
  - .5 10 mm cedar or hardboard for finishes over wood surfaces.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .1 Lead, cadmium and chromium: presence of and amounts.
  - .2 Mercury: presence of and amounts.
  - .3 Organochlorines and PCBs: presence of and amounts.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation and application instructions.
- .7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
  - .1 Product name, type and use.
  - .2 Manufacturer's product number.
  - .3 Colour numbers.
  - .4 MPI Environmentally Friendly classification system rating.

1.6 MAINTENANCE

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

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:
- .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:
- .1 Identify products and materials with labels indicating:
  - .1 Manufacturer's name and address.
  - .2 Type of paint or coating.
  - .3 Compliance with applicable standard.
  - .4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:
- .1 Provide and maintain dry, temperature controlled, secure storage.
- .2 Store materials and supplies away from heat generating devices.
- .3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:
- .1 Provide one 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 National Fire Code of Canada requirements.

.9 Waste Management and Disposal:
- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Ensure emptied containers are sealed and stored safely.
- .4 Unused paint materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.
- .5 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .6 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .7 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.8 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.9 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.10 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.

1.8 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Paint Inspection Agency and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is over 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

2 PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E3 rating.

2.2 COLOURS

.1 Departmental Representative will provide Colour Schedule after Contract award.

.2 Colour schedule will be based upon selection of three base colours and two accent colours. No more than five colours will be selected for entire project and no more than five colours will be selected in each area.

.3 Selection of colours from manufacturer's full range of colours.

.4 Where specific products are available in restricted range of colours, selection based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

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

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

.2 Gloss level ratings of painted surfaces as indicated and as noted on Room Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete masonry units: smooth and split face block and brick:

.1 INT 4.2E - Institutional low odour/low VOC. Gloss Level 4 – Satin-like finish.

.2 Structural steel and metal fabrications: columns, beams, joists, miscellaneous metal fabrications, etc:
.1 INT 5.1C - Waterborne dry fall finish.

.3 Steel piping and conduits: sprinkler and gas piping, etc::
.1 INT 5.1S - Institutional low odour/low VOC. Gloss Level 5 – Traditional semi-gloss finish.

.4 Galvanized metal: railings, misc. steel, pipes, overhead decking, and ducts.
.1 INT 5.3H - Waterborne dry fall finish.

.5 Galvanized metal: doors, frames.
.1 INT 5.3N - Institutional low odour/low VOC. Gloss Level 5 – Traditional semi-gloss finish.

.6 Plywood back boards for electrical and telecommunications equipment:
.1 INT 6.4P - Pigmented fire retardant coating (ULC rated). Gloss Level 3 - Eggshell finish.

.7 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
.1 Walls: INT 9.2M - Institutional low odour/low VOC. Gloss Level 3 – Eggshell finish.
.2 Ceilings: INT 9.2M - Institutional low odour/low VOC. Gloss Level 1 – Matte finish.

.8 Dressed Lumber: doors, door and window frames, casings, mouldings, etc.
.1 Opaque Finish Requirements:
.1 INT 6.3A - High-performance architectural latex semi-gloss finish.
.2 For repainting work: RIN 6.3T - High performance architectural latex semi-gloss finish.
.2 Clear finish requirements: Baltic Birch Plywood
.1 INT 6.3X - Polyurethane, clear, moisture cured gloss finish.
.2 For refinishing work: .1 RIN 6.3Y - Clear two-component polyurethane finish.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

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

3.3 EXAMINATION

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

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:
- .1 Stucco, plaster and gypsum board: 12%.
- .2 Concrete: 12%.
- .3 Clay and Concrete Block/Brick: 12%.
- .4 Wood: 15%.

3.4 PREPARATION

.1 Protection:
- .1 Protect building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.

.2 Surface Preparation:
- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
- .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
- .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 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. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or vacuum cleaning.

.7 Touch up of shop primers with primer as specified.

.8 Do not apply paint until prepared surfaces have been accepted by Departmental Representative

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
- .4 Brush out immediately all runs and sags.
- .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matte black paint.

.8 Paint fire protection piping red.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

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

3.8 FIELD QUALITY CONTROL

.1 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative.

.2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Cooperate with inspection firm and provide access to areas of work.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 08 11 00 – Metal Doors and Frames

.2 Section 08 14 16 – Flush Wood Doors

.3 Section 10 21 13.19 – Plastic Toilets Compartments

1.2 REFERENCE STANDARDS

.1 Government of Canada
- .1 Federal I dentity Program (FIPs) Manual. https://www.canada.ca/en/treasury-board-secretariat/services/government-communications/federal-identity-program/manual.html

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for signage and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit catalogue sheets and full size templates.
- .2 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
- .3 Submit full size templates for individually fabricated lettering indicating word and letter spacing.
- .4 Provide project specific shop drawings with elevations of each door to be numbered, and/or identified by pictogram.

.4 Samples:
- .1 Submit duplicate representative sample of each type sign, sign image and mounting method.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect specified materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 – Construction / Waste Management and Disposal.

2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Signage package to meet Federal Identity Program (FIP) requirements for tactile signage.

.2 Signage will be exclusively numerical and or pictographic or contain simple text, room functions and names will not be identified. Pictograms will include bilingual braille text repeated in black dome braille near the base of black field.

.3 Tactile signage will consist of 3.2mm polymer plates, with 1.5mm raised numbers and pictograms. Plates will be black, numbers and pictograms will be raised in a contrasting white. Braille, the colour of the plate will be included in the lower left.

2.2 MATERIALS

.1 Acrylic sheet: polymethylmethacrylate (PMMA) cast sheet suitable for intended use in sign fabrication, colours as indicated.

.2 Self-stick foam tape: 1.6 mm thick, 352.4 kg/m³ density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides.
- .1 Width: to suit sign sizes.

.3 Adhesives, paints, sealants and solvents: type recommended by sheet manufacturer for applicable condition.

.4 Acrylic top-coat: clear, non-yellowing, exterior grade, satin finish, acrylic polyester resin protective coating, compatible with acrylic, fibreglass, metal surface of type recommended by sheet manufacturer.

2.3 SIGN GRAPHICS

.1 Sign graphics: well defined, arranged for balanced appearance, and properly word and letter spaced.
- .1 Standard typeface: Helvetica regular.
- .2 Pictograms shall be employed to indicate specific functions as indicated.
- .3 All doors will be identified with numerical plates indicating the room they provide access to.
- .4 Doors will be identified from one side only, facing the corridor, or most public space.

.2 Silk screen process: white over raised characters and pictograms on black background.

2.4 TACTILE SIGNS

.1 Plastic wall plates:
- .1 Fabricate from black acrylic sheet 3.2 mm thick. Sizes as indicated.
- .2 Sign graphics: Raised pictograms, lettering and dome braile.

.2 Fixed mounting:
- .1 Include back-up plates for fixing to uneven surfaces where required.

.3 Tactile and Pictograph signage: Raised pictograms, lettering and dome braille. Bilingual. Text repeated in black dome braille near the base of black field.
- .1 Individual universal washroom indicating child change station (1 sign total): 450 mm wide x 230 mm high.
- .2 Female washroom indicating barrier free accessibility and child change station (1 sign total): 450 mm wide x 230 mm high.
- .3 Male Washroom (1 Sign total)
- .4 Barrier free stall indicating child change station. (1 sign total, mounted on outside of washroom partition door.)
- .5 Indicating stall is suitable for users who may require grab bars. (1 sign total, mounted on outside of washroom partition door.)
- .6 Service room (1 sign total): 150 mm wide x 230 mm high.

2.5 FABRICATION

.1 Fabricate signs in accordance with Federal Identity Program (FIP) Manual, specifications and shop drawings.

.2 Build units square, true, accurate to size, free from visual or performance defects.

.3 Fit and securely join sections to obtain tight, closed joints.

.4 Allow for thermal movement without distortion of components.

.5 Polish exposed edges of plastic to smooth, slightly convex profile.

.6 Manufacturer's nameplates on sign surface permitted in non visible locations in completed work.

3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

.1 Manufacturer's Instructions: compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Erect and secure signs plumb and level at elevations as directed by Departmental Representative.
- .1 Typical installation requires tactile signage to be installed at height of 1500 mm to the signs center line on the wall adjacent to the latch side of the doorway, with the edge approximately 50-75 mm from door frame.

.3 Comply with sign manufacturer's installation instructions and approved shop drawings.

.4 Comply with parameters identified in the Federal Identity Program (FIP) Manual under the heading “Installation of Tactile Signage”.

.5 Adhesive attachment:
- .1 Use self-stick adhesive foam tape to manufacturer's instructions to fix sign and prevent "rocking".
- .2 Keep tape maximum 1.6 mm from edges.

3.3 CLEANING

.1 Progress 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.
- .1 Leave signs clean.
- .2 Remove debris from interior of sign boxes.
- .3 Touch up damaged finishes.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.

.2 Section 09 30 13 – Ceramic Tiling

.3 Section 10 14 00 - Signage

.4 Section 10 28 00 – Toilet and bath accessories.

1.2 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM A 480/A 480M- 17, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting, Sheet, and Strip.

.2 CSA Group
- .1 CSA B651-12 (R2017), Accessible Design for the Built Environment.
- .2 CAN/CSA-Z809-16, Sustainable Forest Management.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for compact laminate partitions and screens and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.4 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada..

.1 Indicate sizes and descriptions of components, support and bracing fittings, and anchoring and fastening details, for ceiling hung installation.

.2 Indicate fabrication details, plans, elevations, hardware, and installation details.

.3 Furnish sections showing stile anchoring and leveling devices, concealed threaded inserts, panel and stile construction and edge construction.

.4 Show anchorage, attachment devices and accessory items. Provide location drawings for bolt hole locations in supporting members for attachment of compartments.

.5 Indicate panel colours and finishes inside and out. Indicate finishes of all hardware components.

.5 Samples:

.1 Submit duplicate 300 x 300 mm samples of panel showing finish on both sides, two finished edges and core construction.

.2 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Solid phenolic toilet partitions.

.1 Solidly fused plastic laminate with matte-finish melamine surfaces, coloured face sheets, and multiple layers of resin-impregnated kraft paper core. Integrally bonded.

.2 Urea-formaldehyde free.

.3 Factory installed threaded inserts for securing hinges and door latches

.4 Flame spread rating – Class A

.5 Colour to be selected from manufacturer’s standard and extend range of colours.

.6 Floor mounted.

.2 Pilaster ceiling trim: 0.8 mm stainless steel, 102 mm high. Satin finish.

.3 Attachment: stainless steel tamper proof type screws and bolts.

.4 Levelling device: 5 mm thick hot rolled steel bar, chromate-treated and zinc plated, bolted to stile.

2.2 COMPONENTS

.1 Hinges:
- .1 Heavy duty, non-lubricating nylon bushings.
- .2 Material/finish: stainless steel casting.
- .3 Swing: as indicated.
- .4 Return movement: gravity on inswing and spring loaded to remain open 50mm on outswing.
- .5 Adjustable to hold door open at any angle up to 90 degrees.
- .6 Emergency access feature.

.2 Latch set: surface mounted, combination latch, door-stop, keeper and bumper, stainless steel, emergency access feature.

.3 Wall and connecting brackets: stainless steel, full height U-channel.

.4 Coat hook: hook with maximum projection 29 mm from face of wall, stainless steel.

.5 Door pull: Barrier-free type suited for outswinging doors, stainless steel. D-type, 140 mm long. Provide pulls on inside and outside of toilet stall doors, inside pull to be installed horizontally located 250 mm from hinge edge.

2.3 FABRICATION

.1 Doors, stiles and screens: 19 mm thick, solid plastic laminate panels, to sizes indicated.

.2 Panels: 13 mm thick, constructed same as door, to sizes indicated.

.3 Laminate plastic to core material ensuring core and laminate profiles coincide to provide continuous support and bond over entire surface.

.4 Provide internal reinforcement at areas of attached hardware and fittings.

3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

.1 Ensure supplementary anchorage, if required, is in place.

.2 Do work in accordance with CSA B651.

3.3 ERECTION

.1 Partition erection:
- .1 Install partitions secure, plumb and square.
- .2 Leave 6 mm space between wall and panel or end pilaster.
- .3 Anchor mounting brackets to masonry or concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors.
- .4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.
- .5 Install steel support and diagonal bracing in plenum as indicated.
- .6 Provide for adjustment of ceiling variations with screw jack through steel saddles made integral with pilaster. Conceal ceiling fixings with stainless steel shoes.
- .7 Provide templates for locating threaded studs through finished ceilings.
- .8 Equip each door with hinges, latch set, and each stall with coat hook mounted on door and in locations indicated in drawings. Adjust and align hardware for proper function. Set door open position at 30 degrees to front.
- .9 Equip outswinging doors with door pulls on inside and outside of door in accordance with CSA B651.
- .10 Install hardware, grab bars and washroom accessories.

3.4 CLEANING

.1 Progress 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 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCE STANDARDS

.1 Aluminum Association (AA)
- .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
- .1 SCAQMD Rule 1168 (A2017), Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for wall and corner guards and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's for material as follows:
  - .1 Caulking materials during application and curing.
  - .2 Adhesives.

.3 Installation Drawings:
- .1 Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.

.4 Samples:
- .1 Submit duplicate 300 mm long samples of profiles and colours for corner and wall guards.

1.4 QUALITY ASSURANCE

.1 Test Reports:
- .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect wall and corner guards from nicks, scratches, and blemishes .
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Metal corner guard Typ CG1: 1.6 mm thick, 75 x 75 mm size, 1220 mm long, with 3 mm corner radius type 304 satin finished stainless steel, with removable protective paper cover, to profiles indicated, surface, mechanically mounted.

2.2 ACCESSORIES

.1 Fasteners: self-tapping stainless steel, flush (countersunk) mounting.

3 EXECUTION

3.1 EXAMINATION

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

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install units on solid backing and erect with materials and components straight, tight and in alignment.

.2 Mechanically fasten corner guards to substrate at 200 mm on centre and as indicated..

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
  .1 Leave Work area clean at end of each day.

.2 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.

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

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.6 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
  .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by wall and corner guards installation.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 40 00 – Architectural Woodwork

.2 Section 10 21 13.19 – Plastic Toilet Compartments

.3 Section 22 47 00 – Drinking Fountains and Water Coolers.

1.1 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM A 653/A 653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A 924/A 924M-17a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .3 Canada ASTM B 456-17, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CSA International
- .1 CAN/CSA-B651-12 (R2017), Accessible Design for the Built Environment.
- .2 CAN/CSA G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

.4 Samples:
- .1 Submit representative samples for each specified item including mounting brackets, fasteners, and trim.
- .2 Samples will be returned for inclusion into work.

1.3 CLOSEOUT SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:
- .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
- .2 Deliver special tools to Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.

.4 Packaging Waste Management: remove in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Sheet steel: to ASTM A 653/A 653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A 167, Type 304, with brushed finish. Apply manufacturer’s proprietary finish to minimize visual markings and appearance of fingerprints

.3 Stainless steel tubing: Type 304, commercial grade, seamless welded, wall thickness as indicated.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 CH – Coat hook: solid stainless-steel construction, satin finish. 50 mm x 50 mm overall size with 40 mm projection from wall. Flat face, vertical orientation of hook. Heavy duty, all welded construction. 35 mm x 35 mm x 3.6mm thick rectangular stainless-steel cap welded to support arm. Two-piece mounting bracket consisting of 1.2 mm thick stainless steel welded inside flange and 1.6 mm thick stainless-steel wall plate. Stainless steel set screw.

.2 DF1 – Recessed bottle filling station installed by Division 22.

.3 GB# - Grab bars: 32 mm diameter x 1.2 mm wall tubing of stainless steel, satin finish with peened gripping surface. Concealed mounting flanges 3.2 mm thick stainless-steel plate, end flanges 50 mm x 80 mm with holes for attachment to wall. Flange cover, 0.8mm stainless steel with satin finish, 85 mm diameter, cover snaps over mounting flange to conceal mounting screws. Grab bar material and anchorage to withstand downward pull of 2.2 kN.
- .1 Grab bar lengths and location as indicated.

.4 HD - Hand dryer: listed under re-examination service of ULC and CSA approved.
- .1 Surface mounted.
- .2 Mounting Base: 1.5 mm plated steel.
- .3 Cover: stainless steel.
- .4 Motor: universal type, 1.7 kW, 8000 RPM, resilient mounting, sealed, lubricated bearings, fuse protected, 115 V, 15 Amp.
- .5 Fan: double inlet centrifugal type, dynamically balanced, directly mounted on motor shaft, 33.5 L/s.
- .6 Heating element: protected by an automatic, resetting circuit breaker, isolated from nozzle.
- .7 Electronic dryer: power controlled by infrared admitting, receiving electronic control device positioned to dryer on when hands are placed under nozzle. Operation to continue for no more than 90 seconds of continued use.

.5 MIR – Wall mounted mirror per Section 08 80 00 – Glazing.

.6 NTF – Sensor Activated deck mounted faucet, installed by Division 22

.7 SD - Soap dispenser: Sensor activated deck mounted liquid soap dispenser. With all electronics sealed and water tight, compete with a low soap indicator.
- .1 Power type: Hardwired
- .2 Height 108mm above countertop
- .3 Sensor type: Infrared
- .4 Finish: Chrome plated
- .5 Soap: replaceable, minimum 800 ml concealed containers

.8 SND - Sanitary napkin disposal bin: stainless steel, surface mounted unit, heavy-duty stainless-steel piano hinge, self-closing, embossed with universally accepted symbol, removable waxed paper liner.

.9 TTD - Toilet tissue dispenser: double roll type, surface mounted, heavy duty chrome plated steel frame, capacity of maximum 150 diameter toilet tissue roll, roll under spring tension for controlled delivery. Remove roll core to access locking mechanism for servicing.

.10 WDL1 - Waste Disposal: Surface Mounted. Brushed stainless steel. One-piece seamless construction. Heavy gauge stainless steel cabinet, all welded construction. Removable brushed stainless steel receptacle. All welded construction. Secured to cabinet with tumbler lock. 70 litre capacity.

.11 WDL2 - Waste Disposal: Recessed installation, brushed stainless steel. One-piece seamless construction. Heavy gauge stainless steel cabinet, all welded construction. Removable brushed stainless-steel receptacle. All welded construction. Secured to cabinet with tumbler lock. 70 litre capacity.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B 456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:
- .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
- .2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.
- .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
- .4 Toilet and shower compartments: use male to female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer. Provide solid wood blocking between studs at all grab bar locations.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

.5 Install mirrors in accordance with Section 08 80 00 - Glazing.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 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 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Locate accessories where indicated.

.2 Toilet tissue dispenser: one in each toilet compartment, mounting height as indicated.

.3 Combination towel dispenser/waste receptacles: one in each washroom where indicated. Mounting height as indicated.

.4 Soap dispenser: one at each wash basin.

.5 Feminine napkin disposal bin: one in each female toilet compartment, mounting height as indicated.

.6 Hand dryer: one in each washroom. Mounting height as indicated.

.7 Shower rod and curtain: one at each shower compartment, mounting height as indicated.

.8 Wheelchair accessible shower threshold: one at each shower compartment, mounting height as indicated.

.9 Shower seat: one at each shower, mounting height as indicated.

.10 Grab bar: Sizes, mounting heights, and locations as indicated.

.11 Soap holder: one at each shower. Mounting height as indicated.

.12 Robe hook: Locations and mounting heights as indicated.

.13 Where mounting heights are not indicated in the drawings, mount at heights recommended by manufacturer and as required by CAN/CSA-B651.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section covers topics common to all sections of Divisions 21, 22, 23 and 25 and serves to complement the general conditions of the specifications. The general conditions and complementary general conditions apply to work described in this section.

.2 These specifications do not necessarily specify in detail the design, construction, or all various parts and equipment components and their installation. If applicable, observe generally accepted techniques and recommendations of suppliers.

.3 The specifications and drawings for the Electricity (Division 26) and Architecture are integral to the mechanical specifications as if they were reproduced in full.

.4 The Main Contractor and Specialized Contractors should become familiar with the type of construction proposed by carefully examining the drawings and specifications for architecture, structure and electrical works.

.5 The Main Contractor and Specialized Contractors must also become familiar with existing site and perform required surveys for coordination.

.6 The Contractor shall, before submitting his tender, review the general conditions and visit the project site on the required date to gain thorough knowledge of the conditions under which he will work. After visiting the site and examining the conditions affecting his work, the Contractor shall ensure that the work can be done within limits set out in the work execution schedule. The Contractor shall report in writing to the Departmental Representative any discrepancy, omission from drawings, and any other element that prevents execution of the work at least five (5) working days before submitting his tender. It is assumed that all tenderers will have visited the site and no claim may be made due to a lack of knowledge of existing conditions of premises and existing facilities.

.7 During the tender period, the Contractor shall verify the feasibility of work, become familiar with existing site, review existing building construction drawings and take into consideration all existing elements that may conflict with this work. The Contractor shall include in his tender the cost of dismantling, relocating or bypassing such elements.

.8 Any discrepancy between the general drawings and specifications or other specialty trades and the mechanical drawings and specifications must be brought to the attention of the Departmental Representative. The Departmental Representative must provide additional information necessary to eliminate any ambiguity that may result.

.9 Drawings and specifications:

.1 Only drawings and specifications marked "for tender" or "addendum", as appropriate, may be used for the calculation of tenders.

.2 Ensure that the copy of documents is complete: number of pages of drawings and specifications.

.3 The Departmental Representative's mechanical drawings and specifications are complementary to the architectural drawings and specifications. Check all dimensions on site and consult general drawings to ensure exact location of equipment before installation. No supplement will be allocated for discrepancies between mechanical drawings and documents from other disciplines.

.4 In preparing his tender and during the work, the Contractor shall become familiar with the Departmental Representative's drawings, as well as those of other specialty trades to know of any problems in spacing and interference before starting work. The drawings provide a general layout of the work and the Contractor shall make adjustments according to site conditions, if any, after consultation with the Departmental Representative, at no extra cost.

.5 No architectural or structural data will be taken from mechanical drawings.

.6 No additional compensation will be granted for the removal of ducts and equipment deemed necessary due to the structure or any other normal consideration, whether they have been installed or not.

.7 The Departmental Representative reserves the right to move Division 23 equipment without cost or credit on the condition that the displacement does not exceed 3 m and that notice is given prior to installation.

.8 Plans and specifications are complementary. All that appears on drawings or in specifications is considered to be included on drawings and in specifications.

.9 The Departmental Representative reserves the right to interpret mechanical drawings and specifications.

.10 Detail drawings that may be provided to the Contractor during work will also become part of mechanical drawings and specifications. If the Contractor requires detail drawings, he will request such from Departmental Representative in writing at least fifteen (15) days in advance.

.11 In general, large scale details take precedence over floor plans, but all accessories required on floor plans are part of the contract, even if they

are not repeated on detail drawings.

.12 Where site conditions require Departmental Representative to prepare drawings for additional details, such documents become part of the contract and cannot be used by the Contractor to warrant an additional charge, unless the detail indicates additional work required on drawings and in specifications other than those used to prepare tenders.

.13 If the Contractor, at the time of execution of the work, discovers an omission or discrepancy between the drawings and specifications, he must immediately notify the Departmental Representative in writing, who in turn will issue a directive for clarification or a change, if necessary.

.14 All work must be executed perfectly, and the installation of any item must be done taking into account ease of reading, calibrating, access, inspection and repair. The Departmental Representative will require the removal of any item installed without regard to this clause and at the exclusive expense of the Contractor.

.15 In committing to perform the work described on drawings and in specifications, the Contractor acknowledges and agrees that the drawings and specifications may not contain a description of or even mention all accessories, details, minor works, etc., which are required for the full completion of the work and agrees to accept the decision of the Departmental Representative regarding what should be provided and how to the work should be performed to meet the requirements of the drawings and specifications.

.16 The Contractor shall provide, install and connect all materials or accessories required for a complete installation even if they are not specifically included on drawings or in specifications.

.17 The names of specialties included in drawing identification or under drawing title are only used to facilitate work of each section and should not be considered as restrictive.

.1 No additional compensation will be paid for work not provided but required by the type of construction.

1.2 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common works Results for HVAC

.2 Section 09 91 23 – Interior Painting

1.3 LAWS, CODES, REGULATIONS AND PERMITS

.1 Perform work included on drawings and in specifications in accordance with codes and regulations governing the work within this project. Codes and

regulations are issued by federal, provincial, municipal and other authorities.

.2 Perform work in accordance with specific requirements of utility companies and authorized electricity, gas and telephone suppliers.

.3 Comply with codes, regulations and requirements without additional compensation and pay all associated costs for obtaining required permits.

.4 The Departmental Representative reserves the right to interpret mechanical drawings and specifications.

1.4 COST BREAKDOWN

.1 Upon notice of contract award, provide a breakdown of the tender price as required by the general requirements. This price breakdown may be the same as the one used in tender.

.2 Submit the amount tendered as described in the Departmental Representative's general and complementary requirements.

1.5 EQUIVALENTS AND SUBSTITUTIONS

.1 The term "Standard of Acceptance" means that the manufacturer's name is mentioned only in order to establish quality standards for equipment, hardware and service.

.2 When equipment or material is specified and identified by catalog number (acceptable product), this means that the system was designed with that equipment or material in mind and the Contractor shall submit his tender with the equipment or material specified as an acceptable product.

.3 However, the Contractor may submit a tender on equipment or material specified as an acceptable equivalent, and when presenting his shop drawings, the Contractor shall include the drawings of the acceptable product and the acceptable equivalent in design to allow the Departmental Representative to compare the two. The product that the Contractor wishes to use must be clearly identified.

.4 When the Contractor wishes to propose equipment or material from a manufacturer whose name is not mentioned in the specifications (SUBSTITUTE), he must submit a written request for substitution in one (1) copy in PDF format within five (5) working days, and include with the request one (1) copy in PFD format of a comparative table describing the main features of the specified and proposed equipment or material and a copy of datasheets on specified and proposed material.

.1 This table should include information on the following:

.1 Overall dimensions.

.2 Maintenance procedures.

.3 Spare parts.

.4 Guarantees.

.5 Characteristics of device or material.

.5 In addition to the comparative table, the Contractor must include in his request the following information:

.1 Copy of the tender for the specified devices, equipment or materials specified.

.2 Copy of the tender for the proposed devices or equipment; if there are any savings, the difference in price will be credited to Departmental Representative.

.3 The reasons for the substitution request:

.1 References of where equipment is in service and its proven use.

.6 The proposed equipment or materials will be examined taking into account ease of maintenance; spare parts availability and delivery times. The Departmental Representative may reject the proposed equipment based on performance criteria or energy demand or consumption. This applies particularly to any mechanical equipment.

.7 Note that the Departmental Representative's decision will be final. It is the Contractor's responsibility to demonstrate proof of equivalence, which will be entirely at his expense.

.1 If characteristics of the proposed device or equipment require any change to the drawings and work to be performed, the Contractor must cover the cost for such changes, including any adjustments required to meet the work acceptance performance and the cost of additional verifications by the Departmental Representative, for all disciplines involved.

.2 If the device or equipment proposed by the Contractor is rejected, he must provide and install the equipment or materials specified by number, without additional compensation.

.3 Requests for substitution will be rejected if they hinder or delay the execution of work.

1.6 ACTION AND INFORMATION SUBMITTALS

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

.1 Submit one electronic copy (PDF format).

.2 Do not start work until submittals have been verified by the Departmental Representative. These requirements are in addition to the Departmental Representative's requirements for shop drawings. Refer to section 01 33 00 – Submittal.

.3 At the time of submission, notify the Departmental Representative in writing of any deviations from the requirements of drawings and specifications, specifying the reasons for these deviations.

.4 The Contractor's or Supplier's responsibility for deviations from the requirements of drawings and specifications is not relieved by the Departmental Representative's review of the submitted documents, unless the Departmental Representative gives written acceptance of specific deviations.

.5 Notify the Departmental Representative in writing of any changes other than those required by the Departmental Representative for submissions of new documents and/or samples.

.6 Shop drawings: shop drawings submitted must bear the seal and signature of the Departmental Representative, authorized to practice in Canada, in the province of Ontario.

.7 Keep one copy of each submission on site by the Sub-contractor and reviewed by the Departmental Representative.

.2 The present specifies the scope of document verification by the Departmental Representative:

.1 Introduce an intermediate quality control step in the workflow, without constituting a change order to the drawings and specifications.

.2 Check general provision of equipment and materials only.

.3 Ensure, with annotations that are not restrictive, that the minimum requirements used in developing the project have been met.

.3 The present specifies the responsibilities of the Subcontractor or Supplier prior to submitting documents for verification.

.1 Verify that shop drawings and specifications are in accordance with drawings and specifications in terms of quality, characteristics and overall dimensions.

.2 Correct shop drawings and specifications as necessary.

.3 Reviewed shop drawings and specifications.

.4 Coordinate each submittal of required documents in compliance with the requirements of work, drawings and specifications. Note that documents submitted individually will not be checked until related information is available.

.5 Submit shop drawings, data sheets and all required samples in a reasonable amount of time and in the proper order so as not to delay the execution of work. Such delays do not constitute a valid reason to request an extension of the work schedule or contract period and no request for this purpose will be accepted.

.6 Include with the packing slip, shop drawing identification sheets with the following information:

.1 Date.

.2 Project title and number.

.3 Name and address of Subcontractor or supplier.

.4 Identification of shop drawings, datasheets and/or submittals.

.5 Identification of specification section number.

.6 Signature of the sender responsible for the document in question, stating that the document complies with drawings and specifications.

.7 Shop drawings must be presented with a proper identification sheet.

.7 Ensure that documents submitted, with regard to drawings, also contain the following information:

.1 Dates of preparation and revision.

.2 Project name and number.

.3 Name and address:

.1 Contractor and/or;

.2 Subcontractor and/or;

.3 Manufacturer and/or;

.4 Supplier.

.4 Identification of specifications section number.

.8 Ensure that documents to be submitted meet the specified criteria below:

.1 Shop drawings:

.1 Original drawings or standard modified drawings prepared by the supplier and illustrating parts thereof that apply to this work.

.2 Technical data:

.1 Manufacturer's catalog sheets, graphics and performance diagrams to illustrate standard products manufactured.

.2 Sheet dimensions: 8½ x 11 inches or 11 x 17 inches.

.3 Cross-outs of information that does not apply to this work.

.4 Add, to standard information, additional information applicable to this work.

For the shop drawing identification sheet (Section 01 00 10 – General Instructions), which must be submitted in one (1) copy, in electronic PDF format, in colour, high quality. The form must be duly completed (specify section number and paragraph in question), attached to the shop drawing indicating the project number in the subject line, and if known, the name of project director".

.3 Shop drawings and specifications submitted by fax are unacceptable and will be refused.

.4 Any shop drawing submitted without a duly completed identification sheet will be returned.

.4 The present specifies the responsibilities of the Contractor or Supplier after receiving documents verified by the Departmental Representative. According to annotations given in the documents, choose only one (1) of three actions:

.1 All documents rejected by the Departmental Representative must be resubmitted respecting the annotations provided; do not order equipment and/or material and do not start work involving equipment and/or material.

.2 Order equipment and/or material and carry out the work taking into account the Departmental Representative's minor annotations when the shop drawing indicates "Reviewed with annotations", but resubmit revised documents for final verification by the Departmental Representative when indicated "Revise and resubmit".

.3 When reviewed without annotations, distribute documents that do not

contain the Departmental Representative's annotations, order equipment and/or material and perform the installation work.

.5 Shop drawings to indicate:

.1 Mounting arrangements.

.2 Clearances necessary for operating and maintaining equipment.

.6 Submit the following documents with shop drawings and datasheets:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustic data, where applicable.

.3 Points of operation on performance curves.

.4 Compliance certification with applicable codes.

.7 Closeout Submittals:

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

.2 The operation and maintenance manual must be approved by the Departmental Representative before the final inspection. The Departmental Representative will keep final copies.

.3 Operating sheets must include:

.1 Each system's control circuit schematics, including ambient condition controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads, together with set point change schedules and seasonal variances.

.4 Operating instructions for each system and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Schedule of valves and fittings and flow diagram.

.7 Colour coding chart.

.4 Maintenance data must include:

.1 Servicing, maintenance, operation and troubleshooting instructions for each piece of equipment.

.2 Data must include schedules of tasks, frequency, tools required and task time.

.5 Performance data must include:

.1 The equipment manufacturer's performance datasheets with the point of operation, once commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified in contract documents.

.4 TAB reports (Testing, Adjusting and Balancing) reports as specified in Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit two (2) copies of the draft of the Operation and Maintenance Manual to the 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 the Departmental Representative.

.7 Additional data:

.1 Prepare and insert additional data into the Operation and Maintenance Manual if need becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 The Departmental Representative must provide a set of reproducible mechanical drawings. Provide the number of sets of prints required for each work phase and indicate changes as they are made during execution of work. Changes to control systems and their wiring must follow the same procedure.

.2 Every week record the information from reproducible drawings on the drawings; retain the services of a qualified draftsperson for this purpose.

.3 Use waterproof ink colors for each different service.

.4 Keep these drawings on site and make them available to those concerned for reference and verification.

.9 As-built drawings:

.1 Prior to starting Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right-hand corner using at least 12 mm high letters as follows: “AS-BUILT DRAWING: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED.” (Signature of Contractor) (Date).

.3 In general, as-built drawings must be 1:50 scale and done using AutoCAD. All drawings must be clearly identified and numbered. Numbering should refer to the Departmental Representative’s drawings.

.4 Submit to Departmental Representative for approval in two (2) copies, digital format and make corrections as directed.

.5 Perform testing, adjusting and balancing for HVAC systems using as-built drawings.

.6 Submit completed reproducible as-built drawings and an electronic copy in CD format (CD-ROM) with Operating and Maintenance Manual.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.7 HVAC FOREMAN

.1 Each Specialist Contractor must hire and pay for the services of a foreman able to represent Contractor in his absence.

.2 Foremen should have experience and adequate knowledge of their profession and this type of project to ensure cooperation with other Specialist Contractors and proper execution of orders from persons having jurisdiction over them.

.3 Foremen should be the same persons from beginning to completion of work, unless authorized by the Departmental Representative.

.4 The Departmental Representative reserves the right to demand the dismissal of the coordinator and/or foreman, who, in their opinion, is incompetent in the task assigned to him.

1.8 DEPARTMENTAL REPRESENTATIVE’S PRIVILEGE

.1 The Departmental Representative reserves the right, at their own expense, to have others perform certain work on the project that is not included on drawings or in specifications. The Contractor will not thereby be relieved of his responsibility for the work as part of his contract.

1.9 SCHEMATICS, DIAGRAMS AND PLAN VIEWS

.1 All schematics, diagrams, typical details, piping and duct runs, plan views and cut-always shown on mechanical drawings, as well as in specifications, are complementary. The Contractor shall provide and install all materials, systems and accessories shown on schematics, diagrams, typical details, plan views, sections and/or in specifications.

1.10 PIPING AND DUCT RUNS

.1 Piping runs for hot water heating, and chilled water piping, in addition to air duct networks are not precisely located on drawings. These are represented in schematic form and indicated as piping and duct runs. The Contractor must anticipate as close as possible their runs in mechanical room ceilings and their runs in ceiling spaces in other rooms and/or corridors. The Contractor must evaluate conflict with existing elements and modify the runs as required.

.2 In his tender, the Contractor shall include the design of the exact run for these systems, the necessary openings, elbows, and piping length deemed necessary, media and accessories, as well as coordination with all new elements and existing architectural, structural, mechanical and electrical construction. The Contractor will not be compensated for runs modifications due to existing elements.

1.11 EQUIPMENT: INSTALLATION REQUIREMENTS

.1 Ensure, through the use of unions and flanges that equipment servicing and disassembly can be done by moving connected pipes and ducts as little as possible. Also ensure that building elements/structure or other facilities do not constitute an obstacle to execution of this work.

.2 All required unions and/or flanges are not necessarily shown on drawings. The Contractor shall provide and install all unions and/or flanges required for servicing and material and equipment disassembly.

.3 Provide means to access all materials and equipment for servicing.

.4 Connect equipment run-offs to a floor drain.

.5 Where possible, align equipment frames with the walls of the building.

.6 Manufacturer nameplates and seals/labels of standard bodies for equipment approval must be visible and legible once equipment is installed.

.7 Verify factory-assembled fittings and tighten them as necessary to ensure their integrity for installation.

1.12 CONTROLLER

.1 Remote control devices:

.1 All control devices controlling operating sequences such as thermostats, aquastat, humidistats, pressure or flow switches, push buttons, switches, etc.

.2 These devices must be supplied, installed, wired and connected by Division 26, provided they are included with the starter. Otherwise, they must be supplied, installed, wired and connected by the Sub-contractor responsible for the work specified in Division 25.

.2 Control devices:

.1 All control devices activated by a signal from remote control device such as vent motors, connections, relays, contacts and automatic starters, etc.

.2 Except for starters, these devices must be supplied, installed, wired and connected by the Subcontractor responsible for the work specified in Division 25. The type and number of devices must match the operating sequence.

.3 Starters:

.1 Unless otherwise indicated, all starters must be supplied, installed, wired and connected (primary source only) by Division 26.

.4 Electrical installation:

.1 Required from supply point up to motor terminal.

.2 Electrical installation by Division 26.

.3 For packaged units such as air conditioning units, etc., Division 16 shall provide, install and connect a disconnect switch near the equipment serviced. The connection between the disconnect switch and the packaged unit must be performed by Division 16 according to the manufacturer’s instructions.

.5 Power wiring:

.1 Power wiring starts at the starters’ power supply and electrical connections for all control devices and remote control devices.

.2 Wiring must be supplied and installed by the Automation Sub-contractor.

.3 Types of conduits and wiring described in Division 26.

.6 Overload relay:

.1 Selection of overload relays to be responsibility of Division 26. Provide a list of motor characteristics to Division 26, including the following: power intensity in ampere under no load or under a normal load, capacity of thermal element in the starter, and value of maximum power written in ampere on the motor nameplate.

1.13 ELECTRICITY

.1 The electrical work must be carried out in accordance with the requirements of Division 26 and the requirements of the following paragraphs:

.1 The responsibility of the supplier and installer of electrical equipment and systems is described in the motor, equipment and controls table appearing in electrical drawings/specifications. The responsibility of the mechanical systems supplier and installer is described in the mechanical equipment and systems table appearing in building or mechanical drawings/specifications.

.2 Refer to Division 26 for requirements relating to power wiring and conduits, except in regard to conduits, wires, cables and connections associated with a network/circuit operating at a voltage below 50 V, for elements belonging to the control circuits specified in Division 23 and illustrated in the mechanical drawings. Refer to Division 26 for quality of materials and work execution.

1.14 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Unless otherwise stated, use cast iron or steel sheaves secured to shafts with removable keys.

.3 For motors to 10 hp: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified rpm.

.4 For motors over 10 hp: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for the item in question. Provide sheave of correct size to suit balancing.

.5 Maximum drive rating: 2.0 times nameplate rating on motor. Keep overhung loads within manufacturer’s design requirements on prime mover shafts.

.6 Motor slide rail adjustment plates to allow for centre line adjustment.

.7 Tension belts to the manufacturer’s recommendations before start-up and after the first 100 hours of operation, using a calibrated belt tensioning gauge.

.8 Supply and change all belts and sheaves during system balancing.

1.15 SLEEVES AND COMPARTMENTATION

.1 Locate, supply and install sleeves for pipe crossings at the following locations:

.1 Foundation walls and slabs on ground: leak-proof sleeves, including steel sleeves equipped with waterproof welded flanges and rubber rings. Sleeve dimensions depend on the diameter of pipe.

.2 Floors (other than slabs on ground): galvanized steel sleeves (at least 10 gauge), cast in concrete. Install the sleeves so they extend beyond the finished level by 50 mm (2 in.). Leave an annular space as prescribed so an approved fire resistance system can be used for fire separations.

.3 In mechanical rooms and shafts, the Contractor must pour a 150 mm (6 in.) thick concrete base. The concrete work is specified in Division 03.

.4 Masonry and concrete walls: Galvanized steel sleeves (at least 10 gauge). Leave an adequate annular space for the application of compartmentation materials. The Subcontractor must supply and install lintels and/or opening reinforcements (if necessary due to their size) and fill the space between the sleeve and the opening with material compatible with that of the wall in question.

.5 Drywall: Install galvanized steel sleeves (at least 10 gauge) at locations where pipes pass through fire retardant partitions. Leave an adequate annular space for the application of compartmentation materials.

.2 Locate, supply and install sleeves for ventilation ducts at the following locations:

.1 Ducts passing through firewalls and fitted with fire dampers: the damper sleeves should be at least 26 gauge (0.6 mm). The gauge of the sleeves must comply with the requirements of SMACNA and the National Fire Protection Association (90A). Leave between 6 mm (¼ inch) and 50 mm (2 in.) of free space between the sleeve and the opening in the wall or the floor to allow for expansion. The Contractor shall provide and install the lintels and/or opening reinforcements (if required by their size). The Subcontractor must supply and install a fireproof sealant on the perimeter of the sleeve's retaining angles and on all joints between the frame of the fire damper and the sleeve. Do not apply a sealant in the space between the fire damper and the wall or the fire-proof flooring reserved for expansion. In the mechanical room and shaft, the Contractor must pour a concrete base with a thickness of 150 mm (6 in.). The concrete work is specified in Division 03.

.2 Ducts without fire dampers passing through drywall: The Contractor must provide and install the lintels and/or the steel reinforcement and/or the metal cover strip around the openings. Leave a space of 12 mm (½ in)

between the ventilation duct (or its insulation) and the opening. The Contractor must seal the space by applying a modified, fireproof, rubber latex acrylic sealer on exposed surfaces. On the surfaces of drywall that are not apparent, use an acoustic-based synthetic rubber sealer such as Tremco's Acoustical Sealant.

.3 Ducts without fire dampers passing through masonry walls: The Contractor must provide and install lintels and/or a steel reinforcement around the openings. Leave a space of 12 mm (½ in.) between the ventilation duct (or its insulation) and the opening. The Subcontractor must seal the space by applying a modified, fireproof, rubber latex acrylic sealer.

.4 Refer to architectural drawings for the location of walls, acoustic walls or airtight masonry walls:

.1 Locate, supply and install materials or combinations of materials to maintain the integrity of a building element by providing an effective barrier against the spread of fire, smoke, water and hot gases through the openings.

.2 The Subcontractors are responsible for performing all air sealing work to ensure required acoustic levels.

1.16 CUTTING AND PATCHING

.1 Provide all openings required for the work. Supply and install required reinforcements.

.2 Provide all sleeves and compartmentation materials in accordance with paragraph 1.17.

.3 Make openings in walls and concrete slabs using a diamond-tip drill or another tool required to achieve penetration providing acceptable finish and precision results.

.4 The Subcontractor will coordinate all required cutting and opening sealing with the Contractor.

.5 The Contractor shall patch and seal all openings in walls, ceilings and concrete slabs after the removal of pipes, ducts or equipment with materials and finishes identical to those of walls or slabs adjacent to patching area.

.6 The Contractor shall patch and seal all openings in walls, ceilings and concrete slabs to ensure pressurization of laboratories and data rooms, in addition to partitions, walls, floors and other openings.

.7 All penetrations in roofs, walls, floors, or other elements required by mechanical and electrical works for openings larger than 150 mm dia., or a duct larger than

150 mm x 150 mm (225 cm²), will be performed by the Contractor. The location of these openings must be approved in advance by the Structural Departmental Representative. All others will be performed by the related subcontractor and the location of these openings must be approved in advance by the Departmental Representative.

.8 All piercing and cutting works to be performed using tools equipped with integral vacuum unit.

1.17 CAULKING

.1 The Contractor shall caulk the edge of all of the following, as per good trade practices:

.1 Piping and Ventilation.

.2 Unless otherwise stated, only one (1) type of mildew resistant caulking should be used:

.1 High performance intumescent firestop sealant.

.3 The VOC (volatile organic compounds) adhesives, sealants and primers for sealants used must be less than the current VOC limits of Regulation No 1168 "South Coast Air Quality Management District Rule".

1.18 PAINTING

.1 Apply at least one coat of corrosion resistant primer to ferrous supports and hangers and site fabricated equipment.

.2 Prime and touch up marred finished paintwork to match the original.

.3 At the discretion of the Departmental Representative, re-finish severely damaged surfaces.

1.19 ENCLOSURE BELT GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives must have following characteristics:

.1 Expanded metal screen welded to steel frame.

.2 Minimum 3/64 in. thick galvanized sheet metal tops, bottoms and inside faces.

.3 1.5-inch diameter holes on both shaft centers for the insertion of a tachometer.

.4 Removable for servicing.

.3 Provide the means to permit lubrication and use test instruments with guards in place.

.4 Install belt guards to allow for the movement of motors for belt tension adjustments.

.5 Supply and install flexible couplings, removable, U-shaped, minimum 1.16 in. thick galvanized mild steel.

.6 Where necessary, provide on unprotected fan inlet or outlet: minimum ¾-in. galvanized wire or expanded metal screen. The guard's net free area is to be not less than 80% of the fan openings.

1.20 EQUIPMENT SUPPORTS

.1 Equipment supports provided by equipment suppliers: specified in Division 23.

.2 Supports not provided by equipment suppliers: supports must be supplied and installed by the Contractor. They must be made of structural steel. Develop and submit structural calculations with shop drawings for review by the Departmental Representative.

.3 Levelling base and housekeeping pad beneath equipment: at least 100 mm (4 inches) thick and 50 mm (2 inches) larger all around than the supported devices. Curve perimeter shall be provided with chamfer edge 12 mm at 45°. Work is specified in structural specifications.

.4 The Subcontractor shall provide and install all additional support elements required to connect pipe supports, ducts, or other equipment to the building structure.

.5 Elements part of steel supports for equipment parts, piping and ducts exposed to weather shall be hot dip galvanized after fabrication.

1.21 ESCUTCHEONS

.1 The specialized contractor must install escutcheons where piping penetrates walls, partitions, floors, and finished ceilings, or where apparent.

.2 Escutcheons: chrome-plated brass, nickel, or stainless steel type 302, fitted with set screw.

.3 Escutcheon outside diameter must be greater than that of sleeve opening or sleeve to conceal.

.4 Escutcheon inside diameter must be adjusted to outside diameter of pipe (insulated or not).

.5 When a sleeve projects from finished floor, escutcheon must cover sleeve extension.

1.22 ACCESS DOORS AND FRAMES

.1 Unless otherwise noted, access doors and frames are supplied and installed by General Contractor.

.2 However, the Contractor of this section shall determine the location and size of doors to ensure easy access to all junction boxes, pull boxes, control devices, lighting fixtures, safety switches, starters or other.

.3 Frames and doors must be as described in the Departmental Representative's document.

.4 Access doors and frames are not indicated on drawings. The Contractor of the present section is responsible for coordinating with other sub-contractors to minimize quantity to be installed. Access door for fire dampers must be shown on as-built documents including plan views and details.

1.23 WORK EXECUTION

.1 The present specifies particular requirements, obligations and responsibilities of the Contractor during work execution.

.1 Coordination:

.1 The Contractor shall consult all drawings and specifications for the various trades and coordinate his work with them, and is ultimately responsible for coordination. The devices will be installed to allow access to the different mechanical equipment and accessories.

.2 Coordination of specialized subcontractors:

.1 The contractor responsible for manufacturing and installation of ventilation ducts shall provide all other contractors for mechanical, electrical, walls and ceilings, with a copy of drawings for the fabrication of air ducts. Other contractors will coordinate their installations with these fabrication drawings. A coordinated, signed and approved copy of such drawings (by all Contractors previously appointed by the General Contractor) shall be given to Departmental Representative.

.3 Division 23 Work:

.1 Conduit and piping crossings:

.1 Mechanical drawings indicate approximate location of conduit and piping crossings through floors in technical rooms. The Contractor

must indicate in timely manner size and exact positions of conduit and piping crossings.

.2 Openings in foundation walls for passage of piping:

.1 The Contractor to use these openings will locate them in a timely manner so as not to delay work. He will install all sleeves required. The Contractor shall make all necessary openings for the passage of pipes and ducts. The Contractor to use these sleeves and openings will be responsible for sealing contour of these openings.

.2 The Contractor shall pay all costs related to non-installation and/or provide and install required sleeves and openings in timely manner.

.3 The General Contractor shall provide and install all required reinforcements and lintels.

.3 Openings in walls and ceilings for passage of ducts and piping:

.1 The Contractor must indicate in timely manner exact positions of duct and piping crossings through walls and floors. The Contractor shall provide and install all required sealing in specifications.

.4 Coordinate all work as well as location of all pipes, ducts, and all equipment shown on construction drawings prepared by the Ventilation and Air Conditioning Contractor and coordinate all passages of all ducts, pipes, and all equipment prior to installation. The Contractor shall sign the drawings and obtain the signature of heads of other divisions before beginning work in accordance with the requirements of section 23.

.5 Method:

.1 Indicate in timely manner spaces to be left in walls, ceilings, roofs, floors and partitions for the installation of various devices and conduits.

.2 To do this, coordinate work to locate in timely manner all sleeves and openings required. Make all openings and fill gaps required for passage of pipes and ducts as necessary.

.3 Each day, remove all waste resulting from work. Once the work is complete, remove from premises all tools, debris, excess material and waste resulting from work, and clean all equipment installed and make sure they are not damaged; if damaged, repair or replace them.

.4 Use of Ram-Set anchors is not permitted.

1.24 CLEANING

.1 Clean equipment and mechanical appliances every day.

.2 Clean the inside and outside of all components and devices, including exhaust fan and fan coil unit.

.3 Carefully clean all devices and leave them in perfect working order. Replace all filters for ventilation systems and clean water filters in preparation for provisional acceptance.

.4 Do not discharge to sewers cleaning products whose contents do not meet competent authorities' requirements. The Subcontractor must collect these products and dispose of them in manner approved by competent authorities.

.5 Protection of work:

.1 The Contractor shall protect his installation against damage until entire work has been accepted by proper authorities.

.2 All materials will be stored carefully in appropriate locations, without disturbing traffic.

.3 Ensure physical protection of materials and equipment installed and/or stored on site. Promptly remove all debris, tools or materials inside and on top of equipment.

.4 Prevent dust, dirt and other foreign matter from entering the openings of facilities and equipment using appropriate means.

.5 When work benches are installed inside building, the Contractor will protect floor against any deposits or debris that may damage floor.

1.25 SERVICE INTERRUPTIONS

.1 No building service should be interrupted without the written approval of the Departmental Representative.

.2 The Contractor's written request must state the zones affected and duration of interruption.

.3 Submit work schedule for approval to the Departmental Representative as to temporary interruption of existing networks or services. Indicate the time for service interruption. Perform outages according to approved schedule and notify those affected in advance. The Departmental Representative must be notified at least ten (10) working days in advance. Confirmation will be requested from the Departmental Representative 24 hours before said interruption.

.4 Take all precautions necessary to avoid disturbing building operations. When making connections to existing networks, do so at times set by the Departmental

Representative while minimizing interference with pedestrian and vehicular traffic.

.5 If work or testing must be conducted in occupied premises, the Contractor must obtain permission from the Departmental Representative and co-ordinate his work accordingly, for any interruption of service, if applicable.

.6 When required, the Contractor shall ensure continuity of existing services in the zones affected. The supply, installation and connection of all equipment required for this purpose should be included in the present contract.

1.26 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 00 10 – General Instructions.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 Health And Safety Requirements.

1.27 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 00 10– General Instructions.

.2 Provide a list of all spare parts recommended by equipment suppliers and provide, among other things, the following change parts:

.1 Three (3) fusible links (at each temperature) for fire dampers.

.3 This list is not exhaustive and does not relieve the Contractor of his responsibility to provide any other spare part considered essential by the Departmental Representative.

.4 Once work is complete and just before final acceptance of the installation, replace cartridge filters and filter banks in accordance with specifications.

.5 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 00 10 – General Instructions.

1.28 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal in accordance with Section 01 00 10 – General Instructions.

1.29 COORDINATION & COOPERATION WITH OTHER TRADES

.1 Co-ordinate your work with the work of all trades to ensure a proper and complete installation. Notify all trades concerned of the requirement for openings,

sleeves, inserts and other hardware necessary in their work for the installation of your work.

.2 The exact locations and routing of mechanical and electrical services must be properly planned, coordinated and established with all affected trades prior to installation such that they will clear each other as well as any obstructions. Generally, piping requiring uniform pitch shall be given the right of way, with other services located and arranged to suit.

1.30 PERMITS, CERTIFICATES & FEES

.1 Display all required permits on worksite and include copies of inspection certificates in operating and maintenance instruction manuals.

.2 Obtain "Hot Work Permit" from the Client prior to commencement of soldering, welding or other high temperature work.

.3 Comply with all requirements of Section 01 00 10.

1.31 FEDERAL HALOCARBON REGULATION

.1 Generate halocarbon records for work on equipment (cooling equipment with CFC's, HCFC's and HFC refrigerants; fire suppression systems; solvent cleaning systems) that may result in the release of a halocarbon.

.2 Tag equipment with duplicate of halocarbon record.

.3 Provide additional copy of halocarbon record to BGIS for inclusion in the Zone Halocarbon Service File.

1.32 CLEANING & FINAL ADJUSTMENT

.1 During construction, keep the site reasonably clear of rubbish and waste material resulting from your work on a daily basis to the satisfaction of the Departmental Representative. Notify the general contractor of any requirements for a waste receptacle for disposal of waste materials.

.2 Clean interior and exterior of all systems including strainers, and vacuum interior of air handling units.

.3 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters in all air and piping systems.

.4 Balance and adjust all systems and each piece of equipment to operate as designed.

1.33 STORAGE OF EQUIPMENT & MATERIALS

.1 Arrange for sufficient storage facilities off the premises for the storage of equipment and materials which will not be allowed to stand in the open, nor to interfere with normal operations in the building.

.2 Bring prefabricated materials on the job site as and when required to be installed.

1.34 HOISTING & SCAFFOLDING

.1 Provide all necessary hoists and scaffolds required for your work.

.2 Design and construction of scaffolding to be in accordance with CSA S269.2

1.35 BUILDING AUTOMATION SYSTEM

.1 Mechanical contractor shall carry all base building BAS contractor “Regulvar”.

.2 Regulvar will provide all temperature sensors and all other sensors outlined in the mechanical drawings. Low voltage wiring for associated controls will be by BAS contractor.

.3 Mechanical contractor shall review full scope of work with controls contractor during tender period and allow for installation of all BAS sensors and other coordination items.

Part 2 Products

2.1 MATERIALS / EQUIPMENT

.1 Not applicable.

Part 3 Execution

3.1 PAINT TOUCH-UPS

.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 finishes which have been damaged to new condition.

3.2 CLEANING

.1 The Contractor shall be responsible for taking all measures, both ordinary and extraordinary, in order to protect all ducting systems (new and existing) against dust, as well as against all substances that may become dirty such as the inside and outside of ducts and accessories.

.2 If, in the opinion of the Departmental Representative, Contractor fails to take adequate protective measures and/or if portions of pipes already installed become contaminated, the Contractor shall clean such portions of ducts at his own expense. If cleaning is inadequate, Contractor shall remove those portions of pipes and replace them with new pipes at his own expense.

.3 Any activity that, in the opinion of the Departmental Representative, generates dust and/or dirt and/or contaminants that may affect project environmental quality will be executed outside perimeter of the building.

.4 Obstruct openings: prevent dust, dirt and other foreign matter from entering openings of facilities and equipment using appropriate means.

.5 Clean equipment and mechanical devices every day.

.6 At the end of duct erection, and before ventilation systems start-up, Contractor shall clean inside and outside of all elements, devices and systems, including screens and filters, and vacuum inside the ducts and air handling units and leave them in perfect working order, replace all air unit system filters and clean water filters in anticipation of provisional acceptance. To do this, Contractor shall provide and install all doors required to clean all parts of duct systems.

.7 Do not discharge to sewers cleaning products whose contents do not meet competent authorities' requirements. The Subcontractor must collect these products and dispose of them in manner approved by competent authorities.

.8 Cleaning methods will be presented to the Departmental Representative for review prior to cleaning.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 00 10 – General Instructions and submit report as described in PART 1 – SUBMITTALS.

.2 Manufacturer's Field Services:

.1 The Contractor will be responsible for establishing and maintaining an on-site quality control system to ensure Departmental Representative of the highest quality work.

.2 Obtain written report from the 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.

.3 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.

.4 Schedule site visits to review work as directed in PART 1 – QUALITY ASSURANCE.

3.4 DOCUMENTED QUALITY CONTROL

.1 The Contractor is responsible for establishing and maintaining a system of quality control to ensure full documentation to Departmental Representative of the highest quality work. To do this, the Contractor must produce quality control documents to be given to the Departmental Representative at the end of work.

.2 Submit methods of quality control to the Departmental Representative for verification. Correct according to recommendation of Departmental Representative.

.3 Procedures for quality control should include, among others and not limited to, the following:

.1 On-site receiving of equipment and materials:

.1 Ensure quality of equipment and materials upon receiving them on site. To confirm quality control system, the Contractor must produce equipment reception sheets (ERF) confirming that the equipment received is in accordance with shop drawings approved by him and verified by the Departmental Representative. These equipment sheets must state the following:

.1 Project name and number.

.2 Equipment identification number.

.3 Reference to specification section and shop drawing number.

.4 Information from manufacturer's nameplate.

.5 Date equipment received.

.6 Name and address of the supplier.

.7 Compliance with shop drawings.

.8 Name and signature of person who made verification on behalf of Contractor and Departmental Representative.

.9 Any other relevant information.

.2 Installation verification documentation:

.1 Before start-up, check static installation of networks, devices and systems. Produce a static verification sheet (SVS) for each network, equipment and system. SVS should include the following:

.1 Project name and number.

.2 Identification number of the service checked.

.3 Reference to specifications section, drawings and number of shop drawings.

.4 Each network SVS must include confirmation of proper installation of components such as the orientation of valves, etc. Confirmation that all low points are drained, compliance with diagrams, supports, seismic systems, approved cleaning procedure, pressure test, cleaning and rinsing done, strainers cleaned, insulation complete, identification system checked and approved by the Departmental Representative, network identification, flow direction, confirmation that manufacturer nameplates are intact on equipment, references to datasheets received, references to list of parts and spare parts, and as-built drawings and shop drawings.

.5 Each equipment SVS must include the reception sheet number, confirmation of proper installation for components such as supports, insulators, insulation, electrical connectors, and accessories such as isolation valves, pressure gauge, etc.

.6 Any other relevant information.

.7 Name and signature of person who made verification on behalf of Contractor and Departmental Representative.

.8 Spaces for comments.

.3 Documented equipment start-up:

.1 Equipment Pre-Operation stage before starting systems. Proceed to start equipment. Correct and adjust until the specified results are obtained.

.2 Document equipment start-up, adjustment and testing stages:

.1 Produce pre-operation start-up verification sheets (POVS) (system start-up) for equipment demonstrating that manufacturer's instructions was followed and that adjustments were made (see sample sheets attached to this section).

.2 POVS to indicate the following:

.1 Project name and number.

.2 Identification number of service checked.

.3 Reference to the specifications section, drawings and shop drawing numbers, test parameters and adjustments made.

.3 Include reception and installation sheet in appendix.

.4 Include references to start-up reports and initial adjustments, vibrations, etc.

.4 These sheets must be part of the operations and maintenance manual.

3.5 INSPECTION

.1 Prior to any request to the Departmental Representative for an inspection visit or testing, do preparatory test and correct if necessary. Preparatory test must have been successful before the Departmental Representative's visit.

3.6 CONCEALED WORK

.1 No work shall be concealed before Departmental Representative's approval. To do so, the Contractor shall notify Departmental Representative in writing at least three (3) days in advance. If the Contractor does not comply, he shall pay necessary costs incurred for work inspection.

3.7 TESTS

.1 The Contractor, after completing his work, or any part thereof, will perform tests, at his expense and in the presence of the Departmental Representative, to prove that his work meets all requirements. If work appears defective, the Contractor will be required to correct such and repeat tests at his own expense until specified results are obtained.

3.8 SYSTEM START-UP

.1 Apply the setting operation of all systems as prescribed in this Section 01 00 10 – General Instructions and the requirements of this section.

.2 Start up all systems. Ensure that they are operating properly and demonstrate that systems performance meets the requirements of drawings and specifications. Correct and adjust until specified results are obtained.

3.9 DEMONSTRATION

.1 Temporary testing:

.1 Provide labor, materials and instruments for carrying out tests.

.2 Departmental Representative must be able to use facilities and equipment for testing before they are accepted. Provide labour, equipment and instruments necessary for carrying out tests.

.3 The following facilities and equipment will undergo temporary testing:

.1 Leak testing of ventilation ducts.

.2 Flow balancing of ventilation systems and chilled and heating water.

.3 Performance tests of ventilation and air conditioning equipment.

.4 Leak testing of chilled and heating water systems.

.2 Operating and Maintenance Personnel Training:

.1 Provide tools, materials and services of qualified instructors to give training, during normal working hours, to operating and maintenance personnel on the operation, control, adjustment, diagnostics/troubleshooting and maintenance of equipment, materials and systems, before their acceptance.

.2 Training must be provided during normal working hours, prior to acceptance and turn-over of systems and facilities, and prior to substantial completion.

.3 Learning materials must include, among other things, operations and maintenance manual, and as-built drawings.

.4 Requirements for necessary training hours are listed in each relevant section.

.5 Training courses to be based on contents of the operations and maintenance manual.

.6 Training time must conform to the specifications of the appropriate sections and the manufacturer's recommendations.

.7 The Departmental Representative may, if desired, record training on video or audio media for use at a later date.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Contents of sections "Mechanical – Scope of Work" and 21 05 01 – Common Work Results for Mechanical apply to this section as if entirely reproduced.

1.2 RELATED REQUIREMENTS

.1 Section 21 13 13 – Wet-Pipe Sprinkler Systems.

.2 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.3 Section 23 05 53.01 – Mechanical Identification.

1.3 REFERENCE STANDARDS

.1 Unless otherwise indicated, design the system and execute work in accordance with the following standards in effect in Quebec:

.1 National Fire Code of Canada 2015 (NFCC) and all documents referred.

.2 All components must be new and ULC approved.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Work includes, without being limited to, manpower, provision and installation of all materials and equipment necessary for fire protection as indicated on drawings and/or in specifications.

.2 This work includes, particularly:

.1 Coordination, supply, removal and installation of fire protection networks to protect overall building.

.2 Supply and installation of new sprinkler heads.

.3 Identify all piping.

.4 Provision of operating and maintenance manuals.

.5 Necessary assistance for start-up and adjusting of the building’s fire alarm system.

.6 All cutting in walls, floors or other elements required by the present package, in addition to coordination and positioning of such is the responsibility of the Contractor.

.7 This list is not restricted to these items and does not release the Contractor of his responsibilities to provide a complete and operational system.

Part 2 Products

.1 Not applicable.

Part 3 Execution

1.5 TESTING

.1 Perform all tests required by codes and standards in.

.2 Provide all necessary manpower, equipment and tooling to perform these tests required by the authorities having jurisdiction.

.3 Notify the Departmental Representative at least 48 hours in advance prior to testing and temporary shutdown of existing systems.

1.6 INSPECTION

.1 Have the systems inspected once the installation is complete by the competent authority.

.2 Defray the cost of this inspection.

.3 Correct defects, where applicable.

1.7 COORDINATION

.1 Coordinate the fire protection works with all architectural, structural, mechanical and electrical elements of the new zones. Pay particular attention to the following elements' coordination:

.1 Locate sprinklers in ceiling: match positioning of sprinklers with lighting fixtures, diffusers, and return grills.

.2 Locate piping in ceiling spaces: anticipate piping to pass through overall new and/or existing electro-mechanical elements.

.2 The Contractor is not to claim additional amounts for work that must be completed by him in order to coordinate his needs and those of other disciplines.

.3 The Contractor is to execute at his own costs, all required cutting and patching, dismantling and replacement of existing system equipment or that already installed in order to coordinate his work with the work of other disciplines or elements of the existing building.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical are integral parts of this present section.

1.2 RELATED REQUIREMENTS

.1	Section 21 05 01	Common Work Results for Mechanical
.2	Section 22 11 16	Potable and Non Potable Water Piping
.3	Section 22 13 17	Drainage Waste and Vent Piping
.4	Section 23 05 00	Common Work Result for HVAC
.5	Section 23 05 29	Hangers and Supports for Pipes and HVAC Equipment
.6	Section 23 05 48	Vibration and Seismic Controls for HVAC Piping, Ducts and Equipment
.7	Section 23 05 53.01	Mechanical Identification
.8	Section 23 05 93	Testing, Adjusting and Balancing for HVAC Equipment
.9	Section 23 07 15	Thermal Insulation for Piping

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Submit manufacturer's printed product literature and samples in compliance with Section 01 33 00 – Submittals and in accordance with the requirements of section 21 05 01 Common Work Results for Mechanical.

1.4 REFERENCE STANDARDS

.1 Perform work in accordance with project applicable code standards. The following list is not restrictive and does not relieve the Contractor of his responsibility to perform work in accordance with applicable codes and standards.

.2 Perform work in accordance with National Building Code 2015, NFPA and any other applicable standards.

.3 Obtain all authorizations, approvals, permits and certificates required by authorities. Pay all costs for such authorizations, approvals, permits and certificates.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals and in accordance with the requirements of section 21 05 01 Common Work Results for Mechanical.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: in accordance with Section 01 00 10 - General Work Information.

Part 2 Products

.1 Not applicable.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 In accordance with section 21 05 01 Common Work Results for Mechanical, for painting repairs and restoration.

3.2 CLEANING

.1 Carry out cleaning operations in accordance with Section 21 05 01 Common Work Results for Mechanical.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct the following tests in accordance with Section 01 45 00 – Quality Control and in accordance with section 21 05 01 Common Work Results for Mechanical.

3.4 DEMONSTRATION

.1 In accordance with Section 21 05 01 Common Work Results for Mechanical.

3.5 PROTECTION

.1 In accordance with Section 21 05 01 Common Work Results for Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical and section 22 05 00 - Common Work Results for Plumbing concerning the work results, are integral parts of this present section.

1.2 DEFINITIONS

.1 Potable water: safe for human consumption. Water also known as “domestic” or “softened” water (as is the case).

.2 Non-potable water: not safe for human consumption. Water also known as “laboratory”, “animal quarter”, “process” or “softened” water (as is the case).

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 ASTM International Inc.

.1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.

.3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International)

.1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-02a, Butterfly Valves.

.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction

.1 National Plumbing Code of Canada (NPC) - 2015.

.9 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Drawings for the following must be submitted for verification purposes:

.1 Pipe type.

.2 Ball valves.

.3 Check valves.

.4 Strainers.

.5 Gaskets, bolts and nuts.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: in accordance with Section 01 00 10– General Work Information.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA , Regional and Municipal regulations.

Part 2 Products

.1 Piping, fittings and valves for the potable and non-potable networks are described on the schedules included on drawings.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with NPC Plumbing Code and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 DIELECTRIC VALVES

.1 General:

.1 Must be compatible with type of pipe to be joined and same pressure class.

.2 Everywhere pipes of dissimilar metals are joined.

.3 Dielectric connections between dissimilar metals: dielectric fitting complete with thermoplastic liner.

.2 NPS 2 and under: unions.

.3 NPS 2-1/2 and over: flanged.

3.4 DRAINAGE VALVES

.1 Unless otherwise indicated, install drainage valves at all low points and close to shut-off valves.

.2 Bronze full-port ball valves at least NPS 3/4, unless otherwise indicated, straight, threaded end for connection to soft tubes, equipped with bonnet and chain.

3.5 VALVES

.1 Isolate equipment, fixtures and branches with gate, butterfly or ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

.3 Provide valve assembly with extended stems to meet insulation thickness.

3.6 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.

.2 Test pressure: greater of 1 time maximum system operating pressure or 860 kPa. Perform the pressure tests for two hours.

3.7 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

.2 If samples are not satisfactory, drain, disinfect and flush the system. Once disinfection is complete, submit laboratory test results regarding water quality for approval to the Departmental Representative.

3.8 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.9 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.10 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 (if applicable).

.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 Start up water treatment system (if applicable).

.4 Bring HWS storage tank up to design temperature slowly.

.5 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.6 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.11 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.4 Verify performance of temperature controls.

.5 Verify compliance with safety and health requirements.

.6 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.7 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

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.12 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.2 Packaging Waste Management: in accordance with Section 01 00 10– General Work Information.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical and section 22 05 00 - Common Work Results for Plumbing concerning the work results, are integral parts of this present section.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM B32-08, Standard Specification for Solder Metal.

.2 ASTM B306-02, Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).

.1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125.3-05, Plumbing Fittings.

.4 CSA B602 -2016 Mechanical couplings for drain, waste, and vent pipe and sewer pipe

.3 National Research Council (NRC)/Institute for Research in Construction

.1 National Plumbing Code of Canada (NPC) - 2015.

.4 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 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, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: In accordance with Section 01 00 10 - General Work Information.

Part 2 Products

2.1 COPPER PIPING AND CONNECTORS RELATED

.1 Evacuation piping for storm water sanitary evacuation and vent piping, type DWV, intended to be installed aboveground: conforming ASTM B306 standard.

.1 Connectors

.1 Cast brass connectors: conforming CAN/CSA-B125.3, ASME B16.23 standards.

.2 Forged copper connectors: conforming CAN/CSA-B125.3, ASME B16.29 standards.

.2 Solder: tin/antimony.

2.2 CAST IRON PIPING AND FITTINGS

.1 Evacuation piping for sanitary water, storm water evacuation and vent, made of cast iron class 4000, with a nominal diameter equal or greater than DN 40, intended to be underground, and related fittings: conforming CAN/CSA-B70 standards, and covered by a coated protection layer.

.1 Joints

.1 Mechanical Joints (M.J.)

.1 Mechanical joints for evacuation pipes, vent pipes and sewer pipes according to CAN/CSA B602 standards.

.2 Hub and spigot (HUB)

.1 EPDM joints: conforming to CSA B70 standard.

.2 Cold application sealing products.

.2 Evacuation piping for sanitary water evacuation, storm water and vent intended to be installed above ground, and related fittings: conforming to CAN/CSA-B70 standard.

.1 Joints

.1 Hub and spigot (HUB)

.1 EPDM joints: conforming to CSA B70 standard.

.2 Mechanical Joints (M.J.)

.1 Compression gaskets made of neoprene or butyl rubber and stainless steel hose clamps conforming to CSA B602 standard.

.2 The trademark, the diameter, the fabrication date and the CSA sign will be stamped along the pipe.

.3 Quality Control: ISO 9000 Control Quality certification or ISO 14001 Environment Management certification, applicable to cast iron pieces production, has to be supplied under request.

.3 Storm water piping:

.1 To install 4000 series couplings for the first 10 vertical feet above the street level, as well as all the piping under the street level.

.2 To install 2000 series for all subsequent piping.

.3 All horizontal type of joint (such as series 2000, 4000 and 2900) as well as all the vertical joints located where the direction changes will be supported with lifting bridles held together with threaded rods, except by those located directly under the roof.

.4 The piping joints greater than 200 mm, the joints 2000 series as well as all the joints of the 2900 Series (including all diameters) will be stuck together with an adhesive lubricant.

.5 All cleanouts will be supported with lifting bridles held together with threaded rods, unless line cleanouts are used.

.4 Sanitary piping

.1 To install 2000 series couplings for the DN 50 through DN 25.

.2 To install 4000 series couplings for the DN 300 through DN 375.

.3 All the joints greater than DN 100 that are located under the street level will be supported with lifting bridles held together with threaded rods (except the piping buried underground).

.4 All the cleanouts that are located under the street level will be supported with lifting bridles held together with threaded rods.

.5 Sanitary and storm water evacuation joints:

.1 Class 4000 grey cast iron covered by bituminous coating and equipped with a stop step for the positioning of the coupling. The trademark, the diameter and the CSA sign will be cast in the metal conforming to CSA B70 standard.

.1 Mechanical joints (MJ)

.2 Hub and spigot (HUB)

2.3 MECHANICAL JOINTS

.1 Standard coupling for 2000 Series piping and cast iron with mechanical end joint (MJ)

.1 Mechanical joints with neoprene gaskets, reinforced with a 0,008 inch thickness stainless steel sheath, equipped with a stainless steel hose clamp T-304, conforming to CSA-B70, CSA-B-602 and CAN/ULC-S102-07 standards. The joint has to be listed (« Listed Pipe Coupling »).

.2 *Heavy Duty* coupling 4000 series for piping and grey cast iron joints with mechanical joints (MJ)

.1 Mechanical joints with neoprene gaskets, reinforced with an undulated 0,016 inch thickness stainless steel sheath, equipped with a stainless steel hose clamp T-304 with 3/8 inch hexagonal bolt tightened at 80 lb inch conforming to CSA-B70, CSA-B-602, ASTM C1277-94, UPC-IAPMO, FM and CAN/ULC-S102 standards. The joint has to be listed (« Listed Pipe Coupling »).

.3 Piping joints and hub and spigot grey cast iron fittings (HUB)

.1 Neoprene compression joints type BI-SEAL 2900 series, conforming to CAN3-CSA-B70, CSA-B-602 standards.

.2 Cold caulking compounds, such as PC4 or approved equivalent.

.4 Coupling 2400 series between the cast iron piping jointing (MJ) and the copper piping type DWV

.1 Mechanical joints with neoprene gaskets, reinforced with a 0,008 inch thickness stainless steel sheath, equipped with a stainless steel hose

clamp T-304, conforming to CSA-B70, CSA-B-602 and CAN/ULC-S102. The joint has to be listed (« Listed Pipe Coupling »).

.2 Threaded cast iron fitting to fit with the brass spigot (male) fitting. Apply an approved joint compound for piping or 100% Teflon tape.

.3 Solder tin/antimony.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning

.2 Waste Management: In accordance with Section 01 00 10 - General Work Information.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical and section 22 05 00 - Common Work Results for Plumbing concerning the work results, are integral parts of this present section.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A126-95(2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C700-02, Cold Water Meters-Displacement Type, Bronze Main Case.

.2 AWWA C701-02, Cold Water Meters-Turbine Type for Customer Service.

.3 AWWA C702-1-01, Cold Water Meters-Compound Type.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.

.2 CSA-B79-94(R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.

.3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 Plumbing and Drainage Institute (PDI).

.1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

.2 PDI-WH201-92, Water Hammer Arresters Standard.

.6 National Research Council (NRC)/Institute for Research in Construction

.1 National Plumbing Code of Canada (NPC) - 2015.

1.3 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 for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, 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.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.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.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations, in which must be considered:.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building sub trades.

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

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transporting, storing and handling materials and equipment in accordance with section 01 61 00 – Common product requirement

.2 Deliver materials and equipment on site in their original packaging, which must bear a label stating the name and address of the manufacturer.

.3 Waste Management and Disposal:

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 FLOOR DRAINS

.1 Refer to plumbing fixture schedule.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze or stainless steel square and or round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: rectangular or round, cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron and nickel – bronze, round or square, gasket, vandal-proof screws.

.3 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

.1 Stainless steel or Copper construction, piston type: to PDI-WH201.

2.4 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series.

2.5 BACKWATER VALVES DRAINAGE

.1 Coated extra heavy cast iron or galvanized body with bronze seat, revolving bronze flapper and threaded cover.

.2 Access:

.1 Surface access.

.2 Access pipe with cover: maximum 300 mm depth.

.3 Steel housing with gasketed steel cover.

.4 Concrete access pit with cover, as indicated.

2.6 TRAP SEAL PRIMERS FOR ALL DRAINS

.1 Automatic trap primer, all bronze body with integral vacuum breaker, non-liming internal operating piston, stainless steel spring, removable bronze seat with metering office and sealed bronze cover. Product of reference: Zurn Z-1022-CP-XL (« Lead Free »),

2.7 PRESURE REDUCING VALVE

.1 Triple-coated corrosion preventative iron body construction with flanged inlet and flanged outlet connections, replaceable disc, interchangeable diaphragm chamber, replaceable stainless steel seat and stainless steel stem. Tapped for a bypass line and an auxiliary regulator. Maximum Working Pressure: 12.06 bar, Adjustable Reduced Pressure Range: 1.7 to 7.0 bar.

2.8 MIXING VALVES

.1 Refer to plumbing fixtures schedule.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.5 BACKWATER VALVES

.1 Install in main sewer lines, where indicated and at weeping tile connection in pit provided at building cleanout.

.2 Install in access pit as indicated.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install soft copper or plastic tubing to floor drain.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning (MS) Requirements: General Requirements, supplemented as specified herein.

.2 Timing: start-up only 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.

.3 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING

.1 General:

.1 In accordance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC. , supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

.4 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.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.7 Access doors:

.1 Verify size and location relative to items to be accessed.

.8 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.9 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.10 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.11 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

3.10 COMMISSIONING REPORTS

.1 In accordance with Section 01 91 13 - General Commissioning (MS) Requirements: Reports, supplemented as specified.

.2 Include:

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

3.11 TRAINING

.1 Demonstrate full compliance with Design Criteria.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical and section 22 05 00 -Plumbing- General Requirements concerning the work results, are integral parts of this present section.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.

.2 CAN/CSA-B125.3-05, Plumbing Fittings.

.3 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.2 National Research Council (NRC)/Institute for Research in Construction

.1 National Plumbing Code of Canada (NPC) - 2015.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Indicate fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 (For water closets, urinals): minimum pressure required for flushing.

.4 Shop Drawings:

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: In accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Refer to plumbing fixtures schedule.

.2 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.3 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.4 Exposed plumbing brass to be chrome plated.

.5 Fixture piping:

.1 Hot and cold water supplies to fixtures:

.1 Chrome plated rigid or flexible supply pipes with screwdriver or handwheel stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with clean out on fixtures not having integral trap.

.2 Chrome plated in exposed places.

.6 Chair carriers:

.1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

.1 V.P. loose key handles, escutcheons, less flexible copper risers.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Mounting heights:

.1 Standard: to manufacturer's recommendations measured from finished floor.

.2 Wall-hung fixtures: to manufacturer's recommendations, measured from finished floor.

.3 Barrier free: to most stringent NBCC or CAN/CSA B651.

.4 Refer to architectural elevation details.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.

.3 Checks:

.1 Water closets, urinals: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical and section 22 05 00 -Plumbing- General Requirements concerning the work results, are integral parts of this present section.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.

.2 CAN/CSA-B125.3-05, Plumbing Fittings.

.3 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.2 National Research Council (NRC)/Institute for Research in Construction

.1 NRCC 38728, National Plumbing Code of Canada (NPC) - 2010.

1.3 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.

1.4 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.

1.5 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, labeled with manufacturer's name, address.

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

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Refer to plumbing fixture schedule.

.2 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.3 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.4 Exposed plumbing brass to be chrome plated.

.5 Number, locations: architectural drawings to govern.

.6 Fixture piping:

.1 Hot and cold water supplies to each fixture:

.1 Chrome plated rigid flexible supply pipes each with screwdriver handwheel 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.

.7 Chair carriers:

.1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Mounting heights:

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

.2 Wall-hung fixtures: According to the manufacturer’s recommendations, unless otherwise stated in the specifications or drawings. Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA-B651.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Wash fountains: operation of flow-actuating devices.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: In accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical and section 22 05 00 - Common Work Results for Plumbing concerning the work results, are integral parts of this present section.

1.2 REFERENCES

.1 Air-Conditioning and Refrigeration Institute (ARI)

.1 ARI 1010-02, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-B45 Series-02(R2008), CSA Standards on Plumbing Fixtures.

.2 CAN/CSA-B125.3-05, Plumbing Fittings.

.3 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.3 National Research Council (NRC)/Institute for Research in Construction

.1 National Plumbing Code of Canada (NPC) - 2015.

1.3 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 fountains and coolers, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate, for all fixtures:

.1 Dimensions, construction details, roughing-in dimensions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: In accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Refer to plumbing fixtures schedule.

.2 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.3 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.4 Exposed plumbing brass to be chrome plated.

.5 Number, locations: architectural drawings to govern.

.6 Fixture piping:

.1 Hot and cold water supplies to each fixture:

.1 Chrome plated rigid or flexible supply pipes each with screwdriver handwheel stop, reducers, escutcheon.

.2 Provide and install in-line lead filter for all cold water connection.

.2 Waste:

.1 Brass P trap with cleanout on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

.7 Chair carriers:

.1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Mounting heights:

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

.2 Wall-hung fixtures: As indicated by the manufacturer, unless otherwise stated in the specifications or drawings.

.3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

.2 Drinking fountains and water coolers:

.1 In accordance with ARI 1010.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this Section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust water cooler, drinking fountain flow stream to ensure no spillage.

.3 Checks:

.1 Refrigerated water coolers: operation, temperature settings.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: In accordance with Section 01 74 21 - Construction/Demolition.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCE STANDARDS

.1 National Air Duct Cleaners Association (NADCA)

.1 ACR Standard, 2006 edition: Assessment, Cleaning and Restoration of HVAC Systems.

.2 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA 2005, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.

.3 United States Environmental Protection Agency (US EPA)

.1 US EPA 1999, 40 CFR Parts 152 and 156.

1.3 DEFINITIONS

.1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:

.1 Rigid supply and return ductwork;
.2 Flexible ductwork;
.3 Return air plenums including ceiling plenums;
.4 Cooling and heating coils and compartments;
.5 Condensate drain pans, eliminator blades and humidifiers;
.6 Fans, fan blades and fan housing;
.7 Filter housing and frames;
.8 Acoustically insulated duct linings;
.9 Diffusers, registers and terminal units;
.10 Dampers and controls;

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Site Evaluation: conduct a site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.

.1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.

.2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.

.1 Take account of elbows, bends, turning vanes, dampers, transitions.

.2 Scheduling: Hours of Operation: complete work during non-business hours as follows:

.1 Friday from 18:00h to Monday at 04:00h.

.2 Hours of operation are subject to change with 12 hours' notice.

Part 2 Duct Cleaning

2.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit video survey and cleaning plan developed during site evaluation.

.1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.

2.2 CLOSEOUT SUBMITTALS

.1 Post Cleaning Inspection Report: submit 3 copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:

.1 Name and address of facility;

.2 Name and address of HVAC cleaning Contractor;

.3 Description of HVAC systems with sketches identifying systems cleaned;

.4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;

.5 Identification of points where samples were collected and type of analysis used for each collection;

.6 Identification of each sample collected;

.7 Comments complete with photographs of each sampling location and other observed system features;

.8 Identify systems tested, observations, actions taken and recommendations for future maintenance.

.2 Record post cleaning video survey: submit 2 copies of video survey USB Drive media, and include on video survey following:

.1 Areas tested for particulate analysis or microbial growth evaluation;

.2 Areas of special interest and location;

.3 Special internal features;

.4 Problems such as broken or damaged controls or components;

.5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English on video using text or voice over.

Part 3 Products

3.1 ACCESS DOORS AND PANELS

.1 Equipment Access Doors and Panels: construct from same materials as equipment panelling complete with sealing gasket and positive locking device.

.1 Size access doors and panels in equipment to allow for inspection and cleaning.

.2 Provide all access doors required for duct cleaning.

3.2 SYSTEM FILTERS

.1 Supply and install new filters for each HVAC System cleaned.

3.3 AIR DUCT CLEANING EQUIPMENT

.1 Manually propelled full contact brushes:

.1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.

.1 Ensure brushes are sized to fit various duct sizes in HVAC system.

.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.

3.4 MULTI-FUNCTIONAL ROBOTIC CLEANING SYSTEM

.1 Self-propelled remote controlled.

.1 Ensure brushes are specifically manufactured and shaped to fit acoustic lined ducts, equipment and components of HVAC system.

.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces.

.3 Replace worn and ineffective brushes when required.

Part 4 Execution

4.1 PREPARATION

.1 Close down HVAC system.

.2 Locate and identify externally visible HVAC system features which may affect cleaning process including:

.1 Control devices;

.2 Fire and smoke control dampers;

.3 Balancing dampers: indicate and record positions for resetting;

.4 Air volume control boxes: indicate and record positions for resetting;

.5 Fire alarm devices;

.6 Monitoring devices and controls;

.3 Cut openings in equipment panels and ductwork for access to system interior.

.1 Square or rectangular opening sizes: 200 mm minimum each side.

.2 Circular opening sizes: 200 mm minimum diameter.

.4 Installation of Access Doors and Panels: install access doors and panels for equipment where required to facilitate system inspection and cleaning.

.1 Install access doors and panels for inspection and cleaning of equipment as follows:

.1 Heating and cooling coils;

.2 Fan units;

.3 Filters;

.4 Dampers;

.5 Sensors;

.5 Installation of Access Doors in Ductwork: install access doors in ductwork where required to facilitate system inspection and cleaning.

.1 Access door installation is not permitted in flexible ductwork.

.1 Inspect flexible ductwork only by disconnecting from main duct and inspecting from open end.

.6 When acoustically lined duct is cut for access, repair cut edges of acoustic lining using self-adhesive fibre glass tape and water based duct sealer.

.1 Adhere new acoustic lining connected to the inside of the access panel or door to ensure continuity of acoustic properties of system.

.7 Remove and reinstall ceiling tiles to gain access to HVAC system as required.

.1 Replace ceiling tiles damaged or soiled by air duct cleaning procedures.

4.2 EXAMINATION / PRE-CLEANING INSPECTION

.1 Verification of Conditions:

.1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.

4.3 PARTICULATE COLLECTION

.1 Before starting duct cleaning, identify locations for sample collection and collect particulate samples.

.2 Take samples from interior surfaces of HVAC system using sterile wipes for submission to independent testing laboratory.

.3 For each HVAC system collect 4 samples from each HVAC unit as follows:

.1 Sample 1: collect from inside ventilation unit downstream of air filters but before fan discharge;

.2 Sample 2: collect downstream of fan discharge and 1 metre maximum downstream in first horizontal branch;

.3 Sample 3: collect at junction of last horizontal branch and start of low-pressure duct;

.4 Sample 4: collect at junction each air terminal unit and supply duct.

4.4 LABORATORY ANALYSIS

.1 Ensure independent testing laboratory has demonstrated experience in work associated with air duct cleaning.

.2 Proceed with HVAC System Cleaning only after laboratory analysis test results have been received.

4.5 DUCT CLEANING

.1 Do duct cleaning in accordance with NADCA ACR Standard.

.2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through another zones which has already been cleaned.

.1 Isolate zone of duct using air inflated zone bag before cleaning.

.3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.

.4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.

.5 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.

4.6 ACOUSTICALLY LINED DUCTWORK CLEANING

.1 Clean glass fibre acoustically insulated ducts to NAIMA recommended practices.

.1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fibre lining.

.2 Monitor cleaning process progress by onboard camera.

4.7 ANTI MICROBIAL APPLICATION

.1 Report to the Departmental Representative any area where anti-microbial application may be required.

4.8 FIELD QUALITY CONTROL/FINAL INSPECTIONS

.1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.

.1 Carry out video survey as approved by Consultant.

.2 Include in final survey areas inspected by Departmental Representative prior to cleaning.

.3 Identify on HVAC system record drawings access points used for inspection and cleaning.

.4 Re-collect and analyse particulates collected at same locations where original samples were collected before cleaning.

.5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

4.9 SYSTEM STARTUP

.1 Install new system filters after cleaning operations are completed.

.2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.

.3 Restart each HVAC system.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Contents of sections – "Mechanical" and 21 05 01 – Common Work Results for Mechanical apply to this section as if entirely reproduced.

1.2 RELATED REQUIREMENTS

.1 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.2 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

.3 Section 23 05 53.01 – Mechanical Identification.

.4 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.5 Section 23 07 13 – Ductwork Insulation.

.6 Section 23 07 15 – Thermal Insulation for Equipment.

.7 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

.8 Section 23 33 14 – Dampers – Balancing.

.9 Section 23 33 16 – Dampers – Fire and Smoke.

.10 Section 23 37 13 – Diffusers, Registers and Grilles.

1.3 REFERENCE STANDARDS

.1 Perform work in accordance with project applicable code standards.

.2 Obtain all authorizations, approvals, permits and certificates required by authorities. Pay all costs for such authorizations, approvals, permits and certificates.

1.4 ACTION AND INFORMATION SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures and 21 05 01 – General Requirements for Mechanical.

.1 Shop Drawings

.1 Submit shop drawings for review by the Departmental Representative as follows:

.1 Manufacturing standards for metallic ducts and supports.

.2 Duct manufacturing and erection drawings.

.3 Drawings of the locations of penetrations, sleeves, openings and fire dampers.

.4 Flexible air ducts.

.5 All accessories and dampers for air ducts.

.6 Grilles and diffusers.

.7 Anti-vibration devices.

.8 Products for sealing air ducts.

.9 Sealants for caulking.

.10 Firewall products.

.11 Products and procedures for cleaning ducts.

.2 This list is not restrictive and does not relieve the Contractor of his responsibility to submit all shops drawings and/or technical data required by the Departmental Representative.

.2 Obtain the Departmental Representative's approval concerning proposed samples before beginning work.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide a list of all spare parts recommended by equipment suppliers and provide, among other things, the following change parts:

.1 One (1) filter cartridge or (1) filter media set for each filter or filter bank, in addition to final operating set.

.2 One (1) set of belts for each unit.

.3 One (1) set of pulleys for each fan for flow balancing.

.4 Three (3) fusible links (at each temperature) for fire dampers.

.3 This list is not exhaustive and does not relieve the Contractor of his responsibility to provide any other spare part considered essential by the Departmental Representative.

.4 Once work is complete and just before final acceptance of the installation, replace cartridge filters and filter banks in accordance with specifications.

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

.6 Furnish one (1) commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.8 COORDINATION

.1 The Contractor shall locate and indicate in a timely manner to the Construction Manager, the location of sleeves, openings and other work requirements having an impact on other trades.

.2 The Contractor shall not ask for any additional amount for work to be performed by him to coordinate his work with other trades and/or to account for lack of coordination.

.3 The Contractor shall perform, at his own expense, all required sealing, dismantling and reinstallation of equipment and systems already installed in order to coordinate his work with other trades.

1.9 START-UP AND CALIBRATION

.1 The Contractor is responsible for start-up of all equipment and systems supplied and installed by him.

.2 The Contractor is responsible for performance of systems and equipment supplied and installed by him. In this respect, the Contractor is responsible for correcting, modifying and adjusting any equipment, system or network which does not provide adequate performance as stated in specifications.

.3 The Contractor responsible for the scope of work of Section 23 05 93 – Testing, Adjusting and Balancing for HVAC shall supply labour, equipment and material to measure and/or calibrate the performance of networks and systems which are part of his scope of work.

.4 However, the Contractor in charge of work described in the present section is responsible for all work required on systems and networks for which he is responsible, to allow the Contractor responsible for Section 23 05 93 Testing, Adjusting and Balancing for HVAC to perform his work.

.5 The Contractor responsible for the scope of control works (Division 25) shall supply and install all automatic control systems in order to provide proper operation and performance of systems and networks which are part of the scope of work of present section.

.6 Consequently, the Contractor responsible for work described in the present section is responsible for all work required on systems and networks for which he is responsible, to allow the Division 25 Contractor to perform his work.

1.10 COORDINATION OF TESTS

.1 Coordination of FPT mentioned in Section 23 05 93 – Testing, Adjusting and Balancing for HVAC and of PPT mentioned in Division 25 is the General Contractor's responsibility.

.2 The Contractor responsible for the scope of work of Section 23 05 93 – Testing, Adjusting and Balancing for HVAC is responsible for all TAB as well as FPT described in Section 23 05 93. However, the Contractor in charge of work described in Section 23 05 00 – Common Work Results for HVAC is responsible for all work and adjusting related to systems for which he is responsible during FPT. Consequently, in the price of his tender, the Contractor responsible for work described in Section 23 05 00 shall include all costs related to his participation in FPT program. No additional amount of money shall be paid by the Departmental Representative for the Contractor's participation in test program.

.3 The Contractor responsible for the scope of work of Division 25 is responsible for all PPT described in Division 25. However, the Contractor in charge of work described in Section 23 05 00 – Common Work Results for HVAC is responsible for all work and adjusting related to systems for which he is responsible during PPT. Consequently, in the price of his tender, Contractor responsible for work described in Section 23 05 00 shall include all costs related to his participation in PPT program. No additional amount of money shall be paid by the Departmental Representative for the Contractor's participation in test program.

.4 The Contractor in charge of the scope of work of Section 23 05 00 is responsible for supplying all labour, equipment and material required for handling, adjusting and modification of systems that are part of the scope of work so as to allow the

Contractor in charge of Section 23 05 93 – Testing, Adjusting and Balancing for HVAC, to calibrate systems pressure and flow to specified values.

1.11 SYSTEMS OPERATION

.1 Pay all costs related to systems operation, from work start-up to substantial completion.

.2 Supply all labour required for systems operation, from work start-up to substantial completion.

Part 2 Products

2.1 MATERIALS / EQUIPMENT

.1 Not applicable.

Part 3 Execution

3.1 PAINT TOUCH-UPS

.1 Do painting in accordance with Section 09 91 23 – Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 The Contractor shall be responsible for taking all measures, both ordinary and extraordinary, in order to protect all ducting systems (new and existing) against dust, as well as against all substances that may become dirty such as the inside and outside of ducts and accessories.

.2 If, in the opinion of the Departmental Representative, the Contractor fails to take adequate protective measures and/or if portions of pipes already installed become contaminated, the Contractor shall clean such portions of pipes at his own expense. If cleaning is inadequate, Contractor shall remove those portions of pipes and replace them with new pipes at his own expense.

.3 Any activity that, in the opinion of the Departmental Representative, generates dust and/or dirt and/or contaminants that may affect project environmental quality will be executed outside perimeter of the building.

.4 Obstruct openings: prevent dust, dirt and other foreign matter from entering openings of installations and equipment using appropriate means.

.5 Clean equipment and mechanical devices every day.

.6 At the end of duct erection, and before ventilation systems start-up, Contractor shall clean inside and outside of all elements, devices and systems, including screens and filters, and vacuum inside the ducts and air handling units and leave them in perfect working order, replace all air unit system filters and clean water filters in anticipation of provisional acceptance. To do this, the Contractor shall provide and install all doors required to clean all parts of duct systems.

.7 Do not discharge to sewers cleaning products whose contents do not meet competent authorities' requirements. The Contractor must collect these products and dispose of them in a manner approved by competent authorities.

.8 Cleaning methods will be presented to the Departmental Representative for review prior to cleaning.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct the following tests in accordance with Section 01 45 00 – Quality Control and submit reports as described in PART 1 – SUBMITTALS.

.2 Manufacturer's Field Services:

.1 The Contractor will be responsible for establishing and maintaining an on-site quality control system to ensure the Departmental Representative of the highest quality work.

.2 Obtain written report from manufacturer verifying compliance of work, in handling, installing, applying, protecting and cleaning of products and submit Manufacturer's Field Reports as described in PART 1 – SUBMITTALS.

.3 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.

.4 Schedule site visits, to review work, as directed in PART 1 – QUALITY ASSURANCE.

3.4 SYSTEM START-UP

.1 Apply the setting operation of all systems as prescribed in this Section 01 91 13 - Commissioning (MS) - General requirements and the requirements of this section

.2 Provide labour, materials and instruments for carrying out tests.

.3 The Departmental Representative must be able to use facilities and equipment for testing before they are accepted. Provide labour, equipment and instruments necessary for carrying out tests.

.4 The following facilities and equipment will undergo temporary testing:

.1 Leak testing of ventilation ducts.

.2 Flow balancing of ventilation systems and chilled and heating water.

.3 Performance tests of ventilation and air conditioning equipment.

.4 Leak testing of chilled and heating water systems.

3.5 OPERATING AND MAINTENANCE PERSONNEL TRAINING

.1 Provide tools, materials and services of qualified instructors to give training, during normal working hours, to operating and maintenance personnel on the operation, control, adjustment, diagnostics/troubleshooting and maintenance of equipment, materials and systems, before their acceptance.

.2 Training must be provided during normal working hours, prior to acceptance and turnover of systems and facilities, and prior to substantial completion.

.3 For all equipment such as:

.1 Exhaust fans;

This list is not limited; demonstrations and instructions will be given by the manufacturer of the equipment concerned.

.2 Learning materials must include, among other things, the operations and maintenance manual, and as-built drawings.

.3 Requirements for necessary training hours are listed in each relevant section.

.4 Training courses to be based on contents of the operations and maintenance manual.

.5 Training time must conform to the specifications of the appropriate sections and the manufacturer’s recommendations.

.6 The Departmental Representative may, if desired, record training on video or audio media for use at a later date.

3.6 PROTECTION

.1 Protection of work:

.1 The Contractor shall protect his installation against damage until entire work has been accepted by proper authorities.

.2 All materials will be stored carefully in appropriate locations, without disturbing traffic.

.3 Ensure physical protection of materials and equipment installed and/or stored on site. Promptly remove all debris, tools or materials inside and on top of equipment.

.4 Prevent dust, dirt and other foreign matter from entering the openings of installations and equipment using appropriate means.

.5 When work benches are installed inside building, the Contractor will protect floor against any deposits or debris that may damage floor.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 All sections of divisions 01 and 23.

1.2 REFERENCE STANDARDS

.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 B139-04, Installation Code for Oil Burning Equipment.

.3 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2015(NFC).

1.3 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.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.

.1 Primers : in accordance with manufacturer’s recommendations for surface condition.

Part 3 Execution

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

.1 Keep and reinstall the existing piping and accessories.

.2 Install piping in accordance with manufacturer's instructions unless otherwise indicated.

.3 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.4 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, and components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.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.

3.5 AIR VENTS

.1 Install manual air vents to in piping systems CSA B139 at high points.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Install pipework as per building standards:

.2 Screwed fittings jointed with Teflon tape.

.3 Protect openings against entry of foreign material.

.4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.8 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.

.9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.10 Install, except where indicated, to permit separate thermal insulation of each pipe.

.11 Group piping wherever possible and as indicated.

.12 Ream pipes, remove scale and other foreign material before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Provide for thermal expansion as indicated.

.15 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves must be accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball butterfly gate valves at branch take-offs for isolating purposes except where specified.

.7 Install butterfly valves on chilled water and related condenser water systems only.

.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.9 Install plug cocks ball valves for glycol service.

.10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400mm above floor in Mechanical Rooms.

3.8 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.

3.9 PREPARATION FOR FIRE STOPPING

.1 Install fire stopping 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 48hours 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.

3.11 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval by Departmental Representative a minimum of 10 days prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical concerning the work results and section 23 05 00 - Common Work Results for HVAC concerning the work results, are both integral parts of this present section.

1.2 REFERENCES

.1 *American National Standards Institute (ANSI)/American Society of Mechanical Engineers* (ASME):

.1 ANSI/ASME B1.20.1-1983(R2006), *Pipe Threads, Généralités Purpose (Inch)*.

.2 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

.3 ANSI/ASME B16.5-2003, *Pipe Flanges and Flanged Fittings*.

.4 ANSI/ASME B16.10, Face-to-Face and End-to-End Dimensions Valves.

.5 ANSI/ASME B16.11-2001, *Forged Fittings, Socket-Welding and Threaded.*

.6 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.7 ANSI/ASME B16.25-1997, *Buttwelding Ends*.

.8 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.

.2 ASTM International:

.1 ASTM A49-01(2006), *Standard Specification for Heat-Treated Carbon Steel Joint Bars.*

.2 ASTM A126, *Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings*.

.3 ASTM A193/A193M-04, *Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*.

.4 ASTM A194/A194M-03b, *Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service*.

.5 ASTM A216/A216M-1993(03), Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.

.6 ASTM A276-08, *Standard Specification for Stainless Steel Bars and Shapes*.

.7 ASTM A536-84(2004)e1, *Standard Specification for Ductile Iron Castings*.

.8 ASTM B61-08, *Standard Specification for Steam or Valve Bronze Castings*.

.9 ASTM B62-02, *Standard Specification for Composition Bronze or Ounce Metal Castings.*

.10 ASTM B85/B85M-08, Standard Specification for Aluminum-Alloy Die Castings.

.11 ASTM B209, *Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate*.

.12 ASTM B283-08a, *Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed)*.

.*13* ASTM B505/B505M-08a, *Standard Specification for Copper-Base Alloy Continuous Castings.*

.3 *Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.* (MSS):

.1 MSS-SP-25-1998, *Standard Marking System for Valves, Fittings, Flanges and Unions.*

.2 MSS SP-61-03, *Pressure Testing of Steel Valves*.

.3 MSS SP-70-06, *Grey Iron Gate Valves, Flanged and Threaded Ends*.

.4 MSS SP-71-05, *Grey Iron Swing Check Valves, Flanged and Threaded Ends*.

.5 MSS SP-78-1998, *Cast Iron Plug Valves, Flanged and Threaded Ends*.

.6 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.

.7 MSS SP-82-1992, *Valve Pressure Testing Methods*.

.8 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

.9 *MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends*.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 10 – General Instructions.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 00 10 – General Instructions.

.3 Shop Drawings:

.1 Submit data for valves specified in this Section.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10 valves, each size. Minimum 1.

.3 Stem packing: one for every 10 valves, each size. Minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 00 10 – General Instructions.

Part 2 Products

2.1 MATERIALS

.1 Ball valve: (65mm and smaller):

.1 Supplied with vinyl lever cover.

.2 Regular passage hole.

.3 Elongated rod to suit the thickness of the insulation.

.4 With dial and stop memory when scheduled for commissioning.

.5 Class 150.

.2 Chain Pulley:

.1 Supplied valve with a pulley-chain located more than 2.1 m above the floor. Chains extend to a height of 1.5 m above the floor, and tie them so as to release corridors or circulation areas.

.3 Drain valve:

.1 Ball valve with bronze body, threaded, with cap, chain and nets for hoses.

System diameter	Valve diameter
Until DN 32 mm	20 mm
From DN 38 to DN 65 mm	25 mm
To DN 75 and over	50 mm

Part 3 Execution

3.1 INSTALLATION

.1 Remove internal parts before soldering.

.2 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section 01 00 10 – General Instructions:

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of sections 21 05 01 – Common Work Results for Mechanical and section 23 05 00 – Common Work Results for HVAC are an integral part of this section.

.2 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-07, Power Piping.

.2 ASTM International

.1 ASTM A125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat Treated.

.2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-200, Pipe Hangers and Supports – Materials, Design and Manufacture.

.2 MSS SP69 2003, Pipe Hangers and Supports – Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports – Fabrication and Installation Practices.

.5 Underwriters' Laboratories of Canada (ULC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with sections 21 05 01 – Common Work Results for Mechanical and section 23 05 00 – Common Work Results for HVAC.

.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 limitation.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports;

.2 Connections to equipment and structure;

.3 Structural assemblies.

.4 Identify the following items listed on manufacturer's documentation, including:

.1 Upper attachment.

.2 Middle attachment.

.3 Pipe attachment.

.4 Riser clamps.

.5 Shields and saddles.

.6 Sway braces.

.5 Certificates:

.1 Submit certificates signed by the manufacturer certifying that products, materials and equipment comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:

.1 Provide manufacturer's installation instructions.

.1 The Departmental Representative will provide one (1) copy of systems supplier's installation instructions.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials and equipment in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials and equipment to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.

.3 Ensure that supports, guides and anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.2 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers to withstand seismic events as specified in Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment, article 1.4.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces according to ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports must be galvanized or painted with zinc-rich paint after manufacture for corrosive environment.

.2 Use electro-plating or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated.

.2 Upper attachment structural: suspensions from lower flange of I-beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm, UL listed.

.2 Cold piping NPS 2½ or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, to MSS SP58 and MSS SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed, to MSS SP69.

.2 Cold piping NPS 2½ or greater, hot piping: malleable iron top-of-beam jaw clamp with hooked rod, spring washer, plain washer and nut, UL listed.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum larger than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate, UL listed to MSS SP69.

.5 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.6 Pipe attachments: compliant to MSS SP58:

.1 Attachments for steel piping: carbon steel black or galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.7 Adjustable clevis: material to MSS SP69, UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure “U” has a hole in for riveting to insulation shields.

.8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll to MSS SP69.

.9 U-bolts: carbon steel to MSS SP69 with two (2) nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black or galvanized finish.

.2 Finishes for copper, glass, brass or aluminum pipework: black or galvanized finish.

.10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP58, type 42, UL listed.

.2 Copper piping: Carbon steel copper plating to MSS SP58, Type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 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.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected with ±5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR) for each spring.

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel +20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with two (2) springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with ±5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR for each spring.

Part 3 Performance

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install hangers and supports in accordance with the following:

.1 Manufacturer's instructions and recommendations.

.2 Clevis plates attached to concrete:

.1 Attach to concrete with four (4) minimum concrete inserts, one (1) 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.

3.3 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code with Quebec amendments.

.2 Fire protection piping: as per pertinent fire protection code.

.3 Copper piping NPS ½ and smaller: 1 hanger every 1.5 m.

.4 Flexible joint roll groove pipe, flexible joints: in accordance with table below, but not less than one hangar at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.5 One (1) hanger 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 Piping plumbing system NPS 4 and greater, attached to roof structure: one (1) hanger to each beam when run is perpendicular to structural elements; minimum two (2) beams when run is parallel to structural members.

.7 Pipework greater than NPS 12, conform to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Offset hangers so that hanger rods are perfectly straight when network is in operation.

.3 Adjust rod height so that the load is evenly distributed between hangers.

.4 Attach hanger anchoring elements to core of steel beams.

.5 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer’s recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 –Quality Control and submit report as described in PART 1 – Action and Informational Submittals.

.2 Manufacturer’s Field Services:

.1 Obtain written report from manufacturer verifying compliance of work, in handling, installation, applying, protecting and cleaning of product and

submit Manufacturer's Field Reports as described in Part 1 – Action and Informational Submittals.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits in accordance with Quality Assurance, Part 1.

3.8 CLEANING

.1 Clean in accordance with section 01 74 00 – Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: In accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of sections 21 05 01 – Common Work Results for Mechanical and section 23 05 00 – Common Work Results for HVAC are an integral part of this section.

1.2 REFERENCES

.1 Requirements of the NBC 2015.

.2 ANSI B31.1 (SI), Power Piping (SI Edition).

.3 ANSI / MSS SP58 Pipe Hangers and Supports – Materials, Design and Manufacturer.

.4 CAN / CSA S832: Seismic Risk Reduction of Operational and Functional Components of Buildings.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 National Fire Protection Association (NFPA)

.1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

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

1.5 VIBRATION AND SEISMIC CONTROL FOR HVAC, PIPING AND EQUIPMENT WORK

.1 The work largely includes the calculations, supply, installation, supervision and responsibility for all necessary materials and equipment of seismic restraint systems for duct works, piping works and their related equipment for all trades:

.1 Seismic restraint systems calculations and installation details to meet the required standards.

.2 The supply and delivery of these seismic restraint systems to the site fall under the responsibility of the present section.

.3 Supervision and installation of all devices for seismic restraint systems and presentation of a compliance report.

.4 Seismic restraint systems include, without being limited to, the crossbracing of mechanical piping supports and equipment such as pumps, exchangers, etc.

.2 The Contractor must hire an experienced manufacturer to design, supply and supervise the installation of all seismic restraint systems.

.3 The seismic restraint systems manufacturer is responsible vis-à-vis the Contractor for designing, supplying and supervising the installation of seismic restraint systems. The manufacturer remains responsible for the structural integrity of the seismic restraint systems.

.4 The manufacturer must have a professional engineer who specializes in seismic restraint systems design to make the calculations and develop the installation details of the seismic restraint systems.

.5 Submit shop drawings and specifications in accordance with Section 01 78 00 Closeout Submittals.

.6 Identify the following elements indicated in the manufacturer's documentation:

.1 Anchors.

.2 Median elements.

.3 Supports.

.4 Riser clamps.

.5 Protection shields.

.6 Crossbracings.

.7 Design, prepare and supply the shop drawings including those that illustrate the type of seismic restraint systems and their location.

.8 Provide the calculations used. The shop drawings must bear the seal of a professional engineer who is a member of the *Professionnal Engineers of Ontario.*

1.6 SEISMIC RESTRAINT SYSTEMS

.1 Unless otherwise indicated, the seismic control measures must be designed and chosen to meet the requirements of the latest edition of the National Building Code 2015 and it supplement:

.1 The other coefficients (Cp, A_r, A_x) will be taken from the Code and its supplement.

.2 The Contractor must take into consideration floor level in which equipment is installed within the building, i.e. basement, ground floor, upper floor) during the seismic control equipment design.

.2 The anchorings must be designed for a lateral force Vp

Vp = v I Sp Wp, where:

Vp	=	Lateral force on a portion of an element based on its weight distribution
v	=	region's speed ratio (Montreal) = 0.10
I	=	importance factor = 1.0
Sp	=	lateral force importance factor = CpArAx
Wp	=	weight of piping or equipment to be anchored
Cp	=	seismic coefficient for mechanical components = 1
Ar	=	amplification factor = 1.0
Ax	=	location factor relative to building height = 1.0

.3 For calculation purposes, the vertical forces shall be considered equivalent to 1/3 of the lateral force factor.

.4 During or following a seismic event, the anchored equipment may not necessarily remain in operational state as in normal use conditions. Mandatory requirements state that seismic restraint systems shall prevent the systems and mechanical equipment from causing personal injury and the equipment from moving from its normal position during a seismic event.

.5 The manufacturer of seismic restraint systems must obtain from each Mechanical section involved, all information relating to the devices, pipes and equipment necessary for seismic restraint system calculations (weight, fluid type, number, thermal insulation, run, spacing between supports, grouping on trapezoid supports).

.6 The seismic restraint systems manufacturer must obtain the required characteristics from the manufacturer of each device or equipment for calculation purposes.

.7 The calculations and installation details of anchoring bolts and seismic restraint systems shall be approved by a professional engineer specializing in seismic restraint systems design.

1.7 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with 01 35 29.06 – Health and Safety.

1.8 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.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through 30 degrees arc without metal to metal contact.

.2 Type H1 – neoprene – in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 – stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 – stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 – stable spring, elastomeric element with precompression washer and nut with deflection indicator.

.6 Performance: as indicated.

2.3 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.4 SEISMIC CONTROL MEASURES

.1 General

.1 All equipment connected to emergency electrical power and their associated distribution networks must remain in operation during and after an earthquake. The seismic restraint systems to work in every direction.

.2 Fasteners and attachment points shall be capable of sustaining the same loads as the seismic restraint systems.

.3 Drilled or power driven anchors and fasteners not permitted.

.4 No equipment, equipment supports or mounts to fail before failure of structure.

.5 Supports of cast iron or threaded pipe not permitted.

.6 Seismic control measures not to interfere with integrity of firestopping.

.7 All seismic restraint systems must be entirely integrated and compatible with building mechanical and structural design. They must not hinder normal operation of mechanical systems.

.8 Manufacturers of seismic restraint systems to offer vibration isolators, integral and separate seismic shock absorbers, cable fasteners and other fastening systems from manufacturers that regularly fabricate this type of material.

.9 The seismic restraint systems shall be capable of resisting forces in all directions.

.10 Fasteners and fastener fittings must be able to resist same loads as seismic restraint equipment.

.11 For longitudinal crossbracings, the pipe fastener must be directly on the pipe (under thermal insulation).

.12 Seismic anchorings on pipes must be compatible with the anchoring and support specifications for the piping networks.

.13 High resistance mechanical expansion anchors must be used to secure seismic restraint systems to the concrete structures. Use of anchors and supports installed with a nail gun is prohibited.

.14 Supports of cast iron or threaded pipe or other breakable materials not permitted.

.15 The seismic restraint systems must not interfere with the functioning or integrity of firestopping equipment.

.16 Stiffeners shall be added to the suspension rods when necessary in order to avoid buckling.

.17 Seismic restraint crossbracings may be omitted for:

.1 32 mm and under piping.

.2 Individually suspended piping whose length of supports is 300 in. and under.

.18 Cast iron, glass or other pipes containing mechanical joints with rings and tightening screws with supports longer than 300 mm shall be equipped with a seismic restraint crossbracing at every change in direction (90º and +). Riser joints must be stabilized or have a crossbracing between the floors.

.19 Maximum spacing for seismic restraint crossbracings must be 24 m. in a longitudinal direction and 12 m in a transversal direction. The seismic restraint system calculations may necessitate shorter lengths.

.2 Static equipment:

.1 Anchor equipment to equipment supports. Anchor equipment supports to structure.

.2 Suspended equipment:

.1 Use one or more of following methods as per site conditions or as indicated.

.1 Install tight to structure.

.2 Cross brace in every direction.

.3 Brace back to structure.

.4 Cable restraint system.

.3 Seismic restraints

.1 Cushioning action gentle and steady.

.2 Never reach metal-like stiffness.

.3 Vibration isolated equipment

.1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.

.2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.

.3 As indicated.

.4 Piping systems

.1 Fire protection systems: to NFPA 13.

.2 Piping systems: hangers longer than 300 mm; brace at each hanger.

.3 Compatible with requirements for anchoring and guiding of piping systems.

.5 Bracing methods: approved by Departmental Representative hired by the contractor (see scope of work 1.7).

.1 Structural angles or channels.

.1 Cable resistant system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

2.5 MEDIAN ELEMENT (SUSPENSION ROD)

.1 Threaded, carbon steel rod, black finish and electrogalvanized for mechanical rooms, stiffened with forged steel.

2.6 SUPPORTS

.1 Cold water steel or cast iron pipes, hot water steel piping, with less than 25 mm horizontal movement; hot water steel piping suspended on rods longer than 300 mm: adjustable stirrup in accordance with Standard MSS-SP58-1983, type 1.

.2 Cold water copper pipes, hot water copper pipes, with less than 25 mm horizontal movement, hot water copper piping suspended on rods longer than 300 mm: adjustable stirrup in accordance with Standard MSS-SP58-1979, type 1, with copper finish.

.3 Suspended hot water steel and copper pipes with more than 25 mm horizontal movement, hot water steel piping suspended on rods 300 mm in length or shorter: roller stirrup in accordance with Standard MSS-SP58-1979, type 43.

.4 Steel or copper hot water piping, base supported: roller base in accordance with Standard MSS-SP58-1983, type 45.

.5 Non-metallic piping: adjustable stirrup in accordance with Standard MSS-SP-69, type 9.

.6 Type of supports:

.1 Roll stands shall be installed for the following cases:

.1 Case no.1:

.1 On 60°C and + piping networks, with a suspension rod 500 mm or shorter; however, when the suspension rod is longer than 500 mm, the ratio between pipe expansion and suspension rod length must be greater than 1:24 (0.041) to install pipe roll stands.

.2 Example:

.1 50 mm expansion, 1 000 mm rod, ratio 1:20 (= 0.05). In this case, pipe roll stands are required.

.2 Case no. 3*:

.1 When there is vertical movement up to 32 mm expansion maximum, add springs. Choice of spring strength will be based on piping weight and content.

.3 Case no. 4:

.1 On 43°C and + piping networks, with piping supported by angle irons or another type of metal member.

.4 Case no. 5:

.1 Unless otherwise mentioned above, the supports will be vertical adjustment type.

2.7 RISER CLAMP

.1 For steel or cast iron piping: carbon steel clamp, black finish, in accordance with Standard MSS-SP58-1983, type 42, ULC stamped.

.2 For copper piping: carbon steel clamp, copper finish, in accordance with Standard MSS-SP58-1983, type 42.

.3 Non-metallic piping: carbon steel clamp in accordance with Standard MSS-SP-69, type 8.

2.8 INSULATION PROTECTION SHIELDS

.1 Cold water piping NPS 32 mm and +: protection shield for piping with high density thermal insulation and continuous vapour barrier.

.1 It is not acceptable under any circumstances for cold water piping to come into direct contact with a shield.

.2 The Contractor responsible for this section must present the shields to the Contractor responsible for piping insulation. The latter shall install the shields and supply a wood block between the piping and shield for larger diameter piping.

.2 Hot water piping NPS 32 mm and +: protection shield for insulated piping.

.1 Protection shields are not necessary only a clevis hanger with insulation saddle system is used.

2.9 EXPANSION ELEMENTS

.1 Supply flexible connections to within 600 mm of the top and bottom of each riser. For an intermediary riser longer than 915 mm, install a flexible connection at the top and bottom of this column.

.2 For pipes passing through concrete or masonry walls, install flexible connections on both sides of the wall (i.e. two connections). For piping through expansion joints in a building, supply a flexible connection at the joint or close to it.

.3 In all cases, it is permitted to omit flexible connections on piping whose diameter is less than 89 mm.

.4 Install flexible elbows at the ends of hose slides (regardless of pipe dimension).

2.10 RUBBER PADS

.1 Supply and install pads between copper piping and each suspension element to eliminate contact between the copper and iron. This pad shall exceed 25 mm on each side of the collar.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Seismic control measures to meet requirements of NBC 2010.

.2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless otherwise indicated, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS 4: first 3 points of support NPS 5 to NPS 8: first 4 points of support, NPS 10 and over: first 6 points of support.

.2 Fire protection piping: as per pertinent fire protection code.

.3 Copper piping NPS 12.7 mm and smaller: 1 mount/hanger every 1.5 m.

.4 Gas piping NPS 12.7 mm and smaller: 1 mount/hanger every 1.8 m.

.5 Corrugate pipe, flexible joints: in accordance with table below, but not less than one hangar at joints.

.6 Flexible joint roll groove pipe, flexible joints: in accordance with table below, but not less than one hangar at joints.

.7 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

3.3 INSTALLATION OF HANGERS/SUPPORTS

.1 Space the anchoring points so that the suspension rods remain straight when the network is in service.

.2 Adjust the height of suspension rods so that the load is spread uniformly between the hangers/supports.

.3 Secure anchoring elements to the truss joints of steel columns.

3.4 INSTALLATION

.1 Where isolation is bolted to floor use vibration isolation rubber washers.

.2 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

.3 Do not weld seismic restraint crossbracings directly to the supports or guides on mechanical pipe runs.

.4 The opening around bolts must be 1/16 in. maximum larger than the bolt diameter.

.5 Anchoring points in concrete slabs must be at a distance from concrete sides and edges; follow the manufacturer’s anchoring instructions.

.6 Secure cables to the ceiling-suspended equipment so that the cables’ axial projection does not exceed the equipment’s centre of gravity.

.7 Install cables using grommets, assembly lugs and other appropriate hardware to ensure the alignment of restraint devices. Anticipate bending cables at anchoring points.

.8 Position support cables of ceiling-suspended equipment to create a 90º angle (approx.) between them (on drawing), then secure them to the ceiling slab so that the latter does not exceed 45º.

.9 Always use identical crossbeams within the same bracing (do not use a rigid crossbeam with a cable).

.10 All seismic restraint systems must be verified once the mechanical systems are put into service to ensure that the recommended clearances have been obtained (but not more than those recommended because the equipment's delicateness may be affected). Make any necessary adjustments. Ensure that vibration isolation seismic restraints do not cause short circuits at the vibration isolators, if applicable.

.11 A clearance of at least 25.4 mm must be anticipated between the seismic restraint systems and all service equipment and components

3.5 INSPECTION AND CERTIFICATION

.1 Seismic control measures equipment inspection and certification

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start-up and TAB of systems to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.2 Provide BGIS representative with notice 24 hours in advance of commencement of tests.

.3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations.

.4 Submit complete report of test results.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00 – 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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Part 1 General

1.1 RELATED REQUIREMNETS

.1 The requirements of sections 21 05 01 – Common Work Results for Mechanical and 23 05 00 – Common Work Results for HVAC are an integral part of this section.

1.2 REFERENCES

.1 Canadian Gas Association (CGA):

.1 CSA / CGA B149.1-05, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

.1 CAN / CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN / CGSB-24.03-92, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submittals: in accordance with data sheets required under Section 01 33 00 – Submittal Procedures.

.2 Product data to include paint colour chips and other products specified in this sections.

.2 Samples:

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples to include nameplates, labels, tags, and lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packaging, shipping, handling and unloading:

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

.2 Deliver, store and handle equipment and 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 Do not dispose of unused paint or coating material into sewer system, into streams, lakes onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Provide nameplates with raised or recessed lettering, and mechanically secured to each piece of equipment.

.2 Provide CSA or Underwriters' Laboratories plates as required by the respective organizations.

.3 Nameplate manufacturers must indicate size, model, manufacturer name, serial number, voltage, power factor, phases, and motor rating.

.4 Install nameplates in plain view and not covered with insulation or paint.

2.2 NAMEPLATES – GENERAL REQUIREMENTS

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

2.3 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red lettering on white background.

.2 Elsewhere: black lettering on white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	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.

2.4 EXISTING IDENTIFICATION SYSTEM

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified in this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.5 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) regulation.

.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/insulation less than 75 mm: 100 mm long x 50 mm in high.

.2 OD of pipe/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 Height: to full circumference of pipe/insulation.

.2 Length: to accommodate pictogram, full length or 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 or vinyl stickers, with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and legends:

.1 Where not listed, obtain direction from the Departmental Representative.

.2 Colours for legends and arrows: to following table:

Background Color	Legends, Arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background color markings and legends for piping systems:

Contents	Background Color Marking	Legend
** Add design temperature		
+ + Add design temperature and pressure		
Drinking water return	Green	CH. DRINK WTR CIRC.
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Color: black or coordinated with base colour to ensure strong contrast.

2.7 IDENTIFICATION OF VALVES

.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.

2.8 CONTROL COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls and sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English and French.

.2 Use one (1) nameplate and label for both languages.

Part 3 Performance

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified in Section 09 91 23 –Interior Painting.

3.3 INSTALLATION

.1 Perform work in accordance with CAN / CGSB 24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous locations 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.

.4 Secure plates in conspicuous places. If they cannot be installed on cold surfaces, supply and install spacers.

.5 Provide type and number of the device (e.g. pump no. 2), and the service provided, the area or sector of the building served (e.g. southern zone, chilled water, primary).

.6 Have list of plates verified prior to etching message.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in the mechanical room: 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. Where this is not possible, place identification as close as possible, preferable 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 or personal damage or injury and reduce visibility over time due to dust and dirt.

3.6 VALVES

.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 closes "S" hooks.

.2 Install one (1) copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one (1) copy (reduced in size if required) in each of the operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, waste, tools and equipment.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of section 21 05 01 – Common Work Results for Mechanical are an integral part of this section.

.2 The requirements of section 23 05 00 – Common Work Results for HVAC are an integral part of this section.

.3 The requirements of section 01 91 13 - Commissioning (MS) - General requirements are an integral part of this section

1.2 REFERENCE STANDARDS

.1 Perform TAB of mechanical systems over full operating range in accordance with the strictest requirements of the following organizations:

.1 AABC (Associated Air Balance Council), MN-1-2002 (National Standards for Total System Balance).

.2 ASHRAE (American Society of Heating Refrigeration and Air Conditioning Engineers).

.3 NEBB (National Environmental Balancing Bureau).

.4 NABC (National Air Balance Council).

.5 TABES (Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems – 1998).

.6 SMACNA (Sheet Metal and Air Conditioning Contractors National Association), HVAC TAB HVAC Systems (Testing, Adjusting and Balancing – 2002).

.7 The requirements of this section or another section of the Technical Documents.

1.3 GENERAL

.1 TAB: means to test, adjust and balance all systems, including equipment, to perform in accordance with contract documents.

.2 FPT: means flow rate and pressurization tests.

.3 FPTR: means flow rate and pressurization tests report.

.4 PPT: means performance and pressurization tests.

.5 PPTR: means performance and pressurization tests reports.

.6 Follow start-up procedures as recommended by manufacturers.

.7 Special start-up procedures may be specified elsewhere.

.8 Perform TAB and FPT only when work is essentially completed, including:

.1 Installation of ceilings, doors, windows and other elements affecting TAB and FPT.

.2 Application of sealing and caulking, as well as weather stripping.

.3 Start-up by Contractors responsible for work involving mechanical installations and systems.

.4 Departmental Representative approval.

1.4 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit to Departmental Representative the names of personnel to perform TAB.

.2 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 .1.2 (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.

.3 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.4 Use TAB Standard provisions, including checklists and report forms to satisfy Contract requirements.

.5 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.6 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.7 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 applicable to Contract requirements have been published or adopted by body responsible for TAB Standard (AABC, NEBB or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.5 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 and 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 range.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 COORDINATION

.1 Schedule time required for TAB (including repairs and re-testing) into project construction 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.

1.8 PRE-TAB REVIEW

.1 Review manufacturing documentation submitted by the Contractor before project construction is started and confirm in writing to the Departmental Representative adequacy of provision for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and other reference documents and notify the Departmental Representative in writing of proposed procedures which vary from standard.

.3 During construction, coordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.9 START-UP

.1 Unless otherwise specified, follow start-up procedure as recommended by equipment manufacturer.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.10 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by the Departmental Representative for verification of TAB reports.

1.11 START OF TAB

.1 Notify Departmental Representative seven (7) days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows and other building elements affecting TAB;

.2 Application of weather-stripping, sealing and caulking;

.3 Pressure, leakage and other tests specified elsewhere in Division 23 have been completed;

.4 Provisions for TAB installed and operational;

.5 Start-up, verification for proper operation of mechanical and associated electrical and control systems affecting TAB including but not limited to the elements below.

.6 Proper thermal overload protection in place for electrical equipment.

.7 Air systems:

.1 Filters in place and clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire and smoke volume control dampers installed and open.

.6 Coil fins combed and clean.

.7 Access doors and panels installed and closed.

.8 Outlets installed and volume control dampers open.

.8 Fluid systems flushed, filled and vented.

.1 Strainers in place and baskets clean.

.2 Isolating and balancing valves installed and open.

.3 Calibrating balancing valves installed at factory settings.

.4 Chemical treatment systems complete and operational.

1.12 APPLICATION TOLERANCES

.1 Do TAB to following tolerance of design values:

.1 HVAC systems: plus 5%, minus 0%.

.2 Fluid systems: plus or minus 5%.

1.13 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 5% of actual values.

1.14 INSTRUMENTS

.1 Prior to TAB, submit to the Departmental Representative a list of instruments used together with their serial numbers.

.2 Instrument calibration

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within three (3) months of TAB. Provide certificate of calibration to Departmental Representative.

.1 Report to indicate, among other things, serial number of all instruments that have been calibrated.

.1 Any TAB work performed using instruments whose serial numbers are not listed in the calibration report will be rejected and must be re-performed by Contractor at his own expense.

.2 Any TAB work performed by Contractor before instrument calibration report has been submitted and accepted by the Departmental Representative will be rejected and must be re-performed by Contractor at his own expense.

.3 Instrument calibration must be performed using NIST traceable, or Canadian equivalent.

.4 Measurements to be accurate to within plus or minus 2% of actual value.

.5 Perform TAB until within plus or minus 5% of design values.

1.15 ACTION AND INFORMATION SUBMITTALS

.1 Submittals: in accordance with submittals required under Section 01 33 00 – Submittal Procedures.

.2 Submit, prior to commencement of TAB:

.3 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.16 PRELIMINARY TAB REPORT

.1 Submit for verification and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets as follows:

.1 Details of instruments used.

.2 Details of TAB procedures employed;

.3 Calculations procedures;

.4 Summaries.

1.17 TAB REPORT

.1 Format of report in accordance with referenced TAB standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings;

.2 System schematics.

.3 Submit six (6) copies of TAB report to Departmental Representative for verification and approval, in English and French, presented in D-ring binders, complete with index tabs.

.4 Verification:

.1 Reported results subject to verification by the Departmental Representative. Provide personnel and instrumentation to verify up to 30% of reported results. Number and location of verified results as approved by Departmental Representative.

.2 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

.5 Settings: Lock devices in set positions and settings permanently marked.

.6 Measurements as required by reference standards for air handling units include but are not limited to the following:

.1 Measurements:

.1 Air velocity.

.2 Static pressure.

.3 Velocity pressure.

.4 Temperature:

.1 Dry bulb.

.2 Wet bulb.

.5 Cross-sectional area.

.6 RPM.

.7 Electrical characteristics:

.1 Voltage.

.2 Current draw.

.2 Location of equipment measurements:

.1 Inlet and outlet of each:

.1 Fan.

.2 Damper.

.3 Location of systems measurements at:

.1 Main ducts.

.2 Main branch ducts.

.3 Each supply, exhaust and return air inlet and outlet.

.4 Each grille and air diffuser.

.5 Other auxiliary equipment.

.6 All areas served by system.

.7 Measurements as required by reference standards for fluid systems including, but not limited to the following:

.1 Measurements:

.1 Flow.

.2 Pressure.

.3 Temperature.

.4 Density.

.5 RPM.

.6 Electrical power:

.1 Voltage.

.2 Current draw.

.8 Location of equipment measurements:

.1 Inlet and outlet of each:

.1 PRV.

1.18 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 approved by Departmental Representative.

.4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.19 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.

1.20 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.21 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA and ASHRAE.

.2 Do TAB of systems, equipment, components and controls as specified in Division 23.

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB, qualified to standards of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, controls: air velocity, static pressure, flow, pressure drop (or loss), temperatures (dry bulb,

wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise and 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 and controlled devices.

.3 Existing exhaust fans, grilles / diffusers.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.22 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified in this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified in this section.

.2 Quality Assurance: as for air systems specified in this section.

Part 2 Products

N/A.

Part 3 Execution

N/A.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 -Mechanical- General Requirements concerning the work results and section 23 05 00 -HVAC- General Requirements concerning the work results, are both integral parts of this present section.

1.2 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.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547-[07e1], Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Green Seal Environmental Standards (GSES)

.1 Standard GS-36-00, Commercial Adhesives.

.5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.6 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.

1.4 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 air duct insulation and include product characteristics, performance criteria, physical size, finish and limitations including the following data.

.1 Description of equipment and materials including manufacturer's name, type, model, year, airflow and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

.2 Provide two (2) copies of WHMIS MSDS – Material Safety Data Sheets in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.3 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.4 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations, and special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Certificates

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Installation Instructions

.1 Submit manufacturer’s installation instructions.

.2 The Departmental Representative will make available one (1) copy of systems supplier’s installation instructions.

1.6 QUALIFICATIONS:

.1 Installer: specialist in performing work of this section with in this size and type of project, qualified to standards of TIAC.

1.7 HEALTH AND SAFETY:

.1 Do construction occupational health and safety in accordance with 01 35 29.06 – Health and Safety Requirements.

1.8 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 and address.

.3 Store at temperatures and conditions recommended by manufacturer.

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

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating : 25.

.2 Maximum smoke developed rating : 50.

2.2 INSULATION

.1 Mineral fibre: as specified, includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with and without factory applied vapour retardant 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 retardant jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket : to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

.1 220 g/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:

.1 To ASTM B209 with and without moisture barrier as scheduled in Part 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Corrugated.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

.1 Stainless steel:

.5 Type: 316.

.6 Thickness: 0.25 mm sheet.

.7 Finish: Corrugated.

.8 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retardant lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retardant Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 g/m^2 cotton, plain weave, treated or untreated with dilute fire retardant lagging adhesive to ASTM C92.

.5 Outdoor Vapour Retardant Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.6 Tape: self-adhesive, aluminum, reinforced 75 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding:12 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation and insulation with expanded metal lath on other face.

.12 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry and free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s 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 retardant jacket and finishes.

.1 Ensure hangers and supports are outside vapour retardant jacket.

.5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retardant	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature air supply ducts	C-2	yes	50
Supply, return and exhaust ducts exposed in space being served			none

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.3 Finishes:

.1 All exposed duct should be covered with a primed linen canvas ready for painting.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove the site materials / equipment surplus, waste, tools and equipment.

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

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The prescriptions for the sections 21 05 01 - Common Work Results for Mechanical concerning the work results and section 22 05 00 - Common Work Results for Plumbing concerning the work results, are both integral parts of this present section.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE 90.1-04-SI Edition, Energy Standard for Buildings except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].

.2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-2003, Mineral Fiber Pipe Insulation.

.7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 33.

.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-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.

.4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For the purposes of this section:

.1 "Concealed" – insulated mechanical services and equipment trenches and pipe shafts in hung ceilings and non-accessible chases and furred-in spaces.

.2 "Exposed" – will mean "not concealed" as defined herein.

.2 TIAC codes:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish (Plumbing).

1.4 ACTION AND INFORMATION 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.

.2 Provide two (2) copies of WHMIS MSDS – Material Safety Data Sheets in accordance with Section 01 35 29.06 – Health and Safety Requirements, and 01 35 43 – Environmental Procedures.

.3 Samples:

.1 Provide for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.1 Mount sample on 12-mm plywood board.

.2 Affix typewritten label beneath sample indicating service.

.4 Manufacturer's Instructions:

.1 Include procedures to be used and installation standards to be achieved.

1.5 QUALITY ASSURANCE

.1 Certificates

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Installation Instructions

.1 Submit manufacturer's installation instructions.

.2 The Departmental Representative will make available one (1) copy of systems supplier's installation instructions.

1.6 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section, and have in this size and type of project, qualified to standards of TIAC.

1.7 HEALTH AND SAFETY:

.1 Do construction occupational health and safety in accordance with 01 35 29.06 – Health and Safety.

1.8 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 and address.

.3 Store at temperatures and conditions recommended by manufacturer.

.4 Packaging Waste Management: in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.9 OPERATING TEMPERATURES

.1 Operating temperatures for the equipment are as follows:

.1 Domestic cold water: 4.4°C.

.2 Domestic hot water: 82°C.

.3 Domestic hot water recirculation: 82°C.

.4 Stormwater drainage: -2°C.

.5 Vent pipe for the following elements:

.1 Sanitary drainage: -5°C.

1.10 INSULATION WORK

.1 Insulate the following networks to suit the operating temperatures specified above and materials specified in Part 2.

.1 Domestic cold water.

.2 Domestic hot water.

.3 Domestic hot water recirculation.

.4 Vent pipe for the following elements:

.1 Partial length:

.1 Sanitary drainage for a distance of 5 meters to roof.

.5 Supply and install all jackets and lines as indicated.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating : 25.

.2 Maximum smoke developed rating : 50.

2.2 INSULATION

.1 Mineral fiber

.1 Glass fibre, rock wool and slag wool

.1 Inorganic fibers include glass wool, rock wool and slag wool.

.2 The coefficient of thermal conductivity coefficient ("k") not to exceed the specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.2 Molded mineral fiber

.1 Without vapor barrier jacket

.1 Insulation with TIAC Code A-1: molded mineral fiber, without factory applied vapor barrier jacket.

.1 Sleeve mineral fiber: comply with ASTM C547.

.2 Coefficient ("k") maximum compliant with ASTM C547.

.2 With vapor barrier jacket

.1 Insulation with TIAC Code A-3: molded sleeve mineral fibers with factory applied vapor barrier jacket.

.1 Duct mineral fiber: comply with ASTM C547.

.2 Jacket: complies with CGSB 51-GP-52Ma.

.3 Coefficient ("k") maximum compliant with ASTM C547.

.3 Mineral fiber blanket

.1 With or without vapor barrier jacket

.1 Insulation with TIAC Code C-2: mineral fiber blanket with or without factory applied vapor barrier jacket (as indicated in table in PART 3 below).

.1 Mineral fiber blanket: comply with ASTM C553.

.2 Barrier: compliant to CGSB 51-GP-52Ma.

.3 Coefficient ("k") maximum compliant with ASTM C553.

.2 Elastomeric unicellular

.1 Flexible tubular elements

.1 Insulation with TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation with vapor barrier to CAN/CGSB-51.40.

.2 Jacket: compliant to CGSB 51-GP-52Ma.

.3 Coefficient (“k”) maximum.

.4 Certified by manufacturer free of potential stress corrosion cracking corrodents.

.3 Calcium silicate

.1 Rigid moulded sections and blocks

.1 Insulation with TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: comply with ASTM C533.

.2 Coefficient (“k”) maximum compliant with ASTM C533.

.3 Design to permit periodic removal and re-installation.

2.3 CEMENT

.1 Thermal insulating and finish

.1 To: ASTM C449/C449M.

.2 Air drying on mineral wool, to ASTM C449.

2.4 TAPES, ADHESIVES AND FASTENINGS

.1 Self-adhesive tape, 100 mm wide, rated under 25 for flame spread and under 50 for smoke development.

.2 Contact adhesive: quick-setting, non-flammable fire resistive adhesive to adhere insulation material to equipment and tanks. Flame spread 15, smoke development 0.

.3 Vapour barrier lap adhesive

.1 Water-based adhesive, flame retardant, quick-setting used to seal joints and overlap the vapor barrier, Flame spread 10, smoke development 0. Compatible with insulation.

.2 VOC content of up to 30 g/L, according to Green Seal Standard GS-36 and under Regulation 1168 of SCAQMD.

.4 For insulation type E-5:

.1 Contact adhesive: quick setting for transverse and longitudinal joints of flexible unicellular insulation, Flame spread 5, smoke development 0.

.5 Tie wire: 1.5 mm diameter stainless steel.

.6 Bands: stainless steel, 19 mm wide, 0.5 mm thick

2.5 COATING

.1 Systems E-5

.1 Finish coat type WB, white color.

.2 Vapour retarder finish

.1 Indoor piping

.1 Vinyl emulsion, acrylic type, compatible with insulation.

.2 Outdoor piping

.1 Vinyl emulsion, acrylic type, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated, 305 g/m^2.

2.6 JACKETS

.1 Polyvinyl Chloride (PVC)

.1 One-piece moulded type and sheet to CAN/CGSB 51-GP-53M with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperature: -20°C.

.4 Maximum service temperature: 65°C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.35 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Indoor: N/A.

.2 Outdoor: UV rated material at least 0.5 mm thick.

.9 Covering adhesive: compatible with insulation.

.2 ABS plastic

.1 One-piece moulded type and sheet with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperature: -40ºC.

.4 Maximum service temperature: 82ºC.

.5 Moisture vapour transmission: 0.012 perm.

.6 Thickness: 0.75 mm.

.7 Fastenings:

.1 Solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Locations

.1 For outdoor use ONLY.

.3 Canvas

.1 120 g/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.4 Aluminum

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheets.

.3 Finish: corrugated.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.5 Stainless steel

.1 Type: 316.

.2 Thickness: 0.25 mm.

.3 Finish: smooth.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry and free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.1 Hot equipment: to TIAC code 1503-H.

.2 Cold equipment: to TIAC code 1503-C.

.2 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.3 Use two (2) 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 Hangers and supports outside vapour retarder jacket.

.5 Supports and hangers:

.1 Apply high compressive strength insulation, suitable for service, where insulation saddles and shoes have not been provided.

.6 Elastomeric insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.

.7 Provide vapour retarder as recommended by manufacturer.

3.4 REMOVABLE, PRE-FABRICATED INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements, flanges and unions at equipment piping connections.

.2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Description

.1 Insulation, products or fasteners and finish coats: complex corresponding to adjacent insulation.

.2 Jacket: corresponding to the complex adjacent insulation.

3.5 ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Unless otherwise specified, insulation of pipes includes valves, valve bonnets, filters and strainers, flanges and fittings.

.2 TIAC Code: A-1.

.1 Securements: bands 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: bands at 300 mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Securements: bands at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1502-C.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Securements: tape.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.

.1 Securements: stainless steel wire.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, or fittings.

Piping/Service	Temp. °C	TIAC Code	Pipe Sizes (NPS) and Insulation Thickness (mm)					
			Run-out	to 1	1¼ to 2	2½ to 4	5 to 6	8 and larger
Domestic hot water and recirculation		A-1	25	25	25	38	38	38
Mixed water piping		A-1	25	25	25	38	38	38
Domestic cold water		A-3	25	25	25	25	25	25
Domestic cold water (with vapor barrier)		C-2	25	25	25	25	25	25
Sanitary drain		C-2	38	38	38	38	38	38

.8 Finishes

.1 Exposed indoor piping: canvas jacket.

.2 Exposed piping in mechanical rooms: canvas and PVC jacket.

.3 Concealed indoor piping: canvas on valves and fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoor piping: waterproof aluminum jacket.

.6 Finish attachments: SS screws at 150 mm on centre.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.1 Remove surplus materials, rubbish, tools and equipment.

.2 Waste Management: in accordance with Section 01 74 21 – Construction/Demolition Waste.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of sections 21 05 01 - Common Work Results for Mechanical and section 23 05 00 - Common Work Results for HVAC are an integral part of this section.

.2 Section 01 33 00 Submittal Procedures

.3 Section 01 35 29 06 - Health and Safety Requirements

.4 Section 01 74 21 - Construction/demolition Waste Management and Disposal

.5 Section 23 05 29 - Hangers and Supports for piping and HVAC equipment.

1.2 REFERENCES

.1 *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.* (ASHRAE).

.2 *American Society for Testing and Materials International*, (ASTM).

.1 ASTM A480/A480M-03c Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

.2 ASTM A635/A635M-02, *Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled*.

.3 ASTM A653/A653M-03, *Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.*

.4 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.4 *National Fire Protection Agency Association* (NFPA).

.1 NFPA 90A-02, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

.2 NFPA 90B-02, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*.

.3 NFPA 96-01, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*.

.5 *Sheet Metal and Air Conditioning Departmental Representatives' National Association* (SMACNA).

.1 *SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997*.

.2 *SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition*.

.3 *SMACNA IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition*.

.6 Transports Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 DOCUMENTS/SAMPLES TO BE SUBMITTED

.1 Submit all technical specification sheets and shop drawings in accordance with section 01 33 00 - Submittal Procedures.

.2 Technical specifications: Submit material safety data sheets required under the Work hazardous material information system (WMIS) which must be compliant with the WHMIS.

.3 Sealants

.1 Tape.

.2 Trade mark prefabricated joints.

.3 Fittings.

1.4 DUCTWORK INSTALLATION

.1 Design, manufacture, supply and install all ducts, equipment and accessories required and / or shown on the drawings

.2 Design, manufacture, supply and install duct systems according to the design criteria set forth in this section, and whose performance will also obtain the results listed in this section

.3 Supply and install all necessary products to seal the duct systems comply with the requirements, sealing and testing of new pipes until satisfactory results

1.5 GENERAL

.1 Neither design criteria mentioned in this section shall be considered restricted in comparison to the other. Use the design criteria the most restrictive.

.2 The Sealing classes are defined in order to establish a minimum criteria of duct sealing, the Contractor shall supply and install all the systems of sealing required to meet the other requirements, including requirements of the sealing classes, so that leakage levels comply with the sealing classes indicated.

1.6 COORDINATION

.1 The plans indicate an approximate location for the passage of new and existing equipment and ducts. Their exact location shall be coordinated by the Contractor according to the projects architectural design and electrical and according to the plans of the existing building and site surveys performed by the Contractor during the work. The Contractor shall coordinate space before submitting shop drawings.

.2 Coordinate installation of duct systems with all the architectural, structural, mechanical and electrical extension and / or the existing building and renovation project. Coordinate especially the following:

.1 Localization of ducts in the ceiling: allow the passage of the ducts under the beams, when required.

.2 Locate all required openings in the structural elements in time for incorporation in the structural work

.3 The Contractor may not claim additional amounts for carrying out work to be done by him in order to coordinate their needs with those of other disciplines and / or existing locations. If the dimensions of ducts should be changed to allow such coordination, the net area of ducts should be kept.

.4 The Contractor shall perform, at its expense, all required openings and fillings, the dismantling and replacement of equipment and systems installed to coordinate its work with other disciplines.

1.7 QUALITY ASSURANCE

.1 Data reliability techniques

.1 Data from catalogues and manufacturers' literature should be reliable, confirmed by tests to have been made by the manufacturers themselves or on their behalf by independent laboratories and certifying the compliance of the requirements of codes and standards.

1.8 HEALTH AND SAFETY

.1 Take the necessary measures for health and safety in construction in accordance with Section 01 35 29.06 - Health and Safety Requirements

1.9 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and/or recycling and place in designated waste containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.10 MANAGEMENT PLAN FOR THE INDOOR AIR QUALITY (IAQ)

.1 Apply during the construction phase, the SMACNA guidelines for the air quality in occupied buildings and set out in the document entitled "Indoor Air Quality Guideline for Occupied Buildings Under Construction".

Part 2 Products

2.1 Classification of ducts

.1 The category of static pressure (Pa) for the construction of air ducts for the system is as follows:

SYSTEM N°	OUTDOOR AIR (1)	SUPPLY (2)	RETURN OR EXHAUST (3)	EXHAUST (4)	CATEGORY OF SEAL
AHU system	-500	+1500 / +500	-500	+500	A
WC Exhaust	--	--	-500	+500	A

Note 1: Air duct from outside air to ventilation system.

Note 2: Air duct from the ventilation system to supply diffuser. When two categories are shown, the first applies to the portion of air duct between the ventilation system and the terminal unit and the second applies to the portion of air duct between the terminal unit and the grid or diffuser.

Note 3: Air duct from return or exhaust grilles or other discharge point, to fan or ventilation system. When two categories are shown, the first applies to the portion of the air duct between the diffuser and the terminal unit and the second applies to the portion of the air duct between the terminal unit and the fan.

Note 4: Air duct from the fan or the ventilation system to outside.

2.2 CATEGORY OF AIR DUCT TIGHTNESS

.1 The category of air tightness of the ducts shall be determined according to data from the table below.

Types of duct	Pressure classes 500 Pa and less (positive and negative)
Rectangular duct	24
Round and oval ducts	12
Welded pipes	No leaks allowed

2.3 CATEGORY OF SEALING

.1 The sealing categories are:

CLASSES	SEAL REQUIRED
A	All transverse joints, longitudinal joints, wall bushings, connections and duct penetrations sealed with a product and a sealing tape.
B	All transverse and longitudinal joints and connections sealed with a sealant, tape seal, or a thereof combination.
C	All transverse joints and connections sealed with gaskets, a product, a sealing tape or a combination thereof. Longitudinal joints unsealed.
D	Unsealed joints.

.2 Sealing classes listed above are the minimum required sealing of the Contractor for all ducts. These minimums do not, however, release the Contractor from its responsibility to manufacture, supply and install all ducts so as not to exceed the maximum leakage rates stipulated in section 2.1. The Contractor shall provide and install all sealing equipment necessary to meet the requirements specified in section 2.1, without additional compensation.

.3 If the opinion of the Contractor, the application of sealing classes defined in this section necessarily involves the use of welded joints at other locations, the Contractor shall include the cost of welded joints amount of the original submission.

2.4 FITTINGS

.1 Fabrication: to SMACNA

.2 Radiused elbows.

.1 Rectangular: standard radius, short radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.

.2 Round: smooth radius five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single double thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.3 Not allowed on return air or exhaust air network

.4 Branches:

.1 Main Rectangular branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.

.2 Main Round 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 Leads secondary entrance at 45 ° equipped with a damper mounted in the main branch or secondary entrance leads to 90 ° including the register and the directional damper mounted in the main branch

.5 Transitions:

.1 Diverging: 20 degrees maximum including angle.

.2 Converging: 30 degrees maximum including angle.

.6 Offsets:

.1 Full short radius elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

.2 The maximum opening angle must be the same as in the case of transition elements.

2.5 AIR DUCT

.1 General

.1 Thickness: according to SMACNA standards or as specified.

.2 Fabrication: according to SMACNA.

.2 Joints: according to SMACNA and manufactured made joints. The flanged joints shall be considered to have a class A manufactured seal.

.3 Round and oval ducts

.1 Construction:

.1 Ducts made of galvanized steel or aluminum: spiral ducts with factory-made fittings and accessories according to SMACNA.

.2 Transverse joints up to 915 mm with sleeve joints and sealing tape. Above 915 mm, Vanstone joints:

.1 90º elbow: made of 5 sections minimum.

.2 Fitting branches: conical T.

.3 Dimensions: the dimensions of ducts shown in the drawings were selected based on the parameters of air velocity and pressure loss. If certain duct dimensions are not available, select dimensions giving an equivalent diameter but never less. The Contractor will be responsible for coordinating the obstructions in the ceiling, mounted, etc.

.4 The test procedures must be submitted by the Contractor to the Departmental representative for verification before running tests.

2.6 GALVANIZED AIR DUCT

.1 Material:

.1 Foldable steel pipes to form seam: ASTM A653/A653M, with zinc coating Z90.

.2 Thickness, fabrication and reinforcement: according to ASHRAE, SMACNA.

.2 Fabrication:

.1 Joints: to ASHRAE, SMACNA, proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

.3 Application:

.1 All ducts, unless otherwise indicated

2.7 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 – Fire stopping.

.1 Ducts should not be distorted by the fire-stop material or its installation

2.8 SEALANT PRODUCTS

.1 Sealant: Duct, polymer-based, fire retardant, oil resistant and can withstand temperatures ranging from 30 degrees Celsius to 93 degrees Celsius.

2.9 SEALANT TAPE

.1 Sealing Tape: Glass fibber membrane, loose weave, treated with polyvinyl, 50 mm wide.

2.10 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to ASHRAE and SMACNA.

.2 Hangers: black galvanized steel angle with black galvanized steel rods according to ASHRAE and SMACNA following table:

Duct size (mm) until 750	**Angle size (mm) 25 x 25 x 3**	**Rod size (mm) 6**
750 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 above	50 x 50 x 6	10

.3 Round duct: hangers according to SMACNA and made of galvanized steel.

.4 Fastener suspension

.1 Attachment to the structure:

.1 Concrete structure: bolt expansion.

.2 Steel structure: manufactured attachments.

.5 Maximum spacing of supports: 3 m

.6 Provide and install all structural elements required to secure the brackets to the building structure. Cover all the structural elements of a layer of zinc rich paint, color chosen by the Departmental Representative.

.7 All materials exposed to bad weather shall be hot dip galvanized after welding. All hardware attachment and bracing required must be stainless steel.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.

.3 Fasten vertical ducts in accordance with the requirements of relevant standards of ASHRAE and SMACNA standards relevant.

.4 Install breakaway joints in ductwork on each sides of fire-stop partitions

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.7 Install the fire stop material in a way to avoid to twist air ducts

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE and SMACNA as follows:

Duct size (mm)	Spacing (mm)
Up to1500	3000
1501 and up	2500

3.3 JOINT SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with a minimum of one coat of sealant to manufacturers recommendations.

3.4 AIR DUCT LEAKAGE TESTS

.1 Perform leak tests in accordance with the requirements contained in the HVAC Contractor Leakage Test Manual of SMACNA.

.2 Do leakage pass tests in sections.

.3 Make preliminary test sealing (to detect air leakage) as directed, to check the quality of work.

.4 Do not install additional ductwork until trial test has been passed.

.5 Proceed with testing minimally one branch section per washroom.

.6 Complete test before performance insulation or concealment Work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of sections 21 05 01 - Common Work Result for Mechanical and section 23 05 00 - Common Work Results for HVAC for the results of work are an integral part of this section.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 29.06 - Health and Safety Requirements.

.4 Section 01 45 00 - Quality Control.

.5 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.6 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 *SMACNA, HVAC Duct Construction Standards, Metal and Flexible-1985*.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTOIN AND INFORMATION SUBMITTALS

.1 Product Data

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions

1.4 HEALTH AND SAFETY REQUIREMENTS:

.1 Take the necessary measures for health and safety in construction, in accordance with Section 01 35 29.06 - Health and Safety requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 GENERAL

.1 The dampers must be manufactured in accordance with relevant standards of SMACNA.

2.2 SPLITTER DAMPERS

.1 Registers blades are made of the same material as the air duct but their normalized thickness is immediately superior to the air duct thickness, with appropriate reinforcing device.

.2 Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod shape designed to prevent from entering it completely into the air duct

.5 Pivot mechanism consists of a piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Made of the same material as the air duct but the normalized thickness is immediately superior to air ducts thickness, V-groove ensuring greater rigidity.

.2 Form and dimensions comply with the recommendations of the SMACNA, except for what is the maximum height, which must be 100 mm consistent with indications.

.3 Lock extension to suit the thickness of the insulation of the air duct

.4 Inside and outside end levels are made of bronze.

.5 Frame profile is the same material as the air duct in which the register is mounted and fitted with stops angles.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct for supply and exhaust systems.

.4 Run-outs to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Install control devices in areas where they are visible and accessible.

.7 The corrections and adjustments will be made by the Departmental representative.

3.3 FIELD QUALITY CONTROL

.1 Tests:

.1 The tests shall cover a period of at least 15 days and must provide evidence that the system works as directed.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

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

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of sections 21 05 01 - Common Work Results for Mechanical for the results of work and section 23 05 00 - Common Work Results for HVAC for the results of work are an integral part of this section.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 29.06 - Health and Safety Requirements.

.4 Section 01 45 00 - Quality Control.

.5 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.6 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-[04a], *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process*.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Performance data.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals

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

1.4 HEALTH AND SAFETY REQUIREMENTS:

.1 Take the necessary measures for health and safety in construction in accordance with Section 01 35 29.06 - Health and Safety.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.2 Waste Management and Disposal:

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

Part 2 Products

.1 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable with a 12 month warranty.

.4 Bearings: roller self-lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position less than 0.001 % of rated air flow at 250 kPa pressure differential across damper.

.2 Pressure drop: at full open position less than 50 Pa differential across damper at 1.50 m/s.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

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

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

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of sections 21 05 01 - Common Work Results for Mechanical for the results of work and section 23 05 00 - Common Work Results for HVAC for the results of work are an integral part of this section.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 29.06 - Health and Safety Requirements.

.4 Section 01 45 00 - Quality Control.

.5 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.6 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 *American National Standards Institute/National Fire Protection Association* (ANSI/NFPA)

.1 ANSI/NFPA 90A-2002, *Standard for the Installation of Air Conditioning and Ventilating Systems*.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.

.2 CAN4-S112.2-M84, Standard method of testing fire performance of fire dampers located in the ceilings.

.3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submit manufacturers' required technical data, specifications and documentation in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Fire-dampers.

.2 Smoke dampers.

.3 Operators.

.4 Fusible links.

.5 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance records required and join them to the manual mentioned in Section 01 78 00 Closeout submittals Documents / Items to submit once work is completed.

1.4 HEALTH AND SAFETY REQUIREMENTS

.1 Apply necessary measures during construction in occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 MAINTENANCE

.1 Extra Materials:

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

.2 Provide following:

.1 Six (6) fusible links of each type.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type A B C, listed and bear label of ULC and meet requirements of CFFM and ANSI/NFPA 90A and authorities having jurisdiction. Fire damper assembly fire tested in accordance with CAN4-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 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.

.4 Built mounting angles 40 mm x 40 mm x 3 mm, all around records of each side of partitions or walls Fire crossed

.5 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.6 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.

.7 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.8 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.9 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 SMOKE DAMPERS

.1 Smoke Dampers: to be ULC or UL listed and labelled.

.2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link as indicated. Two flexible stainless steel blades edge seals to provide required constant sealing pressure.

.3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel to provide required constant sealing pressure. Provide stainless steel negator springs with locking devices to ensure positive closure for units mounted horizontally in vertical ducts.

.4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.

.5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74 degrees C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

.1 Damper: similar to smoke dampers specified above.

.2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with ANSI/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. Coordinate with fire damper installer

.5 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.6 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, evacuate the site materials / equipment surplus, waste, tools and equipment.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The requirements of Section 21 05 01 – Common Work Results for Mechanical and section 23 05 00 – Common Work Results for HVAC are integral parts of this section.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 35 29.06 - Health and Safety Requirements.

.4 Section 01 45 00 - Quality Control.

.5 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.6 Section 01 78 00 - Closeout Submittals.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data must specify:

.1 capacity;

.2 throw and terminal velocity;

.3 noise criteria;

.4 pressure drop;

.5 neck velocity.

.2 Samples

.1 Submit required samples in accordance with Section 01 33 00 – Submittal Procedures.

.3 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 Contractor to make available one (1) copy of installation instructions prepared by the system supplier to BGIS representative.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading

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

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

.2 Waste Management and Disposal

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

1.6 RELIABILITY OF TECHNICAL DATA

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

1.7 MAINTENANCE

.1 Extra materials:

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

.2 Provide the following:

.1 keys for volume control adjustment;

.2 keys for air flow pattern adjustment.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, and neck velocity as indicated.

.2 Grilles, registers and diffusers passing through fire-rated partitions to be equipped with steel sleeves secured to frame in accordance with NFPA 90A.

2.2 GRILLES AND DIFFUSERS

.1 Frames

.1 Standard steel frame with welded visible seams and flared joints.

.2 Aluminium or galv-alum frame with mechanical fasteners and mitered joints.

.3 Full perimeter gaskets.

.4 Plaster frames where set into plaster or gypsum board partition or wall.

.5 Mounting frame: coating as specified for frames.

.6 Concealed fasteners.

.7 Concealed manual volume control damper operators.

.8 Specific dimensions, volumes and characteristics: as indicated on tables within drawings.

.2 Colour as per architect’s instructions.

.3 Refer to grille / diffuser schedule.

.4 Acceptable products: E.H. Price Ltd, Krueger or approved equivalent.

2.3 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install grilles, registers and diffusers in accordance with manufacturer's instructions.

.2 Provide and install all angle irons and steel fasteners necessary so that the weight of type 'C' and 'L' grilles and diffusers is not supported by the ceiling.

.3 Install with flat-head screws in countersunk holes where fastenings are visible.

.4 Plan for all additional connections, transitional elements and suspended T ceilings necessary for installation and connection of grilles and diffusers. Connections to be both robust and sealtight.

.5 Coordinate the installation of grilles and diffusers with the work of other subtrades, in particular those involved in architectural finishes and sealing details.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 00 10 – General Instructions.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 25 05 01 - EMCS: General Requirements.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test periods 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 were 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.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware and qualified to interpret Design Criteria and Design Intents.

1.4 ACTION AND INFORMATION SUBMITTALS

.1 Submittals in accordance with Section 01 00 10 – General Instructions.

.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 and commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 00 10 – General Instructions.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 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 00 10 – General Instructions.

1.6 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 13 - General Commissioning (CX) Requirements.

.2 Carry out commissioning under direction of Departmental Representative.

.3 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning of each test. Indicate:

.1 Location and parts 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.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.8 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.

Part 2 Products

2.1 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.

Part 3 Execution

3.1 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.

3.2 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.

.4 Additional instruments to include:

.1 DP transmitters.

.2 VAV supply duct SP transmitters.

.3 DP switches used for dirty filter indication and fan status.

.5 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 and to BECC.

.6 Transmitters above 5 % error will be rejected.

.7 DP switches to open and close within 10% of set point.

.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 start-up testing.

.3 Final Start-up Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and provide:

.1 2 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 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 Prior to beginning of 30 day test demonstrate that operating parameters (set points, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation:

.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

.2 Test to last at least 30 consecutive 24 hour days.

.3 Tests to include:

.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics and software.

.4 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.

.5 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.

.6 Correct defects when they occur and before resuming tests.

.5 Departmental Representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 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 Commissioning sections.

END OF SECTION

Part 1 General

2.2 EMCS WORK

.1 General requirements for building Energy Monitoring and Control System (EMCS) common to the work associated with EMCS sections.

.2 Included work:

.1 To provide a complete functional EMCS, including:

.1 General application controllers (GAC) ;

.2 Instrumentation;

.3 Networking;

.4 Accessories (i.e: cabinet, transformers, etc);

.5 Control drawings;

.6 As Built Drawings;

.7 Installation;

.8 Electrical Work related to controls;

.9 Programming;

.10 Calibration;

.11 Commissioning of all new or modified points;

2.2 RELATED REQUIREMENTS

.1 All sections of division 01, 21, 23, 25 and 26.

.2 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

2.2 REFERENCES

.1 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).

.2 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.

.3 Canadian Standards Association (CSA International):

.1 CAN/CSA-Z234.1-89 (R1995), Canadian Metric Practice Guide.

.4 Department of Justice Canada (Jus):

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

2.2 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:

.1 AI - Analog Input.

.2 AO - Analog Output.

.3 BACnet - Building Automation and Control Network.

.4 BC(s) – Building Controller(s).

.5 DI - Digital Input.

.6 DO - Digital Output.

.7 ECU - Equipment Control Unit.

.8 EMCS - Energy Monitoring and Control System.

.9 HVAC - Heating, Ventilation, Air Conditioning.

.10 GAC – General Application Controller.

.11 I/O - Input/Output.

.12 ISA - Industry Standard Architecture.

.13 LCU - Local Control Unit.

.14 VAV – Variable Air Volume.

2.2 MATERIAL OR PRODUCTS OF ACCEPTANCE

.1 When materials or products are specified by trademark, consult the Tenderer Instructions for procedure to follow with regard to request for approval of replacement materials or products.

2.2 DISMANTLING

.1 All dismantled control boxes and application controllers will be returned to the Departmental Representative.

.2 Dismantle and eliminate all electrical conduits, pneumatic conduits, cables, panel relays, equipment, etc. (all control components) that have become unnecessary.

.3 Erase, delete and/or eliminate all obsolete programming following work and back up as per controller back-up procedure.

2.2 COLOUR GRAPHIC INTERFACE SOFTWARE

.1 Modify existing graphics to add new equipments.

2.2 CALIBRATION

.1 Calibrate all instruments such as temperature sensors, pressure sensors, flow sensors, current sensors, etc., using a calibrated and certified instrument.

2.2 SHOP DRAWINGS AND TECHNICAL DATA SHEETS

.1 Submit shop drawings and technical data sheets in accordance with the requirements of Section 01 00 10 – General Instructions and Section EMCS: Shop Drawings, Product Data and Review Process.

.2 Shop drawings and technical data sheets must include the following:

.1 Proposed system architecture detailing communication networks with BACnet and IP address for each controller (GAC and ASC), room number for controller location and communication type (MS/TP or IP).

.2 Digital controller technical data sheets.

.3 Instrumentation technical data sheets.

.4 Diagram of each system including BACnet address for each I/O, connections between various components, electrical diagrams, equipment description and operating sequence.

.5 Floor plan including location of general application controllers (GAC), application specific controllers (ASC) with their BACnet and IP address, as well as transformers.

.6 Complete schedule of valves, actuators and damper actuator including identification on drawing, make, model, diameter, Cv and location in which room or which system.

.7 Schematic assembly of each controller (GAC and ASC) with identification of I/O points as per department requirements.

.8 Complete schedule of controlled equipment for each room including I/O point addresses.

.3 Submit for review:

.1 Equipment list and systems manufacturers at time of tender.

.4 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 01 00 10 – General Instructions, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Department Representative certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/ specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative.

.8 Existing devices to be reused: submit test report.

2.2 QUALITY ASSURANCE

.1 Have staffed by trained personnel capable of providing response within two (2) hours for EMCS instruction, routine maintenance and emergency service.

.2 Provide record of successful previous installations.

.3 Have access to local supplies of essential parts and provide seven (7) year warranty of availability of spare parts after obsolescence.

.4 Ensure qualified supervisory personnel continuously direct and monitor work and attend site meetings.

.5 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 07 12 – Health and Safety Requirements.

2.2 CONTROL POINTS CHANGE OF STATE OR VALUE DISPLAY

.1 Change of state or value (COSV) display for all room temperatures and their set point must be 0.1℃.

.2 Change of state or value (COSV) display for all temperatures, except room temperatures, must be 0.1℃.

.3 Change of state or value (COSV) display for all modulating I/O's in percentage must be 1%.

.4 Change of state or value (COSV) display for all pressure readings in in. H_2O must be 0.1 in. H_2O.

.5 Change of state or value (COSV) display for all pressure readings in Pascal must be 1 Pa.

.6 Change of state or value (COSV) display for all readings of air flow products in CFM must be 10 CFM.

2.2 TESTING

.1 Conduct testing in compliance with the requirements of Section 01 91 13 – General Commisioning Requirements;

.2 All instruments required for testing must be calibrated as per manufacturer's recommendations. They must have a tag certifying calibration.

.3 Once all equipment has been installed and mechanical and electrical connections have been made, carry out preliminary tests demonstrating that the entire installation is perfectly operational.

.4 The Contractor must request authorization from the Department Representative, before connecting his work to the main BACnet/IP network of the Departmental Representative's EMCS.

.5 Final operating testing:

.1 The overall system must undergo final operational testing that will last at least thirty consecutive days, twenty-four hours per day, in order to demonstrate that the EMCS operates both correctly and in compliance with all requirements of contractual documents. Demonstrate suitable operation of all monitoring and control points as well as operating and sequence possibility, report creation, specialized control algorithms, troubleshooting and all other software. If equipment operates at AEL of at least 99% during the 30-consecutive day testing period, it will be considered to comply with performance standards and system's final approval will be issued as long as the Contractor will have met the other requirements of these specifications.

.2 If the required AEL is not attained during the 30 consecutive days, the test period in view of final acceptance will be extended by one day at a time until the AEL is both attained and maintained for a period of 30 consecutive days. AEL is defined as the ratio between total test period less any system downtime accumulated within that period and test period. Downtime occurs when the EMCS is unable to fulfill its functions as detailed in the present specifications, due to any defect,

whether caused by the equipment or software. Any equipment or software defect must be corrected as it occurs prior to recommencing testing.

.3 Downtime for each incident must be measured by calculating the interval between the time, during the testing period, in which the Contractor or authorized representative is notified of an equipment failure and the time in which the system resumes its normal operations. System downtime attributable to the following reasons will not be considered as system failures:

.1 Downtime resulting from a main power failure beyond the normal emergency source's capacity, provided that automatic start-up of all emergency sources has been activated and re-start of all components meets the requirements of these specifications.

.2 Failure of a communication link, provided that the controllers operate automatically and correctly in standalone and provided that the failure was not provoked by a piece of equipment provided by the Contractor.

.3 Downtime resulting from an existing equipment failure.

.4 An operating failure resulting from an individual detector or controller provided that the system has recorded the failure and the mechanical equipment is transferred by default to protection mode in the case of defect, and that AEL for all detectors and controllers is at least 99% during the 30-day testing period.

.6 The proportional and integral band for room control outputs must operate to restrict variation in room temperature by 5% with respect to its set point.

.7 The proportional and integral band for ventilation system control outputs must operate to restrict variation in room return humidity or room supply temperature by 5% with respect to their set point.

.8 Within the programming, use of a negative command (Not) is forbidden. Example: IF NOT HORAIRE.

2.2 CONTROLLERS – MEMORY

.1 The memory file for each controller must contain all programmed elements.

.2 All control technicians who make modifications to the programmed elements within a controller must update the memory file.

2.2 OPERATING MANUAL

.1 Provide O&M sheets and incorporate them into the manual specified in Section 01 78 00 – Closeout Submittals.

.2 Operating sheets must include the following:

.1 Proposed system architecture detailing communication networks with BACnet and IP address for each controller (GAC and ASC), room number for location of controller and communication type (MS/TP or IP).

.2 Digital controller technical data sheets.

.3 Instrumentation technical data sheets.

.4 Diagram of each system including BACnet address and department standards for each I/O, connections between various components, electrical diagrams, operating sequence and equipment description list.

.5 Floor plan including location of general application controllers (GAC), application specific controllers (ASC) with their BACnet and IP address, as well as transformers.

.6 Complete schedule of valves, actuators and damper actuator including identification on drawing, make, model, diameter, Cv and location in which room or which system.

.7 Schematic assembly of each controller (GAC and ASC) with identification of I/O points as per department standards.

.8 Complete schedule of controlled equipment for each room including I/O point addresses.

.3 O&M sheets will be provided in two formats: hard copy in letter format (8½ x 11) inserted into a three-ring binder. Coiled documents will not be accepted. A second format will consist of a USB stick and CD.

.4 For work that involves several buildings, operating sheets, in hard copy, will be delivered separately for each building. However, for electronic format, a single USB stick and CD for all buildings will be provided.

2.2 INTEGRATED COMMISSIONING

.1 During commissioning of equipment with a BACnet controller and to be integrated into the EMCS, the Controls Contractor and Contractor supplying a piece of equipment with a BACnet controller must communicate with the Departmental Representative and establish a date for integrated commissioning. Each Contractor must provide a qualified technician to carry out integration and commissioning.

2.2 FINAL COMMISSIONING

.1 During commissioning, the Controls Contractor must communicate with the Departmental Representative and establish a date for detailed final acceptance. This will include a point-by-point verification of all equipment and software including dynamic graphics and execution of various tasks as indicated. This verification must also include complete operational demonstration of the system in compliance with paragraph 1.14, O&M Personnel Training:

.1 This stage must be carried out under the entire direction of the Departmental Representative.

.2 Plan for all equipment necessary for testing.

2.2 O&M PERSONNEL TRAINING

.1 Provide tools, material and services of qualified instructors or technicians who have participated in the majority of work to provide O&M personnel training with regard to operating, commands, adjusting, troubleshooting and maintenance of all systems and equipment during normal work hours.

.2 The training sessions must be based on the O&M manual content, as-built drawings, audiovisual documents, etc.

.3 The training sessions can only be given once final commissioning has been completed and the project's overall graphics have been completed and before acceptance and handover of systems and equipment.

.4 Provide a training program including the following points:

.1 Layout and functioning of equipment.

.2 Location and basic maintenance for all programmable controllers.

.3 One 2 hour training sessions

.4 Anticipate training, for a duration of fifteen (15) minutes, for each new system to confirm operation according to determined sequences such as:

.1 Heat pumps

2.2 TAB

.1 Carry out testing, adjusting and balancing work by providing the required personnel to collaborate on this work.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components**.**

Part 2 Products

2.2 FIELD DEVICES

.1 Field Devices:

.1 Provide all field devices suitable to base building standards. Manufacturer must be familiar with existing building. Provide and coordinate location of all devices for installation by Contractor. Refer to points list.

.2 Field Wiring:

.1 Provide all field wiring for EMCS systems. All field wiring to be installed under EMT conduits.

2.2 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer’s recommendations.

.2 All wiring and conduit shall be installed as per Section 26.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 25 01 11- EMCS: Start-Up, Verification and Commissioning.

.2 Section 25 05 01- EMCS: General Requirements.

.3 Section 25 90 01- EMCS: Site Requirements Applications and Systems Sequences of Operation.

.4 Section 26 05 00- Common Work Results for Electrical.

.5 Section 26 05 21 – Wires and cables (0-100V).

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA).

.1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).

.1 CSA-C22.1-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01- EMCS: General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions.

1.5 EXISTING CONDITIONS

.1 Repair surfaces damaged during execution of Work.

.2 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, vibration-proof enclosures.

.3 Operating conditions: 0- 32degrees 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.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.1 Installation shall be the responsibility of the Contractor, wiring and connection shall be the responsibility of the contractor.

.2 Power wiring shall be completed by the Contractor, to Quebec Electrical code wiring requirements based on the VFD bypass input current.

.3 The Contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2 START-UP

.1 Factory start-up shall be provided for each drive by a factory authorized service center.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 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: #18 AWG.

.2 Analog input and output: shielded #18 minimum solid copper.

3.5 IDENTIFICATION

.1 According to identification system implemented as per department existing standards.

END OF SECTION

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Part 1 General

1.1 GENERAL DESCRIPTIONS

.1 Consult Departmental Representative in order to obtain all schedules of events, schedules of various modes and to perform programming.

.2 All operating parameters such as set points, data for adjusting tables, proportional, integral and derivative gains, etc., shall be programmed as variables in order to easily modify them without having to modify programming.

.3 All proportional, integral and derivative gains shall be adjusted until each control loop is approved by Departmental Representative.

.4 Each motor must include a programmable parameter allowing sequential start-up of all motors following a power failure in order to avoid overloads. This parameter also applies to system re-start after a fire alarm. Contractor to demonstrate to Departmental Representative that the parameters to be programmed comply with approved sequence upon power return. Furthermore, each motor's running time is to be calculated and displayed with runtime alarms upon operator request. A motor's running time can be reset to zero via operator command.

.5 Supply, installation and connection of all electrical relays, interlocks, converters and other accessories required in order to meet operation sequences described in this section are the responsibility of present Contractor.

.6 Any transition of set point or operation mode to another shall take place progressively in order to avoid abrupt operations. Transition time shall be adjustable according to application.

.7 All alarms related to a system shall be deactivated when system is off. Moreover, an adjustable time period shall allow delay of activation of alarm function upon system start-up.

.8 All flow values indicated on drawings and in this section shall not be considered as accurate. The Contractor shall obtain accurate values from ventilation, heating and cooling, shop drawings; if in doubt, verify with Departmental Representative.

.9 All readings from flow measuring devices (including coil differential pressure flow readings) are provided with adjustable dampening and mean average computation to achieve control loop stability.

.10 When two or more components are to be used to perform the same task, an alternating sub-routine shall allow equal wear of both components. Moreover, operator shall be able to provide each component with desired operation priority.

.11 Program all alarms related to the temperature and relative humidity of rooms and systems according to Departmental Representative's parameters list.

.12 Program all alarms related to differential pressure sensor filters (on air and water systems).

.13 Program high and low level alarms for all analog inputs. Unintended status alarms will be programmed for digital points when control and status are available.

.14 The Controls Contractor shall be responsible for verifying the operation of each instrument he controls, even if supplied by others.

.15 All values will be programmed as a variable and can be changed easily on the screen of the EMCS computer.

.16 Air flow indication must be zero if the fans are stopped.

.17 All VAV boxes must completely close their dampers when the flow set point is zero. The damper must not stop closing when the flow reading is zero, the actuator must close completely to 0% (closed) when the flow demand is zero.

.18 All systems described on the drawings list must operate in sequence and in standalone.

.19 Some interlocks will be required to integrate mechanical and electrical equipment.

.20 The outside temperature and outside humidity will be associated with analog variables in the building's main controller. These analog variables will be used in the programs of all building controllers.

.21 Outside temperature and humidity:

.1 The main GAC (general application controller) for each building will have a transfer program. This program will be used exclusively to associate the value from the overall outside temperature and humidity transmitter to analog variables. These analog variables will then be used in the programs for all building controllers.

.2 The main GAC for each building will transfer the value of the analog variable associated with the overall outside temperature transmitter and the analog variable associated with the overall outside humidity transmitter.

.3 In the case of communication loss with the controller or a fault in the overall outside temperature and humidity transmitter, anticipate programming to allow for referencing to the local outside temperature or humidity transmitter.

.4 All values transferred, between the GAC and ASC (general application and application specific) controllers, will be done according to the manufacturer's recommendations.

.22 Point transfer between controllers:

.1 All values transferred, between the GAC and ASC controllers, will be done using a dedicated program for this purpose. There shall be no control points within the operating programs, without having been previously transferred to a transfer program.

Part 2 Products

2.1 EXHAUST FANS

.1 General description: Same sequence as existing exhaust fans. Fan to be operated on/off on a operator defined schedule. Provide fan status/alarm.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group:

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83(R2010), 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.

1.2 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 10 General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets.

.3 Shop drawings:

.1 Submit drawings stamped and signed by Contractor as being reviewed and compliant with the project specifications.

.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 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified material.

.2 Permits and fees: Pay all permits and fees related to the electrical scope of work identified on the drawings and specifications.

.3 Submit, upon completion of Work, load balance report as described in part 3 - Load Balance.

.4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 00 10 General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer`s instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

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

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse by manufacturer and return of padding, crates, pallets, packaging materials as specified in Waste Reduction Workplan.

1.6 SEISMIC RESTRAINT

.1 Supports and anchors used to install equipment and conduits must comply with the seismic requirements detailed in the Ontario Building Code. Provide for evaluation of all installations detailed in drawings, specifications, addendums and change notices by a seismic engineer and all required installations in order to comply with the Ontario Building Code.

.2 Provide shop drawings for review for all required seismic supports prior to installation.

.3 Provide a conformity report signed and sealed by a professional engineer detailing that all technical documents have been reviewed and all electrical installations meet the applicable seismic requirements in effect detailed by the Ontario Building Code and National Building Code of Canada.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

2.2 MATERIALS AND EQUIPMENT

.1 Factory assembles component assemblies.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with labels and nameplates as follows:

.1 Nameplates: lamicoid label 3mm thick, black core and white face, 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 and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per label or 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 approved by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered and coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

2.6 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 3m intervals.

.3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Other Security Systems	Red	Yellow

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for proposed installations:

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

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

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 LOCATION OF OUTLETS

.1 Locate outlets as indicated on drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, 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.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise:

.1 Wall receptacles:

.1 General: 400mm.

.2 Above top of counters or counter splash backs: 175mm.

.2 Wall switches not less than 900mm and no more than 1100mm.

.3 Telecom rough-ins:

.1 General: 400mm.

.2 Above top of counters or counter splash backs: 175mm.

.4 Panelboards as required by code.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in Part 1 - Action and Informational Submittals, phase and neutral currents on panelboards, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 00 10 General Requirements.

.1 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Provide fire alarm verification report.

.6 Provide emergency lighting testing report. Including voltage of battery before and after test, as well as voltage of furthest electrically connected emergency remote head before and after test in all areas within the project scope.

3.8 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for recycling reuse in accordance with Waste Reduction Workplan:

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.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)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

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

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of padding, pallets, crates, packaging materials as specified in Waste Reduction Workplan.

Part 2 Products

2.1 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 Bushing stud connectors: to NEMA to consist of:

.1 Connector body and stud clamp for copper stranded, round.

.2 Bolts for copper conductors.

.3 Sized for conductors as indicated.

.4 Clamps or connectors armoured cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductor cables and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.

.2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

.3 Install bushing stud connectors in accordance with NEMA.

3.2 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment

.3 Waste Management: separate waste materials for reuse or recycling in accordance with Waste Reduction Workplan:

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

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 00 10 General Requirements.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of crates packaging materials, padding, pallets in accordance with Waste Reduction Workplan.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE Jacketted.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: anti short connectors.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

3.2 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 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.4 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.

.5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

.2 To be used for final connections only.

.3 Not to exceed 3 meters.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 10- General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse by manufacturer and return of pallets, crates, padding, packaging materials as specified in Waste Reduction Workplan.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41mm, 2.5mm thick, suspended/surface mounted.

2.2 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps:

.1 One-hole malleable 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 diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1m O.C.

.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.

2.3 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment Waste Management: separate waste materials for reuse or recycling:

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 22nd Edition.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Multi and Single gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm 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 48mm.

.4 102mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 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.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.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. 45-M1981 (R2003), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985 (R2003), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984 (R2003), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and datasheets:

.1 Submit cable manufacturing data.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling or reuse.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, aluminum.

2.2 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 1m.

.4 Threaded rods, 6mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Set-screw couplings.

2.4 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use electrical metallic tubing (EMT) except for final connections.

.4 Use flexible metal conduit for final connections.

.5 Install conduit sealing fittings in hazardous areas:

.1 Fill with compound.

.6 Minimum conduit size for lighting and power circuits: 19 mm.

.7 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend steel conduit over 19 mm diameter.

.9 Install fish cord in empty conduits.

.10 Remove and replace blocked conduit sections:

.1 Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface or suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CLEANING

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

END OF SECTION

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Part 1 General

1.1 REFERENCE STANDARDS

.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).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 10 General Requirements.

.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.

.3 Shop Drawings:

.1 Submit drawings stamped and signed as reviewed and approved by the Contractor.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 00 10 General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

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

.2 Store and protect wiring device from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse by manufacturer and return of pallets, packaging materials, padding, crates, as specified in Waste Reduction Workplan in accordance with Section.

Part 2 Products

2.1 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, to: CSA C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

2.2 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

2.3 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

2.4 UNIVERSAL WASHROOM EMERGENCY CALL SYSTEM KIT

.1 Kit to be CSA rated and complete with all devices to meet Ontario REG. 368/13 Amendment to 2015 Ontario Building Code for barrier free and universal washrooms.

.2 Designed for universal washrooms with or without barrier free door operators.

.3 Audible and visual alarm devices inside and outside washroom. Signal is activated until button has been placed in the ‘off’ position.

.4 Low voltage step down transformer.

.5 Signage to be located above the activation switch, approximately 1.6mm, 381mm x 381mm, 25mm high black lettering with a 5mm stroke. Text shall be; 'IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE'.

Part 3 Execution

3.1 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 to match existing on site.

.2 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.3 Universal washroom emergency call system kit:

.1 Audible and visual signals to be mounted above door frame, or adjacent to door header if space is limited.

.2 Signage to be posted above the emergency button.

3.2 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment

.3 Waste Management: separate waste materials for reuse or recycling:

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

3.3 PROTECTION

.1 Protect installed products and components from damage during 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

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Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA International:

.1 CSA C22.2 No. 5-09.Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.3 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations:

.1 Production certificate of origin must be submitted to Departmental Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension or additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title: Workplace modification 28th Floor.

.2 Departmental representatives reference number.

.3 List of circuit breakers.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of crates, padding, packaging materials pallets, as specified in Waste Reduction Workplan.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling:

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

END OF SECTION

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Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 10 General Requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 00 10 General Requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 WARRANTY

.1 For batteries in this Section 26 52 13.13 - Emergency Lighting, 12 months.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, AC.

.3 Output voltage: 12 V DC.

.4 Operating time: 120 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON'.

.10 Lamp heads: integral on unit or remote as indicated, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 4W, minimum output.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Auxiliary equipment:

.1 Test switch.

.2 Battery disconnect device.

.3 AC input and DC output terminal blocks inside cabinet.

.4 Bracket.

.5 Cord and plug connection for AC.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: Minimum #8 RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized in accordance with manufacturer's recommendations and the Ontario Electrical Safety Code.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

3.2 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 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 General Requirements.

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-15, Unit Equipment for Emergency Lighting.

.2 CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Quality Assurance Submittals: submit following in accordance with Section 01 45 00- Quality Control.

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

1.3 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: Steel chassis, backbox and brushed aluminum finish trims.

.3 Edge lit face plate: Pictogram c/w directional arrows. Coordinate directional arrows with drawings and layout on site.

.4 Lamps: LED. 120/347VAC Input, field selectable, 120V/0.035 A/4.16W or 347V/0.012 A/3.99W max power consumption.

.5 Operation: designed for 40,000 hours of continuous operation without relamping.

.6 Separate backbox/housing to be pre-installed at any time prior to faceplate and electronics.

.7 Hanger bars for drywall ceilings or walls included, maximum extension of 540 mm.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 - Common Work Results For Electrical.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC):

.1 CAN/ULC-S524-2014, Standard for the Installation of Fire Alarm Systems (ULC 524).

.2 CAN/ULC-S525-2007, Audible Signal Device for Fire Alarm Systems (ULC 525).

.3 CAN/ULC-S537-2013, Verification of Fire Alarm Systems (ULC 537).

1.3 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. Include:

.1 Details for devices.

.2 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.3 Battery and power calculation, showing compliance with this specification.

.4 Bill of material for equipment shipping.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Submit certificate signed by manufacturer certifying that fire alarm technician is approved to provide installation and verification services on the existing equipment.

.3 Contractor certificates signed by training provider (IBEW or CFAA) that installers are certified to install fire alarm systems.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: fire alarm verification reports.

.4 Closeout Submittals:

.1 Instructions for all added components of the fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.4 Approved fire alarm verification report.

.5 Warranties.

.6 Acceptance report by Authority having jurisdiction

.7 List of recommended spare parts for system.

.8 Proof of acceptance of training to Departmental Representative.

.9 As-built drawings showing device and conduit locations size, wiring counts wire size and device address.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in fire alarm system installations with documented experience and approved by manufacturer. IBEW or CFAA certified to install fire alarm systems.

.2 Fire Alarm Technician: provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

.3 System:

.1 Subject to Department Representative’s and Authority Having Jurisdiction’s inspection for final acceptance.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.6 WASTE MANAGEMENT:

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

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by existing fire alarm system manufacturer.

.2 Audible signal devices: to ULC 525.

2.2 SYSTEM OPERATION

.1 Retain existing sequence of operations for all device types.

.2 Existing audible signalling pattern to remain.

2.3 CONTROL PANEL

.1 Control panel is existing Mircom FX-2000. Provide modifications required to support system changes indicated or required to provide a complete system.

.2 System Capacity:

.1 Confirm loading of existing input and output circuits prior to modifying system.

.2 Where existing loading is more than 90% of system capacity, make such extensions or additions of existing equipment as indicated or required to provide a complete system.

.3 New circuits shall be designed to be loaded not more than 80% of its capacity.

.3 New signalling circuits:

.1 Class to match existing.

.2 All signal outputs to be synchronized.

2.4 POWER SUPPLY

.1 Power supply is existing. Provide modifications required to support system changes indicated or required to provide a complete system.

.2 System Capacity:

.1 Confirm loading of existing power supply capacity prior to modifying system.

.2 Where existing loading is more than 90% of system capacity, make such extensions or additions of existing equipment as indicated or required to provide a complete system.

.3 New circuits and batteries shall be designed to be loaded not more than 80% of its capacity.

2.5 CONDUIT

.1 Electrical Metallic Tubing (EMT) with red couplings and connectors.

.2 Surface Metal Raceway and Fittings:

.1 Two-piece painted steel.

.2 Totally enclosed snap-cover type.

.3 Neatly mark each coupling, box cover and conduit at each side of walls with red paint stripe or tape.

2.6 WIRING

.1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.

.2 Twisted copper conductors: FAS rated.

.3 To signal circuits: minimum 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 Insulation 90 degrees C minimum with nylon jacket.

.5 Colour code wiring.

2.7 INTELLIGENT NAC EXPANDER/POWER SUPPLY

.1 10 Amp output

.2 120 / 240V operation

.3 Configured using DIP switches

.4 Isolated input from the host panel

.5 Five Class B (Style Y) or Class A (Style Z) synchronized output circuits

.6 DC regulated outputs

.7 Configurable AC Power fail delay

.8 Ground fault enable or disable

.9 Option available on configuration to enable or disable the battery charger on activation

.10 Minimum 7 to 15 Address functions (Combination of inputs and outputs)

.11 Outputs individually controllable

.12 Separate Relay for Ground Fault and Common

.13 Trouble available on terminals

.14 Horn/Strobe synchronization protocols include Amseco, Gentex, System Sensor and Wheelock

.15 Two-wire horn/strobe Sync Mode allows audible notification appliances (horns) to be silenced while visual notification appliances (strobes) continue to operate

.16 Audible signals may be configured for steady, temporal Code, and march time

.17 Output circuits four and five can be configured to provide auxiliary power for four-wire detectors or door holders.

.18 Two stage operation

.19 Output fault notification to fire alarm control panel

.20 Ability to sync outputs for multiple units

.21 2.5 Amp max. current per output

.22 1.7 Amp auxiliary power output

.23 Built-in charger for sealed lead acid or gel type batteries

.24 Unit includes power supply, charger, red door, black backbox, transformer and battery leads

.25 Compatible with any UL/ULC listed 24VDC conventional fire alarm control panel to provide Notification Appliance Circuit expansion.

2.8 AS-BUILT RISER DIAGRAM

.1 Modify fire alarm system riser diagram where circuits are added.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install systems in accordance with ULC 524.

.2 Modify central control unit and power supply. Provide programming, additional circuits, lamps, labels etc. Provide additional circuit control equipment where required.

.3 Extend circuits from existing field devices. Do not extend circuits from an existing junction box. If wiring extended from an existing junction box, a verification of all the devices on the entire existing circuit will be required.

.4 Locate and install field devices and connect to appropriate circuit following ULC 524 and specified placement rules.

.5 Connect new circuits where required to main control panel.

.6 Splices are not permitted.

.7 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.

.8 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.9 Identify circuit and other related wiring at central control unit, annunciators, and terminal boxes.

.10 Install intelligent NAC expander c/w all necessary accessories and power supplies for a complete installation.

.11 Horn/strobes to be connected to new intelligent NAC expander.

.12 Horn/strobes to be sync’d where more than one is visible at any point.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - for Electrical and ULC 537.

.2 Fire alarm system:

.1 Test all affected fire alarm devices.

.2 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.3 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.3 Provide testing documentation with the ULC 537 verification report for each isolator sequence tested: documentation to include list of all isolators and devices failed (include device address) during each sequence.

.4 Provide final PROM program re-burn for Departmental Representative incorporating program changes made during construction.

.5 Provide a software compare in compliance with ULC 537.

3.4 REMOVAL OF OLD EQUIPMENT

.1 Decommission, disconnect and remove redundant/un-used fire alarm equipment following acceptance of the new fire alarm system.

3.5 CLEANING

.1 Upon completion, verification of performance of installation, and old equipment removal, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 00 – Cleaning.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit 2 samples.

.2 Allow continual sampling by Departmental Representative during production.

.3 Provide Departmental Representative with access to source and processed material for sampling.

.4 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.

.5 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as approved by Departmental Representative.

.6 Supply new or clean sample bags or containers according appropriate to aggregate materials.

.7 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

.8 Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

.3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

Part 2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Flat and elongated particles of coarse aggregate: to OPSS.MUNI 1010

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

- .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .2 Reclaimed asphalt pavement.
- .3 Reclaimed concrete material.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

- .1 Crushed rock.
- .2 Gravel composed of naturally formed particles of stone.
- .3 Light weight aggregate, including slag and expanded shale.
- .4 Reclaimed asphalt pavement.
- .5 Reclaimed concrete material.

2.2 SOURCE QUALITY CONTROL

.1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.

.2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.

.3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for topsoil stripping.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with topsoil stripping. Only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Topsoil stripping:

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Begin topsoil stripping of areas after area has been cleared of brush, grasses, weeds and removed from site.

.3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.

.2 Aggregate source preparation:

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.

.2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.

.3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.5 Trim off and dress slopes of waste material piles and leave site in neat condition.

.6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.

.3 Processing:

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.

.1 Use methods and equipment approved in writing by Departmental Representative.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.

.5 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

.1 Use only equipment approved in writing by Departmental Representative.

.6 Stockpiling:

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet work schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as approved by Departmental Representative within 48 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Maximum 1.5 m for coarse aggregate and base course materials.

.2 Maximum 1.5 m for fine aggregate and sub-base materials.

.3 Maximum 1.5]m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.3 CLEANING

.1 Progress 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 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.4 Leave any unused aggregates in neat compact stockpiles as approved by Departmental Representative.

.5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

.6 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Section 01 74 00 – Cleaning.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

.2 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 EXISTING CONDITIONS

.1 Known underground and surface utility lines and buried objects are as indicated on site plan.

Part 2 Products

2.1 MATERIALS

.1 Fill material: Type 1 granular B in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of existing substrate are acceptable for rough grading installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.

.2 Commence topsoil stripping of areas as indicated after area has been cleared of grasses and removed from site.

.3 Strip topsoil to depths as indicated. Rototill grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as approved by Departmental Representative. Stockpile height not to exceed 2 m.

.5 Dispose of unused topsoil off site.

3.3 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

.1 100 mm for grassed areas.

.3 Slope rough grade away from building 2% min.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 Compact filled and disturbed areas to ASTM D698, as follows:

.1 90 % under landscaped areas.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.4 TESTING

.1 N/A

3.5 CLEANING

.1 Progress 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.

3.6 PROTECTION

.1 Protect landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 32 01 90.33 - Tree and Shrub Preservation.

.4 Section 31 05 16 - Aggregates For Earthwork.

.5 Section 01 35 29.06 - Health and Safety Requirements.

1.2 MEASUREMENT PROCEDURES

.1 Excavated materials will be measured in cubic metres in their original location.

.1 Common excavation quantities measured will be actual volume removed within following limits:

.1 Width for trench excavation should be minimum and limited to trench shoring width.

.2 Depth from ground elevation immediately prior to excavation, to sanitary lateral bedding elevation.

.2 Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment.

.3 Backfilling to authorized excavation limits will be measured in cubic metres compacted in place for each type of material specified.

.4 Placing and spreading of topsoil will be measured for payment in cubic metres calculated from cross sections taken in area of excavation from original location.

.1 If double handling of topsoil is directed by Departmental Representative (stockpiling and later placing), then quantities will be measured twice; on excavation from original location and on excavation from stockpile.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-[05], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

.6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CSA Group (CSA)

.1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.4 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: solid material in excess of 1.00 m^{3}and which cannot be removed by means of heavy duty mechanical excavating equipment. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.7 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422, ASTM C136: Sieve sizes to CAN/CGSB-8.2 CAN/CGSB-8.1.

.2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Quality Control: in accordance with Section 01 45 00 - Quality Control :

.1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.

.2 Submit to Departmental Representative written notice at least 7 days prior to excavation work.

.3 Submit to Departmental Representative written notice when bottom of excavation is reached.

.4 Submit to Departmental Representative as described in PART 3 of this Section.

.3 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

.2 Submit records of underground utility locates, indicating: clearance record from utility authority, location plan of relocated and abandoned services, as required, location plan of existing utilities as found in field.

.4 Samples:

.1 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

1.6 QUALITY ASSURANCE

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Not Used.

1.8 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work establish and verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, establish location and state of use of buried utilities and structures.

.6 Confirm locations of buried utilities by careful test excavations.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Departmental Representative.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

.3 Where required for excavation, cut roots or branches in accordance with Section 32 01 90.33 - Tree and Shrub Preservation.

Part 2 Products

2.1 MATERIALS

.1 Properties to Section 31 05 16 - Aggregates For Earthwork.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.3 PREPARATION/PROTECTION

.1 Protect existing features (using temporary barriers and enclosures for example) in accordance with applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas after area has been cleared of grasses and removed from site.

.2 Strip topsoil to depths as indicated in drawings.

.1 Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed Departmental Representative.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.4 Dispose of unused topsoil off site.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.1 Where conditions are unstable, Departmental Representative to verify and advice methods.

.2 Construct temporary Works to depths, heights and locations as approved by Departmental Representative.

.3 During backfill operation:

.1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.5 Upon completion of substructure construction:

.1 Remove shoring and bracing.

.2 Remove excess materials from site as directed.

3.7 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Departmental Representative review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.8 EXCAVATION

.1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions as indicated.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of surplus and unsuitable excavated material in approved off site location.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.11 Notify Departmental Representative when bottom of excavation is reached.

.12 Obtain Departmental Representative approval of completed excavation.

.13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.14 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

.15 Install geotextiles.

3.9 FILL TYPES AND COMPACTION

.1 Use types of fill as indicated on drawings. Compaction densities are percentages of maximum densities obtained from ASTM D1557.

.1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95 % of corrected maximum dry density.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated and drawing and as specified in Section 33 31 11 - Public Sanitary Sewerage Gravity Piping.

.2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

.1 Adequate vibratory compaction equipment should be used.

.2 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.

.2 Departmental Representative has inspected and approved of construction below finish grade.

.3 Inspection, testing, approval, and recording location of underground utilities.

.4 Removal of concrete formwork.

.5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.6 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.6 m.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 7 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative:

.2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.

3.12 RESTORATION

.1 Upon completion of Work, remove waste materials and correct defects as directed by Departmental Representative.

.2 Replace topsoil as indicated.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 74 00 - Cleaning.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A1064/A1064M-13, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.2 CSA Group

.1 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.3 Health Canada - Pest Management Regulatory Agency (PMRA)

.1 National Standard for Pesticide Education, Training and Certification in Canada (1995).

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Fertilizers Act (R.S. 1985, c. F-10).

.3 Fertilizers Regulations (C.R.C., c. 666).

.4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 DEFINITIONS

.1 Not Used.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Obtain approval from Departmental Representative of schedule indicating beginning of Work.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Not Used

1.6 DELIVERY, STORAGE AND HANDLING

.1 Not Used.

1.7 MAINTENANCE DURING WARRANTY PERIOD

.1 Not Used.

Part 2 Products

2.1 MATERIALS

.1 Not Used.

Part 3 Execution

3.1 EXAMINATION

.1 Not Used.

3.2 IDENTIFICATION AND PROTECTION

.1 Tree protection to be installed prior to the start of any on site work.

.2 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.

.3 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.

.4 Ensure no root pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

3.3 TRUNK PROTECTION

.1 Install board cladding vertically around the perimeter of designated deciduous trees within the active work zone.

3.4 ROOT CURTAIN SYSTEM

.1 Identify limits for required construction excavation as approved by Departmental Representative.

.2 Prior to construction excavation, hand dig trench minimum 500 mm wide x 1500 mm deep, along perimeter of excavation limits.

.3 Prune exposed roots cleanly at side of trench nearest plants to be preserved. Pruned ends to point obliquely downwards.

3.5 AIR LAYERING SYSTEM

.1 Not Used.

3.6 TRENCHING AND TUNNELING FOR UNDERGROUND SERVICES

.1 Centre line location and limits of trench/tunnel excavation to be approved by Departmental Representative prior to excavation.

.2 Excavate manually within zone of root system. Do not sever roots greater than 40 mm diameter except at greater than 500 mm below existing grade. Protect roots, and cut roots cleanly with sharp disinfected tools.

.3 Backfill for trench to 90 % Modified Proctor Density. Avoid damage to trunk and roots of tree.

.4 Complete tunnelling and backfilling at tree within 2 weeks of beginning Work.

3.7 LOWERING GRADE AROUND EXISTING TREE

.1 Not Used.

3.8 PRUNING

.1 Not Used.

3.9 ANTI-DESICCANT

.1 Not Used.

3.10 VERIFICATION

.1 Not Used.

3.11 CLEANING

.1 Progress 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.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 00 - Cleaning.

1.2 MEASUREMENT PROCEDURES

.1 Preparation of sub-grade for placing of topsoil will be measured in square metres of area prepared.

.2 Topsoil stripping will not be measured by Departmental Representative.

.3 Measure placing of topsoil in square metres..

.4 Measure finish grading in square metres from actual surface measurements as determined by Departmental Representative.

1.3 PAYMENT

.1 Testing of topsoil: Departmental Representative will pay for cost of tests.

1.4 REFERENCE STANDARDS

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment

.1 PN1340-2005, Guidelines for Compost Quality.

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.5 DEFINITIONS

.1 Not Used.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Quality control submittals:

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 QUALITY ASSURANCE

.1 Pre-installation meetings: conduct pre-installation meeting to verify applicable requirements, installation instructions and warranty requirements.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Not Used.

Part 2 Products

2.1 TOPSOIL

.1 Topsoil for seeded areas: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

- .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
- .2 Contain no toxic elements or growth inhibiting materials.
- .3 Finished surface free from:
  - .1 Debris and stones over 50 mm diameter.
  - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

.1 Not Used.

2.3 SOURCE QUALITY CONTROL

.1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.3 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.

- .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as indicated after area has been cleared of weeds, brush, grasses and removed from site.

.2 Strip topsoil to depths 150mm below grade.

.1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Stockpile in locations as directed by Departmental Representative.

.1 Stockpile height not to exceed 2 m.

.4 Disposal of unused topsoil is to be in an environmentally responsible manner.

.5 Protect stockpiles from contamination and compaction.

3.3 PREPARATION OF EXISTING GRADE

.1 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.2 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75 mm above surface.

.3 Dispose of removed material off site.

3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Departmental Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Spread topsoil to following minimum depths after settlement.

.1 135 mm for sodded areas.

.5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.5 SOIL AMENDMENTS

.1 Not Used.

3.6 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.

.1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.7 ACCEPTANCE

.1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.8 SURPLUS MATERIAL

.1 Dispose of materials except topsoil not required [off site] [where directed by Departmental Representative.

3.9 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 32 91 19.13 - Topsoil Placement and Grading.

.3 Section 01 74 00 – Cleaning.

1.2 MEASUREMENT AND PAYMENT

.1 Payment for sodding will be made at unit price bid of actual area surface measurements taken and computed by Departmental Representative for:

.1 Commercial Grade Turf Grass Nursery Sod per square metre.

1.3 REFERENCE STANDARDS

.1 Not Used.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Schedule sod laying to coincide with preparation of soil surface.

.2 Schedule sod installation when frost is not present in ground.

1.5 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 sod..

.3 Samples.

.1 Not Used.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.

1.7 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 in accordance with supplier's recommendations.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Commercial Grade Turf Grass Nursery:

.1 Mow sod at height directed by Departmental Representative within 36 hours prior to lifting, and remove clippings.

.2 Not more than 5 broadleaf weeds and up to 20% native grasses per 40 square metres.

.2 Water:

.1 Supplied by Departmental Representative at designated source.

2.2 SOURCE QUALITY CONTROL

.1 Obtain written approval from Departmental Representative of sod at source.

.2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 Execution

3.1 INSTALLERS

.1 Not Used.

3.2 EXAMINATION

.1 Verification of Conditions: verify that conditions of existing substrate are acceptable for sod 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.

3.3 PREPARATION

.1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.

.2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

.3 Fine grade surface free of humps and hollows to smooth, even grade,], to tolerance of plus or minus 15 mm for Commercial Grade Turf Grass Nursery, surface to drain naturally.

3.4 SOD PLACEMENT

.1 Ensure sod placement is done under supervision of certified Landscape Planting Supervisor.

.2 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.

.3 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.4 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.5 SOD PLACEMENT ON SLOPES AND PEGGING

.1 Not Used.

3.6 FERTILIZING PROGRAM

.1 Not Used.

3.7 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Clean and reinstate areas affected by Work.

3.8 PROTECTION BARRIERS

.1 Not Used.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of installation until acceptance.

- .1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .2
- .3 Maintain sodded areas weed free 95%.
- .4 Temporary barriers or signage to be maintained where required to protect newly established sod.

3.10 ACCEPTANCE

.1 Sodded Commercial Grade Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:

- .1 Sodded areas are properly established.
- .2 Sod is free of bare or dead spots and extent of weeds apparent in grass is acceptable.

.2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

.3 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

.4 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.11 MAINTENANCE DURING WARRANTY PERIOD

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Section 01 74 00 – Cleaning.

1.2 MEASUREMENT AND PAYMENT

.1 Measure excavation and backfill under Section 31 23 33.01 - Excavating Trenching and Backfilling.

.2 Measure supply and installation of sanitary sewer including testing and granular bedding and surround and including excavation and backfilling horizontally from connection point at building to lot limits in metres.

.3 Measure granular bedding and surround in cubic metres compacted in place.

.4 Provide video and photographic pipe inspections including inspectors, trained operators, equipment and materials.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbf/ft^3(600 kN-m/m^3)).

.4 ASTM D3034-[08], Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.2 CSA Group (CSA)

.1 CSA B1800-11, Thermoplastic Non-pressure Pipe Compendium.

.1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.

.2 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Departmental Representative 24 hours minimum in advance of any interruption in service.

1.5 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 pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.4 Certificates:

.1 Certification to be marked on pipe.

.5 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.

1.6 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 in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 VITRIFIED CLAY PIPE

.1 Not Used.

2.2 ASBESTOS- CEMENT PIPE

.1 Not Used.

2.3 CONCRETE PIPE

.1 Not Used.

2.4 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 or CSA B182.2.

.1 Standard Dimensional Ratio (SDR): 28.

.2 Locked-in gasket and integral bell system.

.3 Nominal lengths: 4 m.

2.5 SERVICE CONNECTIONS

.1 Type PSM Poly (Vinyl) Chloride: to CSA B182.2.

.2 Plastic pipe: to CSA B182.1, with push-on joints.

2.6 CEMENT MORTAR

.1 Not Used.

2.7 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed or screened stone, gravel or sand.

2.8 BACKFILL MATERIAL

.1 As indicated.

.2 Type in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Unshrinkable fill: to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for sewer pipe installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

.2 Clean and dry pipes and fittings before installation.

.3 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

3.3 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

3.4 CONCRETE BEDDING AND ENCASEMENT

.1 Do not backfill over concrete within 24 hours after placing.

3.5 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 90 % maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.6 INSTALLATION

.1 Lay and join pipes to: ASTM C12.

.2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.3 Handle pipe using methods approved by manufactures.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Joint deflection permitted within limits recommended by pipe manufacturer.

.7 Water to flow through pipe during construction, only as permitted by Departmental Representative.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Install plastic pipe and fittings in accordance with CSA B182.11.

.10 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's written recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and foreign material.

.5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

.12 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.

.13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.14 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

3.7 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 90 % corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % corrected maximum dry density.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.8 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150mm compacted thickness up to grades as indicated.

.3 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.9 UNDERCROSSING

.1 Not Used.

3.10 SERVICE CONNECTIONS

.1 Install pipe to manufacturer's instructions and specifications.

.2 Maintain grade for 125 mm diameter sewers at 2% unless directed otherwise by Departmental Representative.

.3 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.

.1 Use long sweep bends where applicable.

3.11 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Remove foreign material from sewers and related appurtenances by flushing with water.

.3 Repair visible leaks.

.4 Television and photographic inspections:

.1 Carry out inspection of installed sewers by video camera, digital camera or by other related means.

.2 Provide means of access to permit Departmental Representative to do inspections.

.3 Payment for inspection services in accordance with Measurement and Payment in PART 1.

3.12 CLEANING

.1 Progress 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 Waste Management: separate waste materials for recycling or for reuse.

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

END OF SECTION

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Fort Wellington – Visitor Reception Centre
Prescott, Ontario

LIMITED DESIGNATED SUBSTANCES REVIEW

Prepared for:
Parks Canada

Prepared by:
The Thompson Rosemount Group Inc.
Consulting Engineers

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ENV 1.1 SAMPLE LOCATION PLAN

1. Introduction & Scope of Work

The Thompson Rosemount Group Inc. (TRG) was retained by Parks Canada to perform a limited designated substances survey of the Fort Wellington Visitor Reception Centre in Prescott, Ontario. The project was initiated as a condition of Ontario Regulation. 278/08 prior to the interior renovations proposed for the building. As requested, the sampling program was limited to accessible materials that potentially contained asbestos.

The visitor reception centre is a single storey structure with a floor space of approximately 225 m^2, which has been modified several times over its history. The structure was originally two separate buildings constructed in the late 1960s. At some point, the two buildings were joined allowing useable interior space between the two buildings. The current occupancy of the buildings consists of seasonal offices, a gift shop, interpretative display for visitors and a theatre/meeting room.

1.1 Regulatory Requirements

Designated substances are substances and chemicals that the Ministry of Labour (MOL) regulates in the workplace. The following is a current list of designated substances: asbestos, lead, mercury, silica, isocyanates, vinyl chloride monomer, benzene, acrylonitrile, coke oven emissions, arsenic, and ethylene oxide.

These substances are regulated under the Occupational Health and Safety Act (OSHA) and the designated substances regulations specific to each substance identified as Ontario Regulation 835 through 846 respectively. The designated substances regulations specify the occupational exposure limits - time weighted average exposure limit (OEL-TWAEL) for each substance and prescribe control programs. However, under Section 3(3) of the Regulation, construction projects are excluded from OELs and most other requirements of the Regulation. This exclusion should not be interpreted, however, as meaning that preventative measures to control exposure to designated substances are not required, and the OELs establish Ontario standards for worker protection. Procedures that provide the equivalent level of protection should therefore be implemented on construction projects where exposure to designated substances is a hazard. Ensuring that such procedures are in place, would in the words of 25(2)(h) of OHSA be "taking reasonable precautions to protect the health and safety of workers". For this reason the MOL has prepared two Guidelines, to assist owners in meeting this standard.

- Guideline- Lead on Construction Projects, September 2004
- Guideline- Silica on Construction Projects, September 2004

Copies of these Guidelines are available at the following web links:

Lead – http://www.labour.gov.on.ca/english/hs/guidelines/lead/index.html, and
Silica - http://www.labour.gov.on.ca/english/hs/guidelines/silica/index.html.

The owner must provide this report to any Parks Canada staff and/or contractors prior to tendering work in the building. These contractors must in turn also provide this report to their sub-contractors.

1.2 Background Information

This section describes the designated substances, routes of exposure, associated diseases, and the time weighted average exposure values.

1.2.1 Asbestos

Asbestos is a component of a variety of building materials manufactured before 1980 including mechanical insulation, floor tiles, ceiling tiles, caulking, plaster, wiring etc. Workers and building occupants may be exposed during demolition/renovation activities. Exposure to asbestos can cause cancer and lung disease. The route of exposure is primarily by inhalation.

Section 18 of Ontario Regulation 278/05, a Regulation respecting Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, made under the Occupational Health and Safety Act, specifies a maximum airborne concentration of 0.01 fibres per cubic centimetre of air.

1.2.2 Lead

Lead may be present in paint, solder used on copper pipes, caulking on cast iron water pipes, glazing on ceramic tiles, and electrical wires and fixtures. Workers and building occupants may be exposed during demolition/renovation activities. Primary routes of exposure include inhalation, absorption through the skin and ingestion. Over exposure can affect the blood, kidneys, gastro-intestinal system, nervous system and reproductive system. The Hazardous Products Act designates paint with a lead concentration in excess of 0.5% as "lead paint". The Regulation 843 TWAEV for lead is 0.05 mg/m^3.

1.2.3 Mercury

Mercury may be present in thermostats, batteries, level gauges, recording devices, thermometers fluorescent light tubes and some paints. Workers and building occupants may be exposed during demolition/renovation activities. Over exposure can affect the nervous system, organs, skin, eyes, respiratory system, gastro-intestinal system and reproductive system. Regulation 843 specifies a TWAEV for lead of 0.03 mg/m^3.

1.2.4 Silica

Silica is present in the cement, masonry, drywall and sand. Workers and building occupants may be exposed during demolition/renovation activities. Primary routes of exposure include inhalation, skin absorption and ingestion. Over exposure can affect the blood, organs and reproductive system. Regulation 845 specifies a TWAEV of 0.05 mg/m^3 for cristobalite and 0.1 mg/m^3 for tripoli.

1.2.5 Isocyanates

Isocyanate compounds are commonly used in the production of certain types of plastics, foams, coatings, drugs, pesticides, polyurethane, polyisocyanurates, diisocyanates and other products. Primary routes of exposure include the eyes, skin and respiratory system. Over exposure can affect the respiratory system, the skin and eyes. Regulation 842 specifies a TWAEV of 0.005 ppm.

1.2.6 Vinyl Chloride Monomer

Vinyl chloride monomers are generally present in industries producing resins. Primary routes of exposure are inhalation, ingestion and absorption. Regulation 846 specifies a TWAEV of 1 ppm.

1.2.7 Benzene

Benzene, an aromatic hydrocarbon, is produced as a by-product of coal gasification, coke production and from refining petroleum. Primary routes of exposure are inhalation, ingestion and absorption. Regulation 839 specifies a TWAEV of 1 ppm.

1.2.8 Acrylonitrile

Acrylonitrile is a clear colourless, toxic liquid. It is used to manufacture ABS and SAN resins, nitrile rubber, plastics, coatings and adhesives. Primary routes of exposure include inhalation of vapours, direct contact and ingestion. Regulation 835 specifies a TWAEV of 4.3 mg/m^3.

1.2.9 Coke Oven Emissions

Coke oven emissions are generally present in the steel-related industry. Primary routes of exposure include inhalation of vapours, direct contact and ingestion. Regulation 840 specifies a TWAEV of 0.15 mg/m^3.

1.2.10 Arsenic

Arsenic is a heavy metal generally found in coal cinders and in the mining industry. Overexposure to arsenic can impair many human systems. Primary routes of exposure include inhalation and ingestion. Regulation 836 specifies a TWAEV of 10 mg/m^3.

1.2.11 Ethylene Oxide

Ethylene oxide is generally present in organic chemical laboratories and in the petroleum industry. Primary routes of exposure include inhalation and ingestion. Regulation 841 specifies a TWAEV of 1.8 mg/m^3.

1.3 Limitations

This report describes the designated substances observed within the building envelope where access was provided to TRG. The survey assessed the structure, finishes and permanent mechanical equipment. There is a possibility that designated substances may exist which could not be reasonably identified within the scope of the assessment or which were not apparent during the site visit. TRG cannot warrant or guarantee that the information provided herein is absolutely complete or accurate beyond current environmental consulting standards.

TRG did not attempt to identify locations of deposition of mould spores or particles, or minor mould growth that would not exhibit any signs of spotting/staining on building materials. TRG would not be able to identify locations of concealed mould growth within wall cavities and other hidden locations without performing intrusive inspections. The degree of mould growth noted in the report may change with time if water or humidity issues continue or develop after the assessment date(s). Any sources of water infiltration or high humidity must be corrected to prevent the continuation or occurrence of mould growth. Air sampling results (if any) will apply only to the time and conditions of the testing and may not be used to reliably predict conditions on other days.

Work performed by TRG was conducted in accordance with generally accepted engineering or scientific practices current in the geographical area at the time the work was performed. No warranty is either expressed or implied, or intended by the agreement executed with the Client, or by furnishing oral or written reports or findings. The Client acknowledges that subsurface and concealed conditions may vary from those encountered or inspected. TRG could only comment on the conditions observed on the date(s) the assessment was performed. Any budget estimates provided are Class D (Order of Magnitude) only and subject to verification unless otherwise agreed.

TRG makes no other representations whatsoever, including those concerning the legal insignificance of its findings or as to other legal matters mentioned in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set for the herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. TRG accepts no responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

Information provided by TRG is intended for Client use only. TRG will not provide results or information to any party other than the Client, unless the Client, in writing, requests information to be provided to a third party or unless disclosure by TRG is required by law. Any use by a third party, of reports or documents authored by TRG, or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. TRG accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted.

Contractors bidding on renovations or demolition of this building must verify dimensions and unforeseen conditions. The data presented herein is for general purposes only. No other warranties are implied or expressed. A copy of our Standard Terms and Conditions of Retainer are enclosed within ***Appendix A.***

2. Survey and Analytical Methodology

2.1 Survey Methodology

The field work was completed on March 1st, 2007, by Mr. Lyle Casselman of TRG's Cornwall office. The common applications of building materials made from designated substances were surveyed. TRG staff entered each accessible room of the building to conduct a visual assessment. The designated substances were assessed as follows:

- The presence of asbestos containing materials such as pipe and fitting insulation, gaskets, spray-on insulation, floor tiles, ceiling tiles, wall/ceiling boards and plasters were assessed by collecting and analyzing representative bulk samples;
- The presence of lead in paint and ceramic tile was assessed by visually surveying the building. No samples were collected or analyzed;
- The presence of mould was assessed by visibly surveying the building. No samples were collected or analyzed;
- The presence of polychlorinated biphenyls (PCBs) light fixtures were not assessed;

- The presence of mercury was assessed by visually surveying the building for thermostats and fluorescent light tubes. No samples were collected or analysed; and
- The presence of silica was assessed by visually surveying the building for common materials including concrete and masonry products. No samples were collected or analysed.

2.2 Analytical Methodology

In total, 24 bulk samples of materials suspected of containing asbestos were submitted to and analysed by MACCK Industrial Hygiene Inc., utilizing polarized light microscopy and dispersion staining. This analytical method followed the Ministry of Labour code for the Determination of Asbestos from Bulk Samples. The MOL considers materials containing greater than 0.5 % asbestos are classified as asbestos containing materials (ACM). The analytical results for the bulk samples collected during this assignment are discussed herein and presented in ***Appendix B.***

3. Observations & Sample Results

No damaged friable asbestos containing materials were observed in the building. Parks Canada Staff have stated that all accessible asbestos containing pipe insulation has been abated from the building, and that some fittings remain concealed within the walls.

3.1 Asbestos Findings

The asbestos sample results are presented in **Table 3.1**. and **Figure ENV1.1**.

TABLE 3.1
ASBESTOS SAMPLE RESULTS

SAMPLE #	MATERIAL	FLOOR & LOCATION	ASBESTOS CONTENT AND TYPE	FRIABLE
A1-A	12" white ceiling tile	Above the suspended ceiling tile in the south building.	Asbestos Not Detected (AND)	Yes
A1-B	12" white ceiling tile	Above the suspended ceiling tile in the south building.	AND	Yes
A1-C	12" white ceiling tile	Above the suspended ceiling tile in the south building.	AND	Yes
A2-A	Mastic glue	Above the 12" ceiling tiles characterized by Sample A1.	AND	No
A2-B	Mastic glue	Above the 12" ceiling tiles characterized by Sample A1.	AND	No
A2-C	Mastic glue	Above the 12" ceiling tiles characterized by Sample A1.	AND	No
A3-A	Original drywall	Above the 12" ceiling tiles characterized by Sample A1.	AND	Yes
A3-B	Original drywall	Above the 12" ceiling tiles characterized by Sample A1.	AND	Yes
A3-C	Original drywall	Above the 12" ceiling tiles characterized by Sample A1.	AND	Yes
A4-A	New 2' X 4' suspended ceiling tile	Located in the centre and south buildings	AND	Yes
A4-B	New 2' X 4' suspended ceiling tile	Located in the centre and south buildings	AND	Yes

TABLE 3.1
ASBESTOS SAMPLE RESULTS

SAMPLE #	MATERIAL	FLOOR & LOCATION	ASBESTOS CONTENT AND TYPE	FRIABLE
A4-C	New 2' X 4' suspended ceiling tile	Located in the centre and south buildings	AND	Yes
A5-A	Fibrous acoustic board	Above the suspended ceiling in the centre building	AND	No
A5-B	Fibrous acoustic board	Above the suspended ceiling in the centre building	AND	No
A5-C	Fibrous acoustic board	Above the suspended ceiling in the centre building	AND	No
A6-A	Old 2' X 4' suspended ceiling tile	Located in the north building	AND	Yes
A6-B	Old 2' X 4' suspended ceiling tile	Located in the north building	AND	Yes
A6-C	Old 2' X 4' suspended ceiling tile	Located in the north building	AND	Yes
A7-A	Drywall joint compound	North building bathroom	AND	Yes
A7-B	Drywall joint compound	North building corridor	AND	Yes
A7-C	Drywall joint compound	North building office	AND	Yes
A7-D	Drywall joint compound	Centre building interpretive area	AND	Yes
A7-E	Drywall joint compound	Centre building store	AND	Yes
A7-F	Drywall joint compound	Centre building entrance	AND	Yes

Legend: AND – **A**sbestos **N**ot **D**etected

The following sub-sections describe the types of friable and non-friable asbestos products observed in the building during this survey.

3.1.1 Sprayed-On Insulation

Sprayed-on insulation was not observed in the building.

3.1.2 Mechanical Insulation

Asbestos containing pipe and/or fitting insulation was not observed during this survey. All accessible pipe and/or fitting insulation were observed to be fibreglass.

Parks Canada Staff have reported that asbestos pipe insulation remains concealed within the walls where it could not be removed.

3.1.3 Air Handling Systems

The interior air handling systems and associated ductwork were insulated with fibreglass and aluminium-type foil. No samples of duct insulation were collected.

3.1.4 Acoustic Ceiling Tiles

There are three types of ceiling tiles present in the building as characterized by samples A1, A4 and A6. Analysis of these tiles concludes that they do not contain asbestos.

3.1.5 Drywall and Joint Compound

Most of the drywall in the building has been replaced during previous renovations. The remaining drywall and joint compound was characterized by Samples A3 and A7. The sample analysis concludes that they do not contain asbestos.

3.1.6 Asbestos Cement Sheets

Asbestos-cement sheeting or transite were not observed during this survey.

3.1.7 Vinyl Floor Tiles and Linoleum

The floors in the building were improved with carpet and new vinyl flooring which was installed in the 1990s. Parks Canada staff stated that all of the vinyl floor tiles located beneath the carpet were removed. The new vinyl floor should not contain asbestos; however, at the request of Parks Canada, it was not sampled during this survey.

3.1.8 Attic Insulation

The building does not have an attic. Styrofoam insulation was observed beneath the roof.

3.1.9 Roofing Materials

Analysis of the roofing materials was beyond the scope of this assignment. Roofing materials installed prior to 1980 may contain asbestos.

3.1.10 Hidden Asbestos

Parks Canada staff has reported that all accessible asbestos fitting insulation was previously removed from the building and that some asbestos fittings remain concealed within the walls.

Additional destructive testing must always be completed prior to renovation and demolition events that may disturb concealed asbestos. Contractors should always assume that asbestos pipe insulation may be present within interior and exterior walls.

3.2 Lead

Lead may be present in the paint, pipe solder and ceramic tiles. No samples were collected. All construction activities which may release lead should proceed following the MOL Lead Guideline (see ***web links provided in Section 1.1***).

3.3 Mould

No visible evidence of mould was observed in the building.

3.4 Mercury

Mercury is typically contained in switches found in thermostats, level gauges, recording devices, thermometers and fluorescent light tubes. One mercury thermostat was observed in the building. The fluorescent light tubes are also assumed to contain mercury vapour.

3.5 Silica

Silica is present in the masonry and plaster located throughout the building. Free crystalline silica (common construction sand and gypsum) will be present in concrete products, mortars, plaster etc. present throughout the building. Disturbance of silica-containing products may result in excessive exposure to airborne silica; especially if the work is performed indoors and under dry conditions and as such should follow the MOL Silica Guidelines (**refer to web links provided in Section 1.1**).

3.6 Isocyanates, Vinyl Chloride Monomer, Benzene, Acrylonitrile, Coke Oven Emissions, Arsenic, Ethylene Oxide

No isocyanates, vinyl chloride monomer, benzene, acrylonitrile, coke oven emissions, arsenic, nor ethylene oxide was observed in the building.

3.7 PCBs

Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds that are not classified as designated substances. PCBs are either oily liquids or solids that are colourless to light yellow. PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. Products that may contain PCBs include old fluorescent lighting fixtures, electrical devices containing PCB capacitors, and hydraulic oils.

Parks Canada staff may assume that all fluorescent light ballasts installed before 1980 contain PCBs. Excess PCB ballasts must be disposed of per O. Regulation 347.

4. CONCLUSIONS

- The ceiling tiles, drywall, drywall joint compound, mastic and fibrous acoustic board sampled during this review do not contain asbestos.
- Asbestos insulation remains concealed within the walls.
- Vinyl flooring and roofing materials installed prior to 1980 may contain asbestos.
- Paint, pipe solder and ceramic tiles may contain lead.
- Plaster, concrete, and drywall contain silica.
- Thermostats and fluorescent light tubes contain mercury.
- Fluorescent light ballasts installed prior to 1980 may contain PCBs.

5. RECOMENDATIONS

- Manage all asbestos, lead, silica and PCB disturbed during future renovations following applicable the Ministry of Labour/Environment regulations and procedures.
- Provide a copy of this report to all staff or contractors who may disturb the designated substances present in the building.

6. CLOSING COMMENTS AND SIGNATURE

It has been a pleasure working with the Parks Canada on this project. Should you have any questions or require assistance in managing the designated substances during the proposed renovations please contact the undersigned.

Sincerely,

The Thompson Rosemount Group Inc.

Lyle Casselman, B.Eng., C.E.T. C.Chem, CEAS
Manager, Environmental Site Assessment
Associate Director

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APPENDIX A

STANDARD TERMS AND CONDITIONS OF RETAINER

STANDARD TERMS AND CONDITIONS OF RETAINER

1. **Our Standard of Care**- The Thompson Rosemount Group (TRG) has conducted the work as specified in the engagement letter and scope of work contained in the TRG proposal and performed the environmental investigations requested by the Client according to the standards of a reasonable environmental consultant (our "Retainer"). No other warranty, express or implied is made.

2. **Our Sources of Information** - TRG have sought to obtain relevant information, statements and documents concerning the subject site(s) from our Client, government officials and other persons to the extent authorized by our Retainer. The accuracy of the findings, opinions and conclusions expressed in our report is subject to any errors or omissions in, or refusals to provide that information.

3. **Site Inspections** - TRG has completed the inspection of the site(s) in the manner authorized by our Retainer. The purpose of our inspection was undertaken to identify visible evidence of environmental contamination and patent irregularities in waste management practices on the site(s). Our findings during the site inspection(s) are subject to any restrictions placed upon our free access to all aspects of the site(s). A reasonable site inspection may not identify latent or hidden contamination or irregularities.

4. **Sample and Testing Procedures** - The sample and testing procedures described in the TRG report are performed at specific point locations by experienced personnel using equipment and techniques appropriate for our Retainer. Based upon available data, TRG provides expressed opinion as to the conditions which may exist between the test points investigated. As actual conditions may vary significantly between sample or test points, our Client assumes the inherent risk that some conditions may not be detected.

5. **Legal Issues** - The TRG report is intended to direct our Client's attention to potential sources of environmental contamination and to irregular waste management practices at the site(s). Nothing in the report is intended to express any legal opinion upon environmental liabilities relating to the site(s) or whether site operations legally conform with relevant legislative requirements.

6. **Confidentiality of Client Information** - TRG agrees to hold all information obtained in the course of our Retainer and the contents of our report in strict confidence except where disclosure is directed by our Client's written instructions or by compulsion of law.

7. **Working Papers** - The report shall be the property of TRG'S Client. All other data, sample and test results, working sheets, draft reports or other papers, documents or records prepared or collected by us in the course of our Retainer shall remain the property of TRG. Our Client agrees that we shall be entitled to retain a copy of the TRG report for TRG's own files.

8. **Use of the Report** - The information and opinions expressed in the TRG report are prepared for the sole benefit of our Client. No other party may use or rely upon the TRG report or any portion thereof without the express written consent of TRG. TRG will consent to any reasonable request by our Client to approve the use of the report by other parties as "Approved Users". We accept no responsibility for the accuracy of the report to persons other than to our clients and approved users ("The Other Persons"). We give no warranty, representation, or assurance to other persons that the findings, statements, or opinions or conclusions expressed in the report accurate or valid.

9. **Client's Indemnity** - Environmental audit projects have the potential to, and may, cause an accidental leak, release, emission or discharge of contaminants into the environment (an "Accidental Release"). Unless an Accidental Release has been caused by our negligence, our Client agrees to hold harmless and to indemnify and defend TRG, its directors, officers, servants, agents, employees, workmen, contractors, subcontractors and subconsultants from and against any and all claims, losses, damages, demands, disputes, liability and legal and investigative costs for the defence of any proceedings resulting from all Accidental Releases which may occur in the course of our Retainer. This indemnification shall extend to all claims brought or threatened against us under any federal or provincial statue or municipal by-law. Our Client further agrees that it will assert no claims against us (except for our own negligence) for Accidental Releases which may occur in the course of our retainer.

APPENDIX B
ASBESTOS SAMPLE RESULTS

MACCK

1885 Blue Heron Drive
Units 1 & 2
London, ON N6H 5L9

Phone: (519) 657-1113
Fax: (519) 657-6591
Email: macck@macck.com
Website: http://www.macck.com

MACCK Industrial Hygiene Inc.

March 13, 2007

Project No.:	0607201	**Date Received:**	March 5, 2007
Client:	The Thompson Rosemount Group 1345 Rosemount Avenue Cornwall, ON K6J 3E5	**Analysis Requested:** **Analytical Technique(s):**	Bulk Asbestos Polarized Light Microscopy/ Dispersion Staining NIOSH 9002/EPA 600-R93
Contact:	L. Casselman	**Analyst:**	J. MacKenzie

RE: Fort Wellington Visitor Centre

Sample Description	Asbestos Content
A1-A	asbestos not detected
A1-B	asbestos not detected
A1-C	asbestos not detected
A2-A	asbestos not detected
A2-B	asbestos not detected
A2-C	asbestos not detected
A3-A	asbestos not detected
A3-B	asbestos not detected
A3-C	asbestos not detected
A4-A	asbestos not detected
A4-B	asbestos not detected
A4-C	asbestos not detected
A5-A	asbestos not detected
A5-B	asbestos not detected
A5-C	asbestos not detected

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Sample Description	Asbestos Content
A6-A	asbestos not detected
A6-B	asbestos not detected
A6-C	asbestos not detected
A6-D	asbestos not detected
A7-A	asbestos not detected
A7-B	asbestos not detected
A7-C	asbestos not detected
A7-D	asbestos not detected
A7-E	asbestos not detected
A7-F	asbestos not detected

Detection limit <0.5%

James MacKenzie, M.Sc., C.Chem., CIH
Certified Industrial Hygienist

Patricia Caron, B.Sc.
Laboratory Services