Environment and Climate Change Canada
335 River Road,
Lab 124 Recapitalization

Ottawa, Ontario

Issued for Tender **May 31, 2017**

Project No: RR-222

C i v i t a s A r c h i t e c t u r e I n c .
Design Build Architecture Project Management
14 Chamberlain Ave., Suite 101, Ottawa, Ontario. K1S 1V9

DIVISION SECTION

DRAWING LIST

ARCHITECTURAL DRAWINGS

A200	New Construction Floor and Reflected Ceiling Plan, Interior Elevations and Casework Sections

MECHANICAL DRAWINGS

M-001	Legend and Drawing List
M-100	Fire Protection & Plumbing Ground Floor - Demolition / New Layout
M-400	Ventilation - Ground Floor - Demolition / New Layout
M-401	Ventilation - 2nd, 3rd Floor and Roof Plan Demolition / New Layout
M-500	Controls

ELECTRICAL DRAWINGS

E-001	Legend and Drawing List
E-010	Single Line Diagram
E-011	Services - Ground Floor
ED-100	Multidisciplinary - Ground Floor - Demolition
E-100	Lighting - Ground Floor - New Layout
E-200	Services - Ground & 2nd Floor - New Layout
E-201	Services – Ground Floor

END OF SECTION

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises general construction and renovation of an existing laboratory in a building, located at 335 River Road, Ottawa, Ontario; Work generally includes, but is not limited to the following:

- .1 Shot blast existing floor surface to prepare surface for new flooring material,
- .2 New flooring system,
- .3 New Laboratory casework,
- .4 New Acoustic Ceiling with a suspension system,
- .5 Plumbing to a sink and eye wash,
- .6 New Mechanical system,
- .7 New Lighting and power upgrades,
- .8 Roof penetration, and reroofing,
- .9 Installation of a fumehood.

1.2 CONTRACT METHOD

.1 Construct Work under stipulated price contract, CCDC2-2008 and related Supplementary Conditions.

1.3 WORK SEQUENCE

.1 Co-ordinate Progress Schedule with Owner Occupancy during construction.

1.4 EXISTING SERVICES AND BUILDINGS

.1 Where the Work involves breaking into or connecting to existing services, carry out the work at times directed by governing authorities and acceptable to the Owner. Provide the Owner with a minimum of seventy-two (72) hour notice of pre-scheduled activities affecting utility services or existing buildings.

.2 Where unknown services are encountered, immediately advise the Owner and confirm findings in writing.

.3 Obtain all information required for gas, water, telephone, electrical signal systems, and any other utilities that are both within the building and in adjoining areas.

1.5 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for Work, storage, and for access to allow:

- .1 Owner occupancy.
- .2 Public usage.

.2 Co-ordinate use of premises under direction of the Departmental Representative.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 PARTIAL OWNER OCCUPANCY

.1 Schedule and substantially complete designated portions of Work for Owner's occupancy prior to Substantial Performance of entire Work.

.2 Owner will occupy designated areas as follows:

.1 All areas are fully occupied except for the area for the Laboratory fit-up.

.3 Execute Certificate of Substantial Performance for designated portion of Work prior to Owner occupancy. Contractor shall allow:

.1 Access for Owner personnel.

.2 Operation of HVAC and electrical systems.

.4 On occupancy, Owner will provide for occupied areas:

.1 Operation of HVAC and electrical systems.

1.7 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

1.8 PARKING

.1 Parking is available on the site and will be determined after the Contract is awarded.

1.9 Alterations, Additions or Repairs to Existing Building

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

1.10 EXISTING SERVICES

.1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 72 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic.

.3 Provide alternative routes for personnel, pedestrian and vehicular traffic.

.4 Establish location and extent of service lines in area of work before starting Work. Notify Consultant of findings.

.5 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.7 Record locations of maintained, re-routed and abandoned service lines.

.8 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.11 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

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Part 1 Summary of Work

1.1 TIME OF COMPLETION

.1 Commence work in accordance with notification of acceptance of your tender submission and complete the work including rectification of deficiencies within 10 weeks.

1.2 HOURS OF WORK

.1 Hours of operation

.1 Regular hours - Monday to Friday – 07:00 to 16:00 hours

.1 Unescorted access to individuals with security clearance, who have taken the required on-site training as required for work within specified work areas.

.2 Evening work - Monday to Friday – 16:00 to 07:00 hours

.1 All individuals must be escorted during these timelines. This work must be co-ordinated with the site contact and your request will be granted depending on the escort availabilities.

.2 Commissionaires can be scheduled in advance however it requires a minimum 2-3 weeks' notice to set up a commissionaire contract.

.3 On short notice there is no guarantee we can accommodate your request, it depends on the availability of our on-site staff.

.4 Emergency work will require the site security officer acceptance.

.3 Weekend work - Friday night from 16:00 to Monday morning 07:00

.1 Same requirements as for Evening work.

.4 Holiday work

.1 Please avoid booking work on these dates, however if it must be, it will be dependent on the availability of an escort.

.2 Work requiring power shutdown and/or Lock-Out (LOTO) work shall be completed off-hours Monday through Friday from 18:00hrs to 06:00hrs and/or on weekends from 07:00hrs to 18:00hrs.

.3 Shutdown, bypassing or isolating any initiating device or zone on the fire alarm system or the fire sprinkler system shall be undertaken after hours Monday through Friday from 18:00hrs to 06:00hrs or on weekends from 07:00hrs to 18:00hrs.

.4 Provide an implementation strategy in writing three (3) weeks prior to the first shutdown which clearly lists which activities require after hours work, the sequence of shutdowns, and the maximum length of each shutdown, to insure the owner can organize the shutdown of lab equipment.

.5 The Contractor shall not permit his personnel to work alone on this project when the following activities are undertaken;

.1 Work assessment determines that the potential health & safety risk is high;

.2 Work requiring entry into or work within a Confined Space;

.3 Work requiring Lock-Out and Tag-Out;

.4 Work requiring use of fall arrest equipment;

.5 Work on scaffolding;

.6 Work requiring supplied air respirators or similar equipment;

.7 Hot Work and/or Hot Tap activities;

.8 Work involving cranes or hoisting;

.9 Work or work situations identified by the Engineer.

.6 Staff training and demonstrations shall be scheduled during regular business hours Monday to Friday. The Contractor shall obtain approvals from the Engineer on the training schedule prior to the scheduled training date and time.

1.3 SCHEDULING

.1 Within one week of contract award, submit a bar chart construction schedule for the work, indicating anticipated progress stages within time of completion. Minimum stages include mobilization, shop drawing submittal, order and delivery of major components and equipment, major approvals stages, interim and final inspection times, commissioning timeframes, final deficiency corrections and demobilization. When schedule has been reviewed and approved by the Departmental Representative take necessary measures to complete work within scheduled times. Do not change schedule without written approvals from the Departmental Representative. Contractor must confirm the required power shutdowns required and the activities for each shutdown and have these in his schedule

1.4 CONTRACT DOCUMENTS

.1 Drawings and specifications are complementary, items shown or mentioned in one and not in the other are deemed to be included in the contract work.

.2 Any questions that arise in relation to the design shall be brought to the attention of the Engineer. Failure to comply with this procedure may necessitate amendments and other layout modifications as required to complete the Work, costs of which shall be solely the responsibility of the Contractor.

.3 Study all documents, which describe, or are related to any operation before commencement of that operation. Report discrepancies discovered between existing conditions and documentation. Obtain ruling on required interpretation before commencing work

.4 Any changes to the scope of work are to be confirmed in writing by the Engineer and Contract value changes approved, prior to start of said work.

.5 The cost of any additional work to the Owner shall be the actual cost of the work plus ten percent (10%) overhead and ten percent (10%) profit on the actual cost of the work.

1.5 CONTRACTOR'S USE OF SITE

.1 Do not unreasonably encumber site, with material or equipment.

.2 Execute the work with the least possible interference or disturbance to the normal use of the exiting premises. Make arrangements with the Engineer to facilitate the work as stated.

.3 Maintain existing services to the building and provide for personnel and vehicle access.

.4 Maintain a proper solid or chain link security fence c/w suitable locks around work and storage areas at all times.

.5 Where security is reduced by the work, provide temporary means to maintain security.

.6 Contractor shall utilize assigned washroom facilities and shall maintain them neat and tidy.

.7 Contractor to supply their own site trailer, phone, fax, and storage box. No storage will be provided within the building. Accommodation will be made for limited on-site storage at the discretion of the Engineer in area designated by the Engineer.

1.6 CONTRACTOR PROJECT SUPERINTENDENT

.1 The Contractor shall, upon award of contract, designate a Project Superintendent. The Contractor shall provide the name, cellular phone number to the Engineer at the pre-construction meeting. The Project Superintendent shall have full responsibility for the project and shall be authorized to accept and act upon any notice or direction provided by the Engineer. Project Superintendent shall be available on site at all times that work is being performed under this contract.

.2 Supervise and direct all person engaged in the work, including all tradesmen and suppliers. Become familiar with the requirements of each trade. Coordinate delivery and work operations. Examine the work of all trades during work operations to ensure compliance with the contract requirements. Expedite all work to maintain the contract schedule.

.3 Cooperate with all other contractors working on site in parallel or related projects.

.4 Attend coordination and project meetings at the direction of the Engineer.

1.7 CONTRACTOR and SUB CONTRACTORS

.1 The Contractor agrees to employ those sub-contractors proposed by him in writing as listed in the Contractor's tender submission.

.2 Do not change or substitute approved sub-contractors without prior authorization from the Engineer.

.3 Contractor and sub-contractor personnel shall be qualified as per definitions under the Ontario Trades Qualification and Apprenticeship Acts and as required by regulatory agencies in Ontario.

.4 Electrical work shall be carried out by qualified and licensed electrical contractors as per Ontario regulations.

.5 Fire alarm work shall be carried out by qualified and accredited personnel as per Ontario regulations.

1.8 WORKMANSHIP

.1 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Engineer, if required, if work is such as to make it impractical to produce required results.

.2 Do not employ any person unfit or unskilled in their required duties. The Engineer reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.

.3 The Work as covered by the tender documents is intended to comply exactly with the latest rules and regulations of the inspection authorities, and these rules are to be considered an integral part of the tender documents. In case of conflict, any ruling by the Inspection Authority shall be final. All changes and alterations to the Contractor's work required by an authorized inspector or any authority having jurisdiction shall be carried out at the expense of the Contractor.

.4 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Engineer, whose decision is final.

1.9 RECORD DRAWINGS

.1 As work progresses, maintain accurate records to show deviations from the contract drawings. Just prior to completion of work, supply to the Engineer one set of white prints with all deviations neatly inked in. Contractor to show actual layouts for underground services including elevations, all mechanical piping and ductwork and all electrical wiring diagrams, locations and sizes of electrical conduits, pull boxes and wiring, circuits etc. The contractor will deliver the "as-built" records to the prime consultants, and will then provide 2 copies on digital CD's of the "Final Record Drawings" in PDF, and AutoCad formats for the owners records.

1.10 SHOP DRAWINGS

.1 Provide copies of the shop drawings as listed in the specifications and/or drawings to the Engineer prior to ordering materials. Shop drawings to illustrate details of portion of work specific to the project requirements. Information to clearly indicate the items to be reviewed. Generic drawings are not acceptable. Shop drawings shall be forwarded electronically to the Engineer.

.2 Allow two (2) working weeks for Engineer's review of each shop drawing submission.

1.11 CODES AND STANDARDS

.1 The following codes and Standards are in place for work under this contract. The latest edition applicable at the time to be utilized.

.1 The National Building Code of Canada
.2 The National Fire Code of Canada
.3 The Ontario Electrical Safety Code
.4 Ontario Plumbing Code
.5 Ontario Occupational Health and Safety Act and Regulations for Construction Projects
.6 Canada Labour Code Part II and Federal Occupational Health and Safety Policies

1.12 FEES AND CERTIFICATES

.1 Submit a completed Notice of Project Form to the Ontario Ministry of Labour as required by the notification requirements under the Regulations for Construction Projects made pursuant to the Ontario Occupational Health and Safety Act. Provide copy to the Departmental Representative.

.2 Submit to the Electrical Inspection Authority the necessary number of working drawings and specifications for examination and approval prior to commencement of work and pay all associated fees.

.1 Obtain and pay for all electrical inspection fees.

.2 On completion of the work, provide copies of the Electrical Inspection Authority inspection approval certificates.

1.13 CONSTRUCTION SAFETY MEASURES

.1 Observe and enforce construction safety measures required by Ontario Occupational Health and Safety Acts and Regulations for Construction Projects, Canada Labour Code Part II, Occupational Health and Safety, Workers' Compensation Board and municipal statutes and authorities and site specific Health and Safety Policies and Directives

.2 In the event of conflict between any provisions of above authorities, the most stringent will apply.

.3 Provide and maintain guardrails, fences, barricades, lights, signs and other devices required for protection of workmen and public in accordance with the requirements of the Canada Labour Code Part II, Occupational Health and Safety, Ontario Occupational Health and Safety Act and Regulations for Construction Projects and Local by-laws. All signs shall be bilingual or CSA universal pictograms.

.4 Ensure the safety of building personnel at all times when performing work.

.5 Refer to Specifications Section 01 35 30 Health and Safety for additional requirements

1.14 FIRE SAFETY REQUIREMENTS

.1 Comply with the National Building Code of Canada for fire safety in construction and the National Fire Code of Canada for fire prevention, fire fighting and life safety in building in use.

.2 Comply with Human Resources Development Canada (HRDC), Fire Commissioner of Canada (FCC) Standards;

.1 No. 301: Standard for Construction Operations

.2 No. 302: Standard for Welding and Cutting

.3 No. 374: Fire Protection Standard for General Storage (Indoor and Outdoor)

.4 available from Fire protection Engineering Services, Labour program, HRDC or following internet site:

.5 http://info.load-otea.hrdc-drhc.gc.ca/~fireweb/standards/fccen.htm

.6 retain all fire safety documents on site.

.3 Refer to Section 01 35 30 of this document for further information on Health and Safety

1.15 WORKPLACE SAFETY AND INSURANCE BOARD

.1 Prior to commencing the work, throughout the total performance of the work when requesting payments and prior to receiving final payment, the Contractor shall provide evidence of good standing with Workplace Safety and Insurance Board of Ontario.

1.16 UTILITIES

.1 Water supply is available on site and will be provided for construction usage at no cost. Engineer reserves the right to limit volume of water utilized.

.2 Existing electrical services to a maximum of 15 KVA required for the work may be used by the Contractor without charge. Ensure capacity is adequate prior to connecting and imposing additional loads. Connect and disconnect at own expense and responsibility.

1.17 PROTECTION

.1 Protect finished work against damage until take-over.

.2 Protect the work and all surrounding equipment, landscape, structures, floors, ceilings, walls, etc., from damage.

.3 Make good, at no cost to the Owner, any damage caused.

.4 Protect any services, which are uncovered during work.

.5 Protect all areas adjacent to the construction areas from dust and debris produced during construction. Use hoarding, solid walls, drop cloths, sealed dust screens and tarps and clean up and vacuum up all debris daily.

1.18 PRODUCT HANDLING AND STORAGE

.1 Deliver materials in original and unopened containers or wrappings with Manufacturers' seals and labels intact and legible.

.2 Deliver materials in sufficient quantity to allow continuity of the work. Do not encumber site with unnecessary materials.

.3 All unused materials at the end of any working day shall be properly protected from damage.

.4 All materials, equipment, etc. to be handled and stored as not to interfere with the operation of the building.

.5 All material and equipment to be new unless specified otherwise.

.6 Contractors who use controlled products must ensure that their workers are properly trained in the safe use and handling of such products in compliance with the Workplace Hazardous Materials Information System (WHMIS).

7. Comply with all requirements with respect to Controlled products labeling and Material Safety Data Sheets (MSDSs) according to the requirements of WHMIS and the Hazardous Products Act.

1.19 PRODUCT AVAILABILITY

.1 Upon award of contract immediately review product delivery requirements and advise the Engineer of any foreseeable delays.

.2 In the event of failure to notify the Engineer at commencement of the work, the Departmental Representative reserves the right to require the supply of substitute products of equivalent quality at no increase in contract price to ensure adherence to project schedule.

1.20 MATERIALS STANDARDS

.1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirements shall apply.

.2 Products (materials, equipment and articles) incorporated in work shall be new, not damaged or defective and of best quality compatible with specifications for purpose intended. If requested by the Consultant furnish evidence as type, source, and quality of product.

.3 Defective products will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is a 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 the quality of fitness of products, the decision shall rest with the Consultant based upon requirements of Contract Documents. Engineer's decisions shall be final.

.5 Ensure that materials, equipment, services and labour are brought to site in sufficient quantity and in accordance with requirements of the work schedule.

1.21 MATERIALS OTHER THAN SPECIFIED

.1 Secure in writing, permission from the Consultant to use any materials other than those specified.

1.22 HAZARDOUS MATERIALS

.1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials: and regarding labeling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.

1.23 REMOVED MATERIALS

.1 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from the site.

1.24 PROJECT CLEANLINESS

.1 Remove waste materials and debris from the site at the end of each day. Leave the work area unencumbered upon completion of each work shift. Store materials and equipment.

.2 Ensure site is clean, orderly and neat at all times during the work shift. Provide additional cleaning as requested by the Engineer.

.3 At the end of the project, remove dirt, dust and other disfigurations from all surfaces affected by the project including, but not limited to ceilings, walls, floors, fixtures and lights. Clean by dusting, damp wiping, washing, waxing and polishing to the satisfaction of the Engineer.

.4 Upon completion, remove scaffolding, temporary protections and surplus materials. Make good any defects noted at this stage.

.5 Clean areas affected under contract, to a condition at least equal to that previously existing and to satisfaction of the Engineer.

.6 Use only cleaning materials recommended by manufacturer of surface to be cleaned.

1.25 WASTE MANAGEMENT

.1 Comply with the Environmental Protection Act, Ontario Regulations O.Reg. 102/94 and

O. Reg. 103/94 for waste management programs on construction and demolition projects.

1.26 EXISTING SERVICES

.1 Where work involves breaking into or connecting to existing services, Carry out work at times directed by the Consultant. Connection to existing services shall be after hours and/or on weekends.

.2 Before commencing Work, establish location and extent of service lines in area of Work and notify the Consultant of findings.

.3 Submit schedule to and obtain approval from the Consultant for any shutdown or closure of active service or Facility. Adhere to approved schedule and provide notice to affected parties. Do not alter schedule without prior written consent of the Engineer.

.4 Give the Engineer 96 hours notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Obtain written authorization from the Engineer prior to any interruption. Keep duration of those interruptions to a minimum.

.5 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.6 Fire alarm shutdowns, re-activation shall be the responsibility of the Contractor. Shutdown, bypassing or isolating any initiating device or zone on the fire alarm system or the sprinkler system shall be undertaken after hours Monday to Friday from 18:00hrs to 06:00hrs or on weekends from 07:00hrs to 18:00hrs. All shutdowns, bypassing or isolation activities on the fire alarm system or the fire sprinkler system must be authorized in writing by the Property Management District 1 Senior Operations Technician prior to initiating work. Approvals for shutdowns, bypassing or isolation activities require a minimum of 96 hours. Contractors shall schedule their request submittals through the Engineer.

1.27 CUTTING, PATCHING AND MAKING GOOD

.1 Cut existing surfaces as required to accommodate new work. Openings shall be neatly cut and dimensioned to fit electrical conduits, mechanical pipes and/or ductwork passing through the surfaces. Obtain the Engineer's approval before cutting into structure. Cutting torches shall not be permitted.

.2 Patch and make good cut on both sides of surfaces, damaged or disturbed to match or better existing conditions to the satisfaction of the Engineer.

Note: The Contractor shall patch and make good existing openings when Contractor utilizies the existing openings for his work.

.3 Fill voids left around all electrical conduits, mechanical pipes and/or ductwork with appropriate fire-proofing material to maintain fire stop integrity. Finish patching with finishing compounds to the satisfaction of the Engineer.

1.28 DEMOLITION

.1 Except if expressly stated otherwise, materials indicated for removal, become the Contractor's property and shall be promptly taken from the site.

1.29 EQUIPMENT

.1 Provide and maintain equipment such as temporary stairs, ladders, ramps, scaffolds, swing stages, runways, chutes and the like, as required for execution of work

.2 Maintain conveying equipment such as cranes, hoists, derricks and the like, as required for execution of work.

.3 Assume complete responsibility for construction strength, placing, anchoring and operation of derricks, cranes, hoists and other mechanical contrivances used for work; and ensure that loads carried thereon can be safely supported and be free from accidents to all persons.

.4 Have hoist capacities, with regard to anticipated loads, verified by a Professional Engineerregistered in the Province of Ontario.

.5 Comply with all governing safety regulations in force at the time of construction.

.6 Remove immediately such equipment when not required for work.

.7 Provide and maintain, on site, suitable fire extinguishers in sufficient quantities, as required by the Safety Code.

1.30 LOADING

.1 Take precautions to prevent the overloading of any part of the structure during the progress of the work. Make good, at no expense to Owner, any damage resulting from such overloading.

1.31 HOISTING

.1 All crane operations are restricted to the following:

.1 All craning of materials and equipment must be done outside normal building operating hours, ensure interior areas below are kept unoccupied.

1.32 POWDER ACTUATED GUNS

.1 Do not employ powder-actuated guns using explosives, unless expressly permitted by the Consultant. If permitted, comply with requirements of CAN3-Z166.2-M85 (Use and Handling of Powder Actuated Tools).

1.33 TAXES

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

.2 The Harmonized Sales Tax (HST) is NOT to be considered an applicable tax for the purposes of this bid. The bidder shall therefore include separately any amount in his bid price for the said HST. In the event the HST does apply, the successful Contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. The Contractor's HST registration number must be shown on all invoices. This amount will be paid to the Contractor in addition to the amount certified for payment under the contract and will therefore not affect the contract price.

1.34 SIGNS – ADVERTISING

.1 No advertising and/or posting of company signs shall be permitted.

.2 Provide common-use signs as related to traffic control, information, instruction, health and safety, use of equipment, public safety devices, in both official languages or by the use of commonly understood graphic symbols to the Engineer's approval.

1.35 SECURITY CLEARANCES

.1 All personnel employed on this project shall be subject to a security check. Obtain the requisite clearance as instructed for each individual required to enter the premises.

.1 Security access

.1 For access, Contractors must submit the company name, individual names and date of birth along with the individual's security level clearance one week in advance. Once security has reviewed and accepted these individuals they will be granted access.

.2 Enhanced Security level is required for all contractors and individuals on this site.

.3 Special escorted access maybe granted but is not guaranteed for those which do not presently meet this requirement.

.4 All individuals must sign in and out at the main security desk whenever entering or exiting the site. No matter how long the duration is. The exception to this is deliveries or pickups where the individual is not out of the truck working on site.

1.36 BUILDING SMOKING ENVIRONMENT

.1 Smoking is prohibited in the building and on the roofs. Obey smoking restrictions on building property as directed by the Engineer.

1.37 GUARANTEE

.1 Provide written one (1) year guarantee for all materials and labour provided as part of this Contract. Effective start date shall be date of final completion.

.2 The contractor, at own expense, shall correct any defects in the work due to faulty products and/or workmanship appearing within the extended guarantee/warranty periods set out in the individual sections from date of final completion.

1.38 TRAINING AND DEMONSTRATION

.1 Upon completion of the all installations, provide qualified personnel to train and demonstrate all the installations to the site's operations and maintenance personnel. Contractor to review newly installed equipment and demonstrate the start/stop and control functions of the installed equipment. Training and demonstration to be for a duration of four (4) hours or, as indicated in the equipment specification section. Training date and time to be coordinated with and approved by the Engineer.

1.39 OPERATIONS and MAINTENANCE MANUALS

.1 Provide two (2) sets of operations and maintenance manuals with data indexed in vinyl hard covered "D" ring binders. Data to include detailed technical information, documents and records describing operation and maintenance of individual components, copies of all final approved shop drawings, inspection and testing reports, warranties, and all other data specifically requested within the specifications.

.2 Each binder shall have a cover sheet listing title, location and project number. Names, addresses and telephone numbers of the Contractor, Sub-Contractors and all suppliers.

.3 Each binder shall list all maintenance materials, special tools, and spare parts. This will also include a signed transmittal of receipt by the owner's representatives or the engineer.

.4 Provide two copies on digital media in .pdf format and of the entire Operations and Maintenance manual. Vendor literature available from the vendor in native .pdf format shall be included. If vendor literature is not available in .pdf is shall be scanned. All other information shall be scanned into .pdf. An electronic index shall be created which allows for easy navigation through the files.

1.40 Shipping and Receiving

.1 Contractor must be on site to receive all shipments.

.2 Contractor is responsible to unload all shipments.

.3 Deliveries maybe turned away if the contractor is not on site.

.4 Contractor materials are not to be left in the shipping and receiving area.

.5 Shipper may accept to assist the Contractor to load or unload goods and materials. Any movement of Contractor's materials will be at the request of the contractor, however the site accepts no responsibility for any damage lost or stolen goods or materials. If the contractor does not accept this condition the shipper will not assist the contractor.

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Part 1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2008, Stipulated Price Contract.

.2 Project Supplementary Conditions

1.2 CASH ALLOWANCES

.1 Refer to CCDC 2, GC 4.1.

.2 Include in Contract Price specified cash allowances.

.3 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing Work.

.4 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.

.5 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.

.6 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.7 Include progress payments on accounts of work authorized under cash allowances in Consultant's monthly certificate for payment.

.8 Prepare schedule jointly with Consultant to show when items called for under cash allowances must be authorized by Consultant for ordering purposes so that progress of Work will not be delayed.

.9 Amount of each allowance, for Work specified in respective specification Sections is as follows:

.1 For door and security work include allowance of $40,000,.00 for costs for security work.

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 REFERENCES

.1 Owner/Contractor Agreement.

.2 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2008, Stipulated Price Contract.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Make applications for payment on account as provided in Agreement as Work progresses.

.3 Date applications for payment last day of agreed payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.4 Submit to Consultant, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

1.3 SCHEDULE OF VALUES

.1 Refer to CCDC 2.

.2 Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.

1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS

.1 Submit separate schedule of unit price items of Work requested in Bid form.

.2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:

.1 Cost of material.

.2 Delivery and unloading at site.

.3 Sales taxes.

.4 Installation, overhead and profit.

.3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.5 PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Consultant will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 Prepare and submit to Consultant comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work or substantial performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Owner agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.

.3 No later than 10 days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.4 Consultant: to state date of Substantial Performance of Work or designated portion of Work in certificate.

.5 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish reasonable date for finishing Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 After issuance of certificate of Substantial Performance of Work:

.1 Submit application for payment of holdback amount.

.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.3 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.

.4 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.8 PROGRESSIVE RELEASE OF HOLDBACK

.1 Refer to CCDC 2.

.2 Where legislation permits, if Consultant has certified that Work of subcontractor or supplier has been performed prior to Substantial Performance of Work, Owner shall pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

.3 In addition to provisions of preceding paragraph, and certificate wording, ensure that such subcontract Work or products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.9 FINAL PAYMENT

.1 Refer to CCDC 2, GC 5.7.

.2 Submit application for final payment when Work is completed.

.3 Consultant will, no later than 10 days after receipt of application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.

.4 Consultant will issue final certificate for payment when application for final payment is found valid.

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 RELATED REQUIREMENTS

.1 Section 01 00 10 – General Instructions.

.2 Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

.3 Section 01 77 00 - Closeout Procedures.

1.2 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work at the call of Consultant.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Consultant.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three (3) days after meetings and transmit to meeting participants, affected parties not in attendance and the Project Manager and Consultant.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRECONSTRUCTION MEETING

.1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.

.3 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.4 Agenda to include:

.1 Appointment of official representatives of participants in the Work.

.2 Schedule of Work: in accordance with Section 01 32 17 - Construction Progress Schedule.

.3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Delivery schedule of specified equipment.

.6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.8 Owner provided products.

.9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.12 Monthly progress claims, administrative procedures, photographs, hold backs.

.13 Appointment of inspection and testing agencies or firms.

.14 Insurances, transcript of policies.

1.4 PROGRESS MEETINGS

.1 During course of Work and one (1) week prior to project completion, schedule progress meetings every two (2) weeks.

.2 Contractor, major Subcontractors involved in Work, CEPEO Project Manager, Architect, sub-consultants and Owner (optional) are to be in attendance.

.3 Notify parties minimum three (3) days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three (3) days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

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 Section 01 33 00 - Submittal Procedures.

1.2 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.3 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit to Consultant within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Consultant within 5 working days of receipt of acceptance of Master Plan.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Consultant will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Excavation.
.6 Backfill.
.7 Steel.
.8 Interior Architecture (Walls, Floors and Ceiling).
.9 Plumbing.
.10 Lighting.
.11 Electrical.
.12 Piping.
.13 Controls.
.14 Heating, Ventilating, and Air Conditioning.

.15 Fire Systems.

.16 Testing and Commissioning.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

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 SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 ADMINISTRATIVE

.1 All submissions to be provided in PDF format, unless otherwise noted, by email. Subject line must be identified as: **"ECCC – Lab 124 Recapitalization – (TOPIC)".**

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

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

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

.5 Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Consultant, 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 is co-ordinated.

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

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

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

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.

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

.4 Allow 10 days for Consultant to review of submission.

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

.6 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.

.7 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.

.8 Submissions include:

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

.9 After Consultant's review, distribute copies.

.10 Submit electronic copy (in .pdf format) of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.11 Submit electronic copy (in .pdf format) of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copy (in .pdf format) of test reports for requirements requested in specification Sections and as requested by Consultant.

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.

.13 Submit electronic copy (in .pdf format) of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copy (in .pdf format) of manufacturer's instructions for requirements requested in specification Sections and as requested by Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copy (in .pdf format) of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.

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

.16 Submit 3 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

.17 When submitting electronic documents, the documents must be marked up or annotated to detail the specific requirements of the project. Delete information not applicable to project.

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

.19 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, electronic copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.20 The review of shop drawings by Consultant is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Consultant 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.

.21 Arrange and pay for all deliveries and pick-up, to and from, the Consultant's offices.

1.4 SAMPLES

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

.2 Deliver samples prepaid to Consultant's business address.

.3 Notify Consultant 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 Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in samples which Consultant 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.

.8 Arrange and pay for all deliveries and pick-up, to and from, the Consultant's offices.

1.5 MOCK-UPS

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

1.6 PROGRESS PHOTOGRAPHS

.1 Submit progress photographs in accordance with this Section.

.2 Contractor to provide digital photographs for the interior and exterior of the building for all areas affected by the work of this Contract. This will form the basis for recording of all existing conditions before the work proceeds. Review with Consultant before commencing construction.

.3 Provide detailed photographs throughout the extents of the scope of work to document existing conditions before any work is conducted.

.4 Submit digital photograph files in .JPEG or .TIFF formats, by email or on disk to the Consultant, all Sub-consultants and the Owner. Provide room number/location identification, view orientation and date of photograph.

.5 Provide progress photographs at weekly intervals, as a minimum. Provide additional photographs prior to concealment of services and building elements, at significant stages of the project and at final completion.

.6 Viewpoints to be as a minimum each side of building exterior and roof, all elevations of all interior rooms and other locations determined by the Consultant. Include all exterior site and landscaping work.

.7 Submittal of photographs is a requirement for monthly progress payments to the Contractor.

1.7 CERTIFICATES AND TRANSCRIPTS

.1 Submit transcription of insurance immediately after award of Contract.

.2 Immediately after award of Contract, submit Workers' Compensation Board Status.

.3 Provide certificates and transcripts in PDF format.

1.8 SUBMITTAL SCHEDULE

.1 Shop Drawings, Inspections/Testing Reports and Certificates:

.1 Submit electronic transmittal and shop drawing submittal files, all in PDF format by email, for each individual Specification Section to parties as follows:

.1 All specification Divisions 01, 02, 04, 06 to 14: Architect only.

.2 All specification Divisions 03, 05: Structural Engineering Sub-consultant directly, with circulation copy to Architect.

.3 All specification Divisions 21 to 29: Mechanical/Electrical Engineering Sub-consultant directly, with circulation copy to Architect.

.4 All specification Divisions 21 to 29: Civil Engineering Sub-consultant (where applicable) directly, with circulation copy to Architect.

.2 Submit all submittals accompanied by Shop Drawing Submission form of the Architect, duly completed.

.2 Monthly Progress Claims:

.1 Submit the following mandatory submittal files, in electronic format, with each monthly Progress Claim:

.1 Progress Photographs, evidencing all work progress in detail,

.2 WSIB Statutory Declaration,

.3 Current Shop Drawing Log, identifying all detailed shop drawing reviews and approvals in progress. Submit in MS Excel format.

.4 Current Request for Information (RFI) Log, identifying all RFI's, outstanding RFI's, Priorities of Outstanding RFI's, dates and detailed subject. Submit in MS Excel format.

.5 Current Critical Path Schedule, identifying all updates to current progress to the Approved Construction Schedule. Submit in MS Project format.

.3 Application for Substantial Performance:

.1 Submit the following mandatory submittal files, in electronic format, for application of Substantial Performance:

.1 Progress Photographs, evidencing all work in detail,

.2 WSIB Statutory Declaration,

.3 Detailed construction deficiency list, with the cost breakdown for each deficiency and totals for each subtrade division.

.4 Final Electrical Certificate from the authorities having jurisdiction.

.5 Final Fire Alarm Verification Certificate.

.4 Application for Total Performance:

.1 Submit the following mandatory submittal files, in electronic format, for application of Total Performance:

.1 Progress Photographs, evidencing all work in detail,

.2 WSIB Statutory Declaration,

.3 Detailed construction deficiency list, with the cost breakdown for each deficiency and totals for each subtrade division.

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 SECTION INCLUDES

.1 Health and safety considerations required to ensure that the Owner shows due diligence towards health and safety on construction sites.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Province of Ontario

.1 Occupational Health and Safety Act, R.S.O. 1990 Updated 2007.

1.4 SUBMITTALS

.1 Make submittals 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.

.3 Submit electronic copy of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.4 Submit electronic copy of incident and accident reports.

.5 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within three (3) days after receipt of comments from Consultant.

.6 Consultant'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.

.7 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 Consultant.

.8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.5 FILING OF NOTICE

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

1.6 SAFETY ASSESSMENT

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

1.7 REGULATORY REQUIREMENTS

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

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

1.9 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 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.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Health and Safety Act, R.S.O.

.2 Comply with Occupational Health and Safety Regulations, 1996.

.3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.

.4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

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

1.12 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 the project.

.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 and report directly to and be under direction of site supervisor.

1.13 POSTING OF DOCUMENTS

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

1.14 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

.2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 POWDER ACTUATED DEVICES

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

1.16 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.

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 DEFINITIONS

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

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Consultant. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

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

.4 Environmental protection plan: include:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.6 Drawings showing 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.

.7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use

.9 Areas including methods for protection of features to be preserved within authorized work areas.

.10 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

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

.12 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.

.13 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

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

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

.16 Pesticide treatment plan: to be included and updated, as required.

1.3 FIRES

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

1.4 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

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

1.5 DRAINAGE

.1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: 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 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sedimentations control plan.

.3 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

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

1.6 SITE CLEARING AND PLANT PROTECTION

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

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to areas indicated or designated by Consultant.

1.7 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

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

1.8 NOTIFICATION

.1 Consultant 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. Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.

.2 Consultant will issue stop order of work until satisfactory corrective action has been taken.

.3 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 NOT USED

.1 Not Used.

END OF SECTION

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Part 1 General

1.1 CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Architect.

.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Architect.

.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Architect.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws. Smoking in the 335 River Road facility is not permitted.

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 INSPECTION

.1 Allow Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Consultant will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

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

.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 Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

.5 Allocated costs: to Section 01 21 00 – Cash Allowances.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

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

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

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

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.6 REPORTS

.1 Submit electronic copy (in .pdf format) of inspection and test reports to Consultant.

.2 Provide copies to subcontractor of work being inspected or tested and/or manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Consultant and may be authorized as recoverable.

1.8 MOCK-UPS

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

.2 Construct in locations acceptable to Consultant as specified in specific Section.

.3 Prepare mock-ups for Consultant 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 Mock-ups may remain as part of Work when acceptable to Consultant.

1.9 MILL TESTS

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

1.10 EQUIPMENT AND SYSTEMS

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

.1 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.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such Work after use.

1.4 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

.1 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

1.6 TEMPORARY HEATING AND VENTILATION

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

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

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work. Protect Work and products 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.

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

.5 Ventilating:

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

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

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

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

.6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters.

.8 Pay costs for maintaining temporary heat, when using permanent heating system.

.9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform to 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.

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

1.7 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lux.

.5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.8 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data hook up, lines, equipment necessary for own use.

1.9 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.

.2 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, 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 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs.

1.5 HOISTING

.1 Provide, operate and maintain hoists and/or cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists and cranes to be operated by qualified operator.

1.6 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

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

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

1.8 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.9 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lux and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.10 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.

1.11 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.

.3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Consultant.

1.12 CONSTRUCTION SIGNAGE

.1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Consultant.

.2 Construction sign of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.

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

.4 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.

.5 Maintain approved signs and notices in good condition for duration of project, and dispose of offsite on completion of project or earlier if directed by Consultant.

1.13 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 Consultant.

.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 Consultant.

.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 Consultant.

1.14 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.

Part 2 Products not Used

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically flush and butt jointed.

.3 Provide lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.

.6 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide lockable truck gate. Maintain fence in good repair.

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

1.4 GUARD RAILS AND BARRICADES

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

.2 Provide as required by governing authorities

1.5 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

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

1.6 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions 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.

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

1.10 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.

1.11 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

1.12 WASTE MANAGEMENT AND DISPOSAL

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

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 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations.

.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, Consultant reserves right to have such products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be borne by Owner 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 Procurement policy is to 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 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. Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 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 panel 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 Consultant.

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

1.5 TRANSPORTATION

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

.2 Transportation cost of products supplied by Owner will be paid for by Owner. Unload, handle and store such products.

1.6 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 Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

.4 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.5 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.

.6 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, 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 Consultant if there is interference. Install as directed by Consultant.

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 Consultant 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 Consultant.

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, and 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.

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 REFERENCES

.1 Departmental Representative's identification of existing survey control points.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Place of Work.

.2 Same surveying company should be used for all work within the limit of Work.

1.3 SURVEY REFERENCE POINTS

.1 Survey data for this project was generated using UTM (Universal Transverse Mercator) geographic coordinate system.

.2 Existing base horizontal and vertical control points are designated on drawings.

.3 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.4 Make no changes or relocations without prior written notice to Departmental Representative.

.5 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.6 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

.1 Establish minimum two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Locate and establish elevations of existing trees to be preserved, undisturbed slopes adjacent to new Works, and other permanent features to remain.

.4 Establish pipe invert and top of structure elevations.

.5 Stake batter boards for foundations.

.6 Stake micropile, column, and deck locations.

.7 Establish elevations of micropiles at grade, top of micropile plates and top of stairway landing and treads.

.8 Stake for grading, fill and topsoil placement and landscaping features.

1.5 EXISTING SERVICES

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

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

.3 Provide a hard copy of the completed locate plans for public and private services to Departmental Representative.

.4 Ground Penetrating Radar survey of existing underground storm sewer line will be provided by the Departmental Representative after award of contract. Additional survey requirements to implement work will be at the Contractor's expense.

1.6 RECORDS

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

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.7 SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

1.8 SUBSURFACE CONDITIONS

.1 Promptly notify Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should the Departmental Representative determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

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 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 SUBMITTALS

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

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.3 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 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.

1.5 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

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

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

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

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

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

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

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 RELATED SECTIONS

.1 Section 01 33 00 – Submittals.

.2 Section 01 73 03 – Execution

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 SUBMITTALS

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

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.3 GENERAL REQUIREMENTS

.1 This Section provides guidelines to the existing building material refurbishment, as indicated on the Drawings, as specified herein and as required for a complete project, as well as requirements and limitations for cutting and patching the Work.

- .1 Where indicated and required, patch and make good and/or reinstate finishes and assemblies with like materials to match existing finishes which are to remain, or new finishes to be provided.
- .2 Complete work to extent required using appropriate transition points between existing or between existing and new assemblies to ensure neat consistent, finished appearance over entire surface.
- .3 Where a smooth transition cannot be achieved in close proximity to the effected work, finish to appropriate transition points including:
  - .1 Intersection of ceiling or floor and wall plane
  - .2 Intersection of wall planes
  - .3 Intersection of other horizontal or vertical surfaces such as bulkheads
  - .4 Inside or outside corner at changes in surface plane.

.2 Review construction documents and existing conditions at site assessment to ascertain extent of alterations required to meet the requirements described herein.

1.4 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.

1.5 ALTERATIONS, CUTTING AND PROTECTION

.1 Extent:

.1 Perform cutting and removal work so as not to cut or remove more than is necessary and so as not to damage adjacent work.

.2 Shoring, Bracing and Capping:

.1 Provide shoring, needling and bracing as needed to keep the building structurally secure and free of deflection in all its parts and as needed for the installation of new work.

.3 Responsibility and Assignment to Trades:

.1 The Contractor shall assign the work of moving, removal, cutting, patching and repair to trades under his supervision so as to cause the least damage to each type of work encountered, and so as to return the building as much as possible to the appearance of the new work.

.2 Assign patching of finish materials to tradesmen skilled in the work of the finish trade involved.

.4 Protection:

.1 Protect remaining finishes, equipment and adjacent work from damage caused by cutting, moving, removal and patching operations. Protect surfaces which will remain a part of the finished work.

1.6 PATCHING, EXTENDING AND MATCHING

.1 Skill:

.1 Patch and extend existing work using skilled tradesmen who are capable of matching the existing quality of workmanship. The quality of patched or extended work shall not be less than that specified in the applicable Sections of the Contract Specifications.

.2 Patching:

.1 In areas where any portion of an existing finished surface is damaged, lifted, stained or otherwise found to be imperfect, patch or replace the imperfect portion of the surface with matching material.

.2 Do not incorporate salvaged or used material in new construction, except where small quantities of finish material which are difficult to match or duplicate are approved for patching or extending purposes by the Consultant.

.3 Provide adequate support or substrate for patching of finishes.

.4 If the imperfect surface is a painted or coated one, repaint or recoat the patched portion in such a way that uniform colour and texture over the entire surface results.

.5 If the surrounding surface cannot be matched, repaint or recoat the entire surface to nearest natural break.

.3 Quality:

.1 In the Sections of the Specifications to which these alteration procedures are applicable, products required for patching, matching, extending or replacing existing work have not necessarily been described. Obtain all required products in time to complete the Work on schedule. Provide products of quality equal to or better than the existing products.

.4 Transitions:

.1 Where new work abuts or finishes flush with existing work, make the transition as smooth and workmanlike as possible. Patched work shall match existing adjacent work in texture and appearance, so as to make the patch or transition invisible to the eye at a distance of one metre.

.2 Where concrete, drywall, wood, metal or other finished surface is cut in such a way that a smooth transition with new work is not possible, terminate the existing surface in a neat fashion along a straight line at a natural line of division and provide trim appropriate to the finished surface.

.5 Matching:

.1 Where not otherwise specified or indicated, restore existing work that is damaged during construction to a condition equal to its condition at the time of the start of the Work. At locations in existing areas where partitions are removed, patch the floors, walls and ceilings with finish materials to match adjacent finishes.

.2 At locations in existing areas where partitions are removed, patch the floors, walls and ceilings with finish materials to match adjacent finishes.

1.7 EXECUTION

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

.2 Use material to match existing.

.3 Cut rigid materials using a masonry saw or core drill. Pneumatic or impact tools not allowed without prior approval.

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

.5 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

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

.7 Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

.8 Reinstate work in accordance with the conditions of the surface prior to cutting and patching.

.9 Reconnect any services damaged due to cutting as part of patching and repairing of the damage area.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

.2 Debris:

.1 Remove debris promptly from the site each day. Removed material, except that listed or marked by the Consultant for retention, becomes the property of the Contractor. Load removed material directly on trucks for removal from the site. Dispose of removed material legally.

.2 Do not let piled material endanger structure.

.3 Suppress dust. Prevent the occurrence of unsanitary conditions, dirt or debris.

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 PROJECT CLEANLINESS

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

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

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

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

.5 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.6 Dispose of waste materials and debris off site.

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

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

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

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

.11 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 Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

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

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

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

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

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

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

.16 Sweep and wash clean paved areas. Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.17 Clean roofs, downspouts, and drainage systems.

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

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 INSPECTION AND DECLARATION PROCEDURES

.1 Contractor's Inspection: The Contractor and all Subcontractors shall:

- .1 Conduct an inspection of the Work and identify deficiencies and defects;
- .2 Submit type-written list of these items.
- .3 Repair as required to conform to the Contract Documents.
- .4 Notify The Consultant in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made, and
- .5 Request The Consultant's Inspection.

.2 Consultant's Inspection: Consultant and Contractor shall:

- .1 Perform inspection of Work to identify obvious defects or deficiencies.
- .2 The consultant shall submit a list of these items.
- .3 The Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

- .1 Work has been completed and inspected for compliance with Contract Documents.
- .2 Defects have been corrected and deficiencies have been completed.
- .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
- .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies have been submitted.
- .5 Operation of systems have been demonstrated to Owner's personnel.
- .6 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner and Consultant. If Work is deemed incomplete by Owner or Consultant, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

- .1 Final submission of complete, integrated and comprehensive Operations and Maintenance Manuals, in accordance with Section 01 78 00 – Closeout Submittals, including warranties, maintenance information and as-built drawings shall be a Mandatory requirement of substantial performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with CCDC.

.8 Declaration of Total Performance: When the Owner and the Consultant consider final deficiencies and defects have been corrected and it appears that the requirements of

the Contract have been totally performed, the Contractor shall make application for a certificate of Total Performance.

.1 If the Work is deemed incomplete by the Owner and the Consultant, complete the outstanding items and request re-inspection.

.9 Final Payment: when Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment in accordance with the general conditions of the contract.

1.2 REINSPECTION

.1 Should the status of the Work require re-inspection by the Consultant due to failure of the Work to comply with the Contract Documents, the Owner will deduct the costs of re-inspection services from payment to the Contractor.

1.3 CLEANING

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

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 SUBMITTALS

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

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 At Substantial Performance of the Work, submit to the Consultant copies of operating and maintenance manuals in English and French (1 (One) copy each).

.4 Copies will be returned after inspection, with Consultant's comments.

.5 Revise content of documents as required prior to final submittal.

.6 Submit to the Consultant, 2 (two) final copies of operating and maintenance manuals in hard copy and a pdf copy. One copy is reserved for the Architect's records.

- .1 If previous comments have not been addressed or subsequent concerns are observed, copies will be returned after inspection with Consultant comments.
- .2 Final copies, with no outstanding issues, shall be a requirement prior to consideration of substantial performance of the work

.7 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

- .1 Deliver and store as directed by Owner.
- .2 Provide itemized inventory listing complete with acknowledgment endorsed by consultant or owner representative taking delivery of same, including:
  - .1 Date
  - .2 Specification Section
  - .3 Item
  - .4 Quantity
  - .5 Condition

.8 Furnish evidence, if requested, for type, source and quality of products provided.

.9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.10 Pay costs of transportation.

1.2 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. 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. Bind in with text; fold larger drawings to size of text pages.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project; Date of submission; names.

.1 Addresses and telephone numbers of Consultants and Contractor with name of responsible parties.

.2 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. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, 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. Field test records.

.6 Inspection certificates.

.7 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Consultant.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of red line opaque drawings, and in copy of Project Manual, provided by Consultant.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

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

1.6 FINAL SURVEY

.1 Submit final site survey certificate, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.7 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's 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.

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

1.8 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

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

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

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

1.9 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. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 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. Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

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

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.13 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.

.3 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.4 Assemble approved information in binder and submit upon acceptance of work. 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 (10) 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.

.5 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.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 roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, 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 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

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

1.14 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Consultant.

.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.Warranty period.

.5 Inspector's signature.

.6 Construction Contractor.

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 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 21 - Construction/Demolition Waste Management Disposal.

.2 Submit demolition drawings:
- .1 Submit for review and approval by Consultant shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario Canada, showing proposed method.

.3 Sustainable Design Submittals:
- .1 Construction Waste Management:
  - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
  - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

1.2 SITE CONDITIONS

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

.2 Should material resembling spray or trowel-applied asbestos or other designated substance be encountered, stop work, take preventative measures, and notify Consultant immediately.
- .1 Do not proceed until written instructions have been received from Consultant.

.3 Notify Consultant before disrupting building access or services.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.
- .1 Immediately notify Consultant and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Consultant should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.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 demolition.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.

.2 Protection of In-Place Conditions:
- .1 Prevent movement, settlement, or damage to adjacent structures, utilities, landscaping features, and parts of building to remain in place. Provide bracing and shoring required.
- .2 Keep noise, dust, and inconvenience to occupants to minimum.
- .3 Protect building systems, services and equipment.
- .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
- .5 Do Work in accordance with Section 01 35 29 - Health and Safety Requirements.

.3 Demolition/Removal:
- .1 Remove items as indicated.
- .2 Removal of Pavements, Curbs and Gutters:
  - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Consultant.
  - .2 Protect adjacent joints and load transfer devices.
  - .3 Protect underlying and adjacent granular materials.
- .3 Remove parts of existing building to permit new construction.
- .4 Trim edges of partially demolished building elements to tolerances as defined by Consultant to suit future use.

3.3 CLEANING

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

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

.3 Refer to demolition 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 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

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

.2 Reference Standards:
- .1 Canadian Environmental Protection Act,1999 (CEPA 1999)
  - .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
- .2 Department of Justice Canada (Jus)
  - .1 Transportation of Dangerous Goods Act, 1992, (TDG Act-92, c. 34).
  - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 National Research Council Canada Institute for Research in Construction (NRC-IRC)
  - .1 National Fire Code of Canada-2005.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements and Section 01 35 43 - Environmental Procedures to Consultant for each hazardous material required prior to bringing hazardous material on site.
- .3 Submit hazardous materials management plan to Consultant that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.3 Sustainable Design Submittals:
- .1 Construction Waste Management:
  - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
  - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50 % of construction wastes were recycled or salvaged
  - .3 Low-Emitting Materials: submit listing of adhesives, sealants, paints, and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.3 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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.

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

.2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
.3 Use licensed carrier authorized by provincial authorities to accept subject material.
.4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
.5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
.6 Only trained personnel handle, offer for transport, or transport dangerous goods.
.7 Provide photocopy of shipping documents and waste manifests to Consultant.
.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Consultant.
.9 Report discharge, emission, or escape of hazardous materials immediately to Consultant and appropriate provincial authority. Take reasonable measures to control release.

.12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
.13 Report spills or accidents immediately to Consultant. Submit a written spill report to Consultant within 24 hours of incident.

.5 Develop Construction Waste Management Plan related to Work of this Section.

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

PART 2 PRODUCTS

2.1 MATERIALS

.1 Description:
.1 Bring on site only quantities hazardous material required to perform Work.
.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.
.3 Sustainability Characteristics:
.1 Adhesives and Sealants in accordance with Section 07 92 00 - Joint Sealants.
.1 Adhesives and Sealants: maximum VOC limit 50 g/L to SCAQMD Rule 1168.
.2 Primers, Paints, and Coatings in accordance with manufacturer's recommendations for surface conditions and Section 09 91 23 - Interior Painting.

PART 3 EXECUTION

3.1 CLEANING

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

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 00 10 – General Instructions.

.2 Section 01 35 29.06 - Health and Safety Requirements.

.3 Section 01 61 00 - Common Product Requirements.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269-08, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.3 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.

.3 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 00 10 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for 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 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W.

.2 Welding materials: to CSA W59.

.3 Welding electrodes: to CSA W48 Series.

.4 Bolts and anchor bolts: to ASTM A307.

2.2 FABRICATION

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

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

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

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

2.3 FINISHES

.1 Finish:

.1 Shop coat primer: MPI- INT 5.1A.

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 GS-11.

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

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

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

2.6 ANGLE LINTELS

.1 Steel angles: prime painted, sizes indicated for openings. Provide 150 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

.3 Finish: shop painted.

.4 Primer: VOC limit 250 g/L maximum to GS-11 when applied onsite.

2.7 CHANNEL FRAMES

.1 Fabricate frames from steel, sizes of channel and opening as indicated.

.2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.

.3 Weld steel strap anchors to channel jamb frame at 400 mm on centre.

.4 Finish: prime coat painted.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant 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 Consultant.

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 Consultant 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.

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

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 250 g/L to GS-11.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 CHANNEL FRAMES

.1 Install steel channel frames to openings as indicated.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.

3.5 PROTECTION

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.2 QUALITY ASSURANCE

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

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle 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.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wood materials from landfill to recycling, reuse and composting facility approved by Architect.

.5 Do not dispose of preservative treated wood through incineration.

.6 Do not dispose of preservative treated wood with materials destined for recycling or reuse.

.7 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Architect.

.8 Dispose of unused wood preservative material at official hazardous material collections site approved by Architect.

.9 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

Part 2 Products

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:

.1 S2S is acceptable for strapping.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

.4 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

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

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

.3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.

2.3 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111.

.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, explosive actuated fastening devices, recommended for purpose by manufacturer.

2.4 FINISHES

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, interior highly humid areas, pressure preservative, fire retardant and treated lumber.

.2 Stainless steel: use stainless steel 304 alloy for exposed fasteners and grommets or eyelets.

2.5 WOOD PRESERVATIVE

.1 Pressure impregnation wood preservative (PT): All wood associated with the roof, all wood installed on the exterior of the building, including plywood and concealed blocking, and wood in all other locations likely to be subjected to damp and/or humid conditions. Except in locations where run-off could stain other surfaces.

.2 Vacuum pressure impregnate wood for rot resistance, in accordance with CAN/CSA-O80:

.1 Pressure Treated wood Furring, blocking, nailing strips: to CAN/CSA-080.1-97

.2 Pressure Treated Plywood: to CAN/CSA-080.9-97

.3 Impregnate at a rate of 8.8 lbs (above ground) and 14 lbs (ground contact) chemical per m3 wood.

.4 Minimum penetration depth to be 3/8” with no less than 80% of sapwood treated.

Part 3 Execution

3.1 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.

.4 Treat material where indicated as follows:

.1 Wood fascia backing, curbs, nailers, sleepers on roof deck.

3.2 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

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

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

.6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.7 Install sleepers as indicated.

.8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 ERECTION

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

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

3.4 SCHEDULES

.1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

END OF SECTION

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Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C 553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C 665-01e1, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.3 ASTM C 1320-05, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 Canadian Gas Association (CGA)

.1 CAN/CGA-B149.1-05, Natural Gas and Propane Installation Code Handbook.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S604-M1991, Type A Chimneys.

.2 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

1.2 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 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

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

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

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 INSULATION

.1 Thermal Insulation **(BI-01):** Mineral fibre to CAN/ULC-S702-97.

.1 Type: 1.

.2 Size: To suit stud spacing.

.3 Thickness: As indicated on drawings.

.4 Combustibility to CAN4-S114: Non-combustible.

.5 Surface Burning Characteristics to CAN/ULC-S102:

.1 Flame Spread: 0

.2 Smoke Developed: 0

.6 Density: 32 kg/m^3.

.7 Thermal Resistance:

Thickness	RSI
63.5 mm	1.68
88.9 mm	2.30
152.4 mm	3.96

2.2 ACCESSORIES

.1 Insulation clips:

.1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

.2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.

.3 Staples: 12 mm minimum leg.

.4 Tape: as recommended by manufacturer.

Part 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 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.

.5 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 CLEANING

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

END OF SECTION

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PART 1 GENERAL

1.1 REFERENCES

.1 ASTM International Inc.
- .1 ASTM C726-05, Standard Specification for Mineral Fiber Roof Insulation Board.
- .2 ASTM C728-05, Standard Specification for Perlite Thermal Insulation Board.
- .3 ASTM C1177/C1177M-06, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .4 ASTM C1396/C1396M-06a, Standard Specification for Gypsum Board.
- .5 ASTM D41-05, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- .6 ASTM D312-00(2006), Standard Specification for Asphalt Used in Roofing.
- .7 ASTM D2178-04, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- .8 ASTM D6162-00a, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
- .9 ASTM D6163-00e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
- .10 ASTM D6164-05, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- .2 CGSB 37-GP-56M-80b(A1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- .3 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.3 Canadian Roofing Contractors Association (CRCA)
- .1 CRCA Roofing Specifications Manual-1997.

.4 Canadian Standards Association (CSA International)
- .1 CSA A123.21-04, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems
- .2 CSA-A123.4-04, Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O151-04, Canadian Softwood Plywood.

.5 Factory Mutual (FM Global)
- .1 FM Approvals - Roofing Products.

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

.7 Department of National Defense (DND)
- .1 Canadian Forces Support Unit (Ottawa) contractor’s fire orders.

.8 Underwriters Laboratories' of Canada (ULC)
- .1 CAN/ULC-S107-03, Methods of Fire Tests of Roof Coverings.
- .2 CAN/ULC-S126-06, Standard Method of Test for Fire Spread Under Roof-Deck Assemblies.
- .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.4 CAN/ULC-S770-00, Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with roofing contractor's representative and Departmental Representative.
- .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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Provide two copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements, and indicate VOC content for:
  - .1 Primers.
  - .2 Sealers.
- .3 Provide shop drawings:
  - .1 Indicate flashing, control joints, tapered insulation details.
  - .2 Provide layout for tapered insulation.
- .4 Samples: submit two (2) samples 304.8 mm (12") long pieces of XPS insulation.
- .5 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .6 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumen and roofing felts and membrane with specification requirements.
- .7 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .8 Manufacturer's field report: in accordance with Section 01 45 00 - Quality Control.
- .9 Reports: indicate procedures followed ambient temperatures and wind velocity during application.

1.4 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems approved by manufacturer.

1.5 FIRE PROTECTION

.1 Fire Extinguishers:
- .1 Maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle.
- .2 ULC labelled for A, B and C class protection.
- .3 Sizes 1.14, 2.25, 4.5, 9 and 14 kg or as indicated on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 2 hour after each day's roofing operations cease. Refer to the hotwork permit for the fire watch duties and responsibilities.

1.6 DELIVERY, STORAGE, AND HANDLING

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

.2 Storage and Handling Requirements:
- .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .2 Provide and maintain dry, off-ground weatherproof storage.
- .3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
- .4 Remove only in quantities required for same day use.
- .5 Place plywood runways over completed Work to enable movement of material and other traffic.
- .6 Store sealants at +5 degrees C minimum.
- .7 Store insulation protected from daylight and weather and deleterious materials.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

1.7 FIELD CONDITIONS

.1 Ambient Conditions
- .1 Do not install roofing when temperature remains below -18 degrees C for torch application, or to manufacturers' recommendations for mop application.
- .2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.8 WARRANTY

.1 For Work of this Section, 12 months warranty period is extended to 24 months.

PART 2 PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.

.2 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 SYSTEM DESCRIPTION

.1 A 2 ply SBS modified bitumen roof membrane using a mechanically fastened base sheet and heat welded granulated cap sheet over coverboard, polyisocyanurate insulation and vapour retarder.

.2 Design roofing membrane system and base flashings to be watertight, does not permit passage of water through finished roof system and resists exposure to weather without failure.

.3 Regulatory Requirements:

.1 External Fire Resistance: Design roofing system to meet minimum Class A in accordance with CAN/ULC-S107 for surface burning test method.
.2 Internal Fire Resistance: Design roofing system to comply with CAN/ULC-S126, standard test method for fire spread under metal roof deck assemblies.
.3 Compliance with Local, Provincial and Federal Building Codes: Ensure roofing system complies with authorities having jurisdiction over construction covered within scope of this Specification.

.4 Performance/Design Criteria:
.1 Material Compatibility: Components of roof system to be compatible with adjoining materials under application and service as demonstrated by roofing manufacturer and based on testing and field experience.
.2 Metal Deck Roof System: Provide 2 ply SBS modified bituminous mechanically fastened/heat welded on membrane roofing system over metal deck, including but not limited to following:
.1 Existing wood decking.
.2 Vapour retarder directly over metal deck.
.3 Base rigid insulation board.
.4 Tapered insulation.
.5 Coverboard.
.6 Base sheet membrane (mechanically fastened).
.7 Cap sheet membrane (heat welded).
.8 Base sheet flashing.
.9 Heat welded cap sheet flashing.
.10 Accessories:
.1 Metal flashing.
.2 Roof walkways.

2.3 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma & ASTM D 41.

2.4 VAPOUR RETARDER

.1 Base sheet vapour retarder: to CGSB 37-GP-56M, ASTM D 6162, Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, polyester reinforcement, weighing 180 g/m².
.1 Top and bottom surfaces: Sanded/sanded.

2.5 MEMBRANE

.1 SBS Modified Bitumen Cap Sheet: SBS modified asphalt cap sheet meeting CGSB 37-GP-56M, Type 2, Grade 2, Class G, 250 g/m² polyester reinforced, granulated top surface, thermofusible film bottom surface. Granular colour to be grey.

.2 Primer for Self-Adhering Base Sheet Flashings: Quick drying, solvent-based primer.

.3 SBS Modified Bitumen Base Flashing: SBS modified asphalt base sheet meeting CGSB 37-GP-56M, Type 2, Grade 2, Class P, 140 g/m² polyester reinforced, thermofusible film on top and self adhering bottom surface.

.4 SBS Modified Bitumen Cap Flashing: SBS modified asphalt cap sheet meeting CGSB 37-GP-56M, Type 2, Grade 2, Class 2, 250 g/m² polyester reinforced, granulated top surface, thermofusible film bottom surface.

.5 Mastics: Asphalt mastic conforming to CGSB 37-GP-9Ma requirements.

.6 Walkways: SBS modified asphalt cap sheet membrane of a different colour from field membrane cap sheet.

2.6 COVERBOARD

.1 Overlay Board: 3 mm thick asphalt based recovery board with non-woven glass facers, as recommended by the membrane manufacturer
  .1 Install over insulation to provide torch safe surface.

2.7 POLYISOCYANURATE INSULATION

.1 Closed cell rigid foamed plastic boards conforming to CAN/ULC-S704, Type 2, Class 3, faced with glass reinforced organic felt paper, perforated, maximum board size 1220 mm x 2440 mm minimum 84 mm thick to furnish a minimum R-Value in accordance with CAN/ULC-S770, LTTR of 20.4.

2.8 SEALERS

.1 Plastic cement: asphalt.

.2 Sealing compound: rubber asphalt type.

.3 Sealants: Caulking - see Section 07 92 00 - Joint Sealants.

2.9 WALKWAYS

.1 Walkways to consist of one additional ply of cap sheet membrane. Colour to be different from field membrane as selected by Departmental Representative.

2.10 CARPENTRY

.1 Refer to Section 06 10 00 - Rough Carpentry.

2.11 CANT STRIPS

.1 Cut from prefabricated material, to measure 140 mm on slope.

2.12 FASTENERS

.1 Ensure fasteners compatibility with roof membranes and flashings. Ensure fasteners are of type and size shown on Drawings and acceptable by roofing membrane manufacturer.

.2 Use self drilling, self tapping, organic fluoropolymer coated screws for securing of wood nailers and blocking. Screws to pass FM V Class 1 criteria, minimum of 30 cycles in a Kesternich Cabinet. Ensure thread diameter is minimum 6 mm.

.3 Ensure nails used to secure metal to wood are galvanized and long enough to penetrate wood by a minimum of 25 mm.

.4 Use self drilling, self tapping, organic fluoropolymer coated screws to secure rigid insulation to decking. Screws to pass FM Class 1 criteria, minimum of 30 cycles in a Kesternich Cabinet. Ensure thread diameter is minimum 5.58 mm and penetrate decking by a minimum of 25 mm.

.5 Stressplates for Attachment:
  .1 75 mm diameter, galvanized steel or Galvalume (Insulation).
  .2 60 mm diameter, barbed plate (Base Sheet).
  .3 50 mm diameter, steel barbed plate (Base Sheet).
  .4 Minimum Screw Size: #12 fasteners. #14 fasteners minimum for FM approved assemblies.

.6 Ensure fasteners are acceptable to membrane manufacturer and be in compliance with fastener standard FM 4470, 1-28 and 1-29.

PART 3 EXECUTION

3.1 QUALITY OF WORK

.1 Inspect existing conditions to ensure they are suitable for roofing work to begin. Do not proceed until unacceptable conditions are corrected.
- .1 Do priming in accordance with manufacturers written recommendations.
- .2 The interface of the walls and roof assemblies will be fitted with durable rigid material plywood providing connection point for continuity of air barrier.
- .3 Assembly, component and material connections will be made in consideration of appropriate design loads, with reversible mechanical attachments.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:
- .1 Inspect with Departmental Representative deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:
- .1 Prior to beginning of work ensure:
  - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
  - .2 Curbs have been built.
  - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
  - .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 PRIMING DECK

.1 Apply deck primer to deck, wood, metal, concrete, gypsum board, cementitious board roofing substrate at the rate recommended by manufacturer.

3.5 VAPOUR RETARDER (WOOD DECK)

.1 Modified bituminous vapour retarder sheet. Unroll and let relax prior to installation.

3.6 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

.1 Insulation: mechanically fastened application:

.1 Mechanically fasten insulation using screws and pressure distribution plates.
.2 Fasten insulation as per manufacturer's written recommendations.
.3 Number and pattern of screws per board to meet Factory Mutual requirements.
.4 Place boards in parallel rows with ends staggered, and in firm contact with one another.
.5 Cut end boards to suit.

.2 Tapered insulation application:
.1 Mop insulation to vapour retarder and top layer of insulation to bottom layer with hot asphalt at rate of 1 kg/m².
.2 Install tapered insulation as first insulation layer, in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

.3 Overlay Board: adhesive application:
.1 Adhere overlay board to insulation with vulcanized adhesive at the rate of one litre per m².
.2 Place boards in parallel rows with end joints staggered. Cap joints approximately 25 mm.
.3 Cut ends to suit and apply adhesive in continuous ribbons at 300 mm on centre.

.4 Base sheet application:
.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.
.2 Unroll and embed base sheet in uniform coating of asphalt applied at rate of 1.2 kg/m², at 230 degrees C.
.3 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.
.4 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.
.5 Application to be free of blisters, wrinkles and fishmouths.

.5 Cap sheet application:
.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.
.2 Unroll and embed cap sheet in uniform coating of asphalt applied at rate of 1.2 kg/m², EVT at point of contact.
.3 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.
.4 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.
.5 Application to be free of blisters, fishmouths and wrinkles.
.6 Do membrane application in accordance with manufacturer's recommendations.

.6 Flashings:
.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.
.2 Nail mop torch base and cap sheet onto substrate in 1 metre wide strips.
.3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by mopping or torch welding.
.4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.
.5 Provide 75 mm minimum side lap and seal.
.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
.7 Do work in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.

.7 Roof penetrations:
.1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details and Section.

3.7 CANTS

.1 Install prefabricated wood cants over rigid insulation.

.2 Apply hot bitumen to receiving surface and embed cant firmly by hand.
- .1 Fasten wood cants to wood insulation stops.

.3 Angle cut cants to fit tightly on back and bottom where roof to wall angle varies from 90 degrees.

3.8 WALKWAYS

.1 Install walkway membrane in accordance with manufacturer's instructions.
- .1 Apply primer to cap sheet membrane and torch apply, ensuring selvage edge is removed.

.2 Install pavers, level on insulation pads, as indicated.

3.9 FIELD QUALITY CONTROL

.1 Inspections:
- .1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Departmental Representative.
- .2 Departmental Representative will pay for tests as specified in Section 01 45 00 - Quality Control.
- .3 Inspection and testing of roofing application will be carried out by testing laboratory designated by Departmental Representative.
- .4 Costs of tests will be paid by Departmental Representative.

3.10 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
- .3 Ensure emptied containers are sealed and stored safely.
- .4 Divert unused aggregate materials from landfill to local facility for reuse as reviewed by Departmental Representative.
- .5 Unused paint & coating material must be disposed of at official hazardous material collections site as reviewed by Departmental Representative.
- .6 Unused adhesive, sealant and asphalt materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.
- .8 Dispose of unused sealant material at official hazardous material collections site approved by Departmental Representative.
- .9 Dispose of unused asphalt material at official hazardous material collections site approved by Departmental Representative.
- .10 Divert unused gypsum materials from landfill to recycling facility as reviewed by Departmental Representative.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 The Aluminum Association Inc. (AAI)

.1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.

.2 AAI DAF45-03, Designation System for Aluminum Finishes.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 1997.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.

.2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.

.3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.2 SAMPLES

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

.2 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Divert unused metal materials from landfill to metal recycling facility as approved by Architect.

.7 Unused paint and sealant material must be disposed of at an official hazardous material collections site as approved by Architect.

.8 Unused paint and sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 PREFINISHED ALUMINUM SHEET

.1 Finish: factory applied coating to CAN/CGSB-93.1 supplemented and amended as follows:

.1 Coating thickness: not less than 1.2 micrometres.

.2 Outdoor exposure period: 5 years.

.2 Thickness specified for prefinished aluminum sheet applies to base metal.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32.

.4 Sealants: In accordance with Section 07 92 00 – Joint Sealants.

.5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for application.

.7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.8 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate aluminum flashings and other sheet aluminum work in accordance with AA-Aluminum Sheet Metal Work in Building Construction.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.79 mm thick prefinished aluminum.

2.5 PANS

.1 Form pans to receive roofing plastic from 0.79 mm thick prefinished aluminum with minimum 75 mm upstand above finished roof and 100 mm continuous flanges with no open corners. Rivet joints. Make pans minimum 50 mm wider than member passing through roof membrane.

2.6 REGLETS AND CAP FLASHINGS

.1 Form recessed reglets and cap flashing of 0.79 mm thick prefinished aluminum to be built-in concrete and masonry work for base flashings as detailed and in accordance with CRCA FL series details. Provide slotted fixing holes and steel/plastic washer fasteners. Cover face and ends with plastic tape.

2.7 SCUPPERS

.1 Form scuppers from 0.79 mm thick prefinished aluminum.

.2 Sizes and profiles as indicated.

.3 Provide necessary fastenings.

2.8 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with AA DAF45.

.1 Electrolytically deposited colour anodic finish: designation AAMA 2604,

.1 Colours to Vicwest colour system unless otherwise noted.

.2 **FL-01:** Galvalume AZ150.

.3 **FL-02:** Charcoal, 6072.

.4 **FL-03:** Alucobond Spectra, Ocean.

.5 **FL-04:** Alucobond Spectra, Autumn.

.6 **FL-05:** Silver Metallic, QC-2264.

.7 **FL-06:** Copper, QC-3234.

.8 **FL-07:** Aluconbond Spectra, Castle Gray Cool 30.

.9 **FL-08:** Stone Grey, 6071.

Part 3 Execution

3.1 INSTALLATION

.1 Install sheet metal work in accordance with Aluminum Sheet Metal Work in Building Construction as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using standing seams forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

.7 Insert metal flashing into reglets and under cap flashing to form weather tight junction.

.8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.

.9 Caulk flashing at reglet and cap flashing with sealant.

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

3.2 SCUPPERS

.1 Install scuppers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 15 and 16 respectively.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-1995, Fire Tests of Firestop Systems.

1.3 REGULATORY REQUIREMENTS:

.1 The work of this Section shall conform to the requirements of the OBC 2006, latest revision, to ULC design requirements for each assembly and to all other applicable codes and regulations, to the satisfaction of the authorities having jurisdiction.

1.4 SAMPLES

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

.2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.5 SHOP DRAWINGS

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

.2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

1.6 PRODUCT DATA

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

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended and conforming to special requirements.

.2 Firestop system rating: as indicated; Fire-resistance rating of installed fire stopping assembly shall not be less than the fire-resistance rating of the surrounding floor and wall assembly.

.2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.

.3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Do not proceed with the work until unsatisfactory conditions have been corrected to the satisfaction of the installer.

.3 Commencement of the installation will be construed as acceptance of the site conditions and, thereafter, the Contractor shall be fully responsible for satisfactory work as specified herein.

.4 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.5 Maintain insulation around pipes and ducts penetrating fire separation without interuption to vapour barrier.

.6 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install fire stopping and smoke seals at service penetrations through fire resistive construction and at all locations where the continuity of fire resistive construction is interrupted, as indicated on the drawings, as specified herein and as required for a complete project

.2 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.3 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.

.4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.5 Tool or trowel exposed surfaces to a neat finish.

.6 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Edge of floor slabs at curtain wall and precast concrete panels.

.3 Top of fire-resistance rated masonry and gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: greater than 129 cm^2 and as indicated: 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.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C510-05a, Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
- .2 ASTM C 639-01(2007), Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants.
- .3 ASTM C 661-06(2011), Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- .4 ASTM C 679-03(2009)e1, Standard Test Method for Tack-Free Time of Elastomeric Sealants.
- .5 ASTM C 793-05(2010), Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.
- .6 ASTM C 794-10, Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- .7 ASTM C 1183-04(2008), Standard Test Method for Extrusion Rate of Elastomeric Sealants.
- .8 ASTM C 1246-00(2006), Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure.
- .9 ASTM D 412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
- .10 ASTM D 624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- .11 ASTM D 2202-00(2010), Standard Test Method for Slump of Sealants.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB 3.1-92, Leaded Gasoline.
- .2 CAN/CGSB 7.1-98, Lightweight Steel Wall Framing Components.
- .3 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.2 SUBMITTALS

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

.2 Manufacturer's product to describe.
- .1 Caulking compound.
- .2 Primers.
- .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

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

.4 Submit duplicate samples of each type of material and colour.

.5 Cured samples of exposed sealants for each color where required to match adjacent material.

.6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
.1 Instructions to include installation instructions for each product used.

1.3 DELIVERY, STORAGE, AND HANDLING

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

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Architect.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

1.5 PROJECT CONDITIONS

.1 Environmental Limitations:
.1 Do not proceed with installation of joint sealants under following conditions:
.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 5 degrees C.
.2 When joint substrates are wet.

.2 Joint-Width Conditions:
.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:
.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of work as directed by Architect by use of approved portable supply and exhaust fans.

PART 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 offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Polyurethane Hybrid sealant to CAN/CGSB-19.13: Type A, Fast Curing, Low-Modulus, Silane End-Capped.
- .1 Rheological Properties to ASTM C 639: Non-sag (NS), 0"of sag in channel.
- .2 Extrusion Rate to ASTM C 1183, minimum: 93.1 ml.
- .3 Hardness Properties to ASTM C 661: 25.
- .4 Weight Loss to ASTM C 1246: Pass.
- .5 Skin Time: 1 hour.
- .6 Tack Free Time to ASTM C 679: 3-4 hours.
- .7 Stain & Color Change to ASTM C 510: No visible color change/No stain.
- .8 Adhesion-in-Peel to ASTM C 794: Aluminum 20-25 pli, Concrete 18-22 pli. No Adhesion Loss.
- .9 Effects of Accelerated Aging to ASTM C 793: Pass.
- .10 Movement Capability: ±35%.
- .11 Colour: To match adjacent surfaces.
- .12 Recommended Product: Dymonic FC by Tremco Inc.

.2 Silicones One Part to CAN/CGSB-19.13: Type B, General Construction Grade Silicone Sealant.
- .1 One-part, acetoxy silicone sealant.
- .2 Mildew resistant.
- .3 Colour: Clear.
- .4 Recommended Product: Tremsil 200 by Tremco Inc.

.3 Silicones One Part to CAN/CGSB-19.13: Type C, Moisture curing, acetoxy, silicone sealant.
- .1 Tack Free Time to ASTM C 679: 10 to 20 minutes.
- .2 Flow, sag or slump to ASTM D 2202: 0.4 mm.
- .3 Working Time, Skin Formation: 7 to 15 minutes.
- .4 As Cured: After 14 days at 25 degrees C and 50% R.H.
  - .1 Hardness (Shore A) to ASTM C 661: 26 to 30.
  - .2 Tensile Strength at Max Elongation to ASTM D 412: 2.06-2.75 MPa.
  - .3 Maximum Elongation to ASTM D 412: 450-550%.
  - .4 Tensile Strength at 100% Max Elongation to ASTM C 1184: 0.345-0.552 MPa.
  - .5 Tear Strength to ASTM D 624: 7.0-7.5 kN/m.
  - .6 Peel Strength to ASTM C 794: Aluminum and Glass 2.28-2.63 kN/m.

.7 Dynamic Movement to ASTM C 719: ±25%.

.5 Colour: Aluminum and Black, to match window frame.

.6 Recommended Product: Proglaze by Tremco Inc.

.4 Acoustical Sealant to CAN/CGSB 19.21: Type D, One-Part, Non-Skinning, Sound Dampering Sealant.

.1 Resistance to Sag to CGSB 7.1: Passes.

.2 Extrusion Rate to CGSB 3.1: Passes

.3 Viscosity Brookfield: 1,000,000 cps

.4 Shear Modulus using G_R component: 45,000 N/m^2.

.5 Density: 1720 Kg/m^3.

.6 Colour: Dark grey.

.7 Recommended Product: Acoustical Sealant by Tremco Inc.

2.3 SEALANT SELECTION

.1 Sealant Type A:

.1 Control and expansion joints in cast-in-place concrete.

.2 Joints between architectural precast concrete units.

.3 Control and expansion joints in unit masonry.

.4 Perimeter joints between EIFS and frames of doors, windows, storefronts, louvers and similar openings.

.5 Butt joints between metal panels.

.6 Joints between different materials listed above.

.7 Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.

.8 Control and expansion joints in soffits and overhead surfaces.

.9 Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified.

.10 Concealed lap and hook joints in sheet metal flashing and trim.

.11 Control and expansion joints on exposed interior surfaces of exterior walls.

.12 Perimeter joints on exposed interior surfaces of exterior openings.

.13 Joints on precast beams and planks.

.14 Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.

.15 Other interior joints in vertical surfaces and non-traffic horizontal surfaces subject to movement for which no other sealant is specified.

.16 Bedding joints under metal thresholds and saddles.

.17 Bedding joints between sheet metal flashing and other materials

.2 Sealant Type B:

.1 Joints in kitchen counter tops and work surfaces.

.2 Joints between food service equipment and surrounding construction.

.3 Other interior joints, where incidental food contact may occur.

.4 Joints in toilet room and bathroom counter tops.

.5 Joints between plumbing fixtures and adjacent materials.

.6 Joints between locker room lockers and adjacent materials.

.7 Joints between food service equipment and surrounding construction.

.8 Other interior joints in wet areas where needed to limit mold and mildew growth.

.3 Sealant Type C:

.1 Perimeters joints of glazing on interior and exterior within frames; toe, heel, and cap beads, weather seal, and bedding.

.2 Glass applications.

.4 Sealant Type D:

.1 Acoustical sealing of drywall partitions, corridors and party walls.
.2 Lap joint and perimeter sealant for polyethylene vapour barriers over fibre glass batt or other insulations.

2.4 JOINT CLEANER

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

.2 Primer: as recommended by manufacturer.

PART 3 EXECUTION

3.1 PROTECTION

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

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

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

.5 Use sufficient pressure to fill voids and joints solid.
.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
.7 Tool exposed surfaces before skinning begins to give slightly concave shape.
.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:
.1 Cure sealants in accordance with sealant manufacturer's instructions.
.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup:
.1 Clean adjacent surfaces immediately and leave Work neat and clean.
.2 Remove excess and droppings, using recommended cleaners as work progresses.
.3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C 475-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C 514-04(2009e1), Standard Specification for Nails for the Application of Gypsum Board.

.3 ASTM C 557-03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.4 ASTM C 840-08, Standard Specification for Application and Finishing of Gypsum Board.

.5 ASTM C 954-07, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.6 ASTM C 1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.7 ASTM C 1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C 1280-99, Standard Specification for Application of Gypsum Sheathing.

.9 ASTM C 1177/C 1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.10 ASTM C 1178/C 1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.11 ASTM C 1396/C 1396M-09a, Standard Specification for Gypsum Wallboard.

.2 Association of the Wall and Ceilings Industries International (AWCI)

.1 AWCI Levels of Gypsum Board Finish-97.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988),Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.3 SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused gypsum from landfill to gypsum recycling facility for disposal approved by Consultant.

.5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.6 Divert unused wood materials from landfill to recycling or composting facility approved by Consultant.

.7 Divert unused paint and caulking material from landfill to official hazardous material collections site approved by Consultant.

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

Part 2 Products

2.1 MATERIALS

.1 Standard board (GB-01): to ASTM C36/C36M regular, thickness as indicated, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.1 Acceptable Product: CGC, Sheetrock.

.1 Fire-resistant board (GB-02): to ASTM C36/C36M Type X, thickness as indicated, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.1 Acceptable Product: CGC, Sheetrock Firecode 'C' Core.

.2 Water-resistant board (GB-03): to ASTM C630/C630M water-resistant, thickness as indicated, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.1 Acceptable Product: CGC, Sheetrock Water-resistant.

.3 Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing Type X (GB-04): to ASTM C1177/C1177M, water resistant, mold resistant, thickness as indicated, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.1 Acceptable Product: CGC, Georgia-Pacific Gypsum, DensGlass Gold Fireguard.

.4 Shaft wall fire-resistant board (GB-05): to ASTM C442 & C1396, non combustible, flame spread is 20, smoke development is 0, 25.4 mm thick x 610 mm wide x maximum practical length, ends square cut, edges squared.

.1 Acceptable Product: CGC, Sheetrock Gypsum Liner Panels.

.5 Resilient clips: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.6 Steel drill screws: to ASTM C1002.

.7 Stud adhesive: to CAN/CGSB-71.25.

.8 Shadow mould: 35 mm high, snap-on trim, of extruded PVC plastic, white colour.

.9 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.10 Joint compound: to ASTM C475, asbestos-free.

Part 3 Execution

3.1 COORDINATION

.1 Examine the mechanical and electrical drawings and coordinate with appropriate other trades to establish openings, additional support, furring out and other special provisions required for mechanical and electrical fixtures and fittings and access hatches built into the work of this Section.

.2 Examine the architectural drawings and coordinate with appropriate other trades to establish openings, additional support and other special provisions required for items built into or partially supported by the work of this Section.

3.2 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Do application of gypsum sheathing in accordance with ASTM C1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 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 and grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.13 Erect drywall resilient furring transversely across studs, joists and between the layers of gypsum board, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

.14 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

.15 Deflection for wall partitions to be L/270.

Deflection for ceiling partition to be L/360.

3.3 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply single and double layer gypsum board to metal furring or framing using screw fasteners for first layer and 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 in accordance with ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Exterior Soffits and Ceilings: Install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.

.4 Apply water-resistant gypsum board where wall tiles, to be applied and adjacent to slop sinks, janitors closets, washroom wash basins. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and any additional penetrations in partitions where perimeter sealed with acoustic sealant.

.6 Apply board using stud adhesive on furring or framing.

.7 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.8 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.

.9 Install gypsum board with face side out.

.10 Do not install damaged or damp boards.

.11 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 as indicated. 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 where indicated, at changes in substrate construction, at approximate 10 m spacing on long corridor runs and at approximate 15 m spacing on ceilings.

.9 Install control joints straight and true.

.10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Splice corners and intersections together and secure to each member with 3 screws.

.13 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.14 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.

.15 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 2 (Behind wall tile finishes): Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.2 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.16 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.

.17 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.

.18 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.19 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.20 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.21 Mix joint compound slightly thinner than for joint taping.

.22 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.23 Allow skim coat to dry completely.

.24 Remove ridges by light sanding or wiping with damp cloth.

.25 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM C645-08a, Specification for Non-structural Steel Framing Members.

.2 ASTM C754-07, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.40-97, Primer, Structural Steel, Oil Alkyd Type.

1.2 QUALITY ASSURANCE

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

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

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle 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.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility.

1.4 SUBMITTALS

.1 Submit 3 copies of engineering calculations or data verifying the capacity of the members and the ability of the assemblies to meet the design requirements.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.1 Each shop drawing submitted shall bear the stamp and signature of a qualified Professional Engineer and registered in the Province of Ontario. The metal stud systems contractor shall retain the services of a Professional Structural Engineer for the Project and pay for engineering services in connection with shop drawings and review during construction of the metal stud systems.

.2 Include all necessary shop details and erection diagrams. Indicate member sizes, locations, thicknesses exclusive of coating, coating and materials. Include connection details for attaching framing to itself and for attachment to the structure. Show splice details where permitted. Indicate dimension, openings requirement of related work and critical installation procedures. Show temporary bracing required for erection purposes.

.3 Indicate design loads.

.3 Do not fabricate until all submittals are reviewd by the Architect.

.4 Submit 3 copies of field review reports from the Systems contractors Structural Engineer.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, stud sizes as indicated, roll formed from 0.91mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460mm centres.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, flange heights:

.1 Bottom channel: 32 mm

.2 Deflection channel (fixed to u/s of structure): 65 mm

.3 Top channel: 50 mm.

.3 Metal channel stiffener: 1.4mm thick cold rolled steel, coated with rust inhibitive coating.

.4 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

Part 3 Execution

3.1 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically spacing as indicated and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom and ceiling track using screws.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.9 Install heavy gauge single jamb studs at openings.

.10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.12 Provide 40 mm stud, furring channel or wood blocking secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.13 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.14 Extend partitions to underside of deck and structure except where noted otherwise on drawings.

.15 Maintain clearance under deck, beams and joists to avoid transmission of structural loads to studs. Use double track slip joint.

.1 Install 50 mm deep deflection channel at top of partitions.

.2 Nest 65 mm deep top track into deflection channel a minimum of 30 mm and a maximum of 40 mm Do not fasten tracks together.

.16 Install continuous insulating strips to isolate studs from un-insulated surfaces.

.17 Install two continuous beads of acoustical sealant and insulating strip under studs and tracks around perimeter of sound control partitions.

3.2 CLEANING

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

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C 423-02a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

.2 ASTM E 1264-98, Standard Classification for Acoustical Ceiling Products.

.3 ASTM E 1477-98a(2003), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction and Amendment No. 1 1988.

.2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2003, Surface Burning Characteristics of Building Materials and Assemblies.

1.2 SUBMITTALS

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

.2 Submit duplicate 150 x 150 mm samples of each type acoustical units.

1.3 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - 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 Consultant.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers in accordance with Section 01 35 43 - Environmental Procedures.

.6 Ensure emptied containers are sealed and stored safely in accordance with Section 01 35 43 - Environmental Procedures.

.7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.6 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.

1.7 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to the greater of 2% of gross ceiling area or 2 cartons 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.

Part 2 Products

2.1 MATERIALS

.1 Acoustic units for suspended ceiling system (**AT-02**): to ASTM E1264.

.1 Type: III.
.2 Form: 2.
.3 Pattern: CE.
.4 Class: A.
.5 Recycled content: 23 % minimum.
.6 Texture: smooth.
.7 Edge: square.
.8 Colour: white.
.9 Size: 610 x 1220 x 13 mm thick.
.10 Flame spread rating: 25 in accordance with CAN/ULC S102.
.11 Smoke developed rating: 50 or less in accordance with CAN/ULC S102.
.12 Ceiling Attenuation Class (CAC) rating: 40 in accordance with ASTM E1264.
.13 Light Reflectance (LR) range: 0.77 to ASTM E1477.

.14 Acceptable Product: CGC, Sheetrock Lay-in Clima Plus, 3200.

.2 Adhesive: low VOC type recommended by acoustic unit manufacturer.

.3 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

.4 Polyethylene: to CAN/CGSB-51.34, 0.15 mm thick.

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Architect.

3.2 INSTALLATION

.1 Install acoustical panels and tiles in ceiling suspension system.

.2 Install fibrous acoustical media and spacers over entire area above ceiling where indicated.

3.3 APPLICATION

.1 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width. Refer to reflected ceiling plans.

.2 Scribe acoustic units to fit adjacent work. Butt joints tight and terminate edges with moulding.

3.4 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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Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C 635/C 635M-07, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

.2 ASTM C 636/C 636M-08, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.2 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.3 SHOP DRAWINGS

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

.2 Submit reflected ceiling plans for special grid patterns as indicated.

.3 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines change in level details, access door dimensions, and locations and[acoustical unit support at ceiling fixture lateral bracing and accessories.

1.4 SAMPLES

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

.2 Submit one representative model of each type ceiling suspension system.

.3 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.5 REGULATORY REQUIREMENTS

.1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert unused metal materials from landfill to metal recycling facility approved by Architect.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 MATERIALS

.1 Basic materials for suspension system: commercial quality cold rolled steel.

.2 Typical Suspension System **AT-02**: non fire rated, made up as follows:

- .1 Intermediate duty system to ASTM C636.
- .2 Two directional exposed tee bar grid.
- .3 Tee system: 23.8 mm, exposed.
- .4 Colour: Flat white.
- .5 Moulding: Flush.
- .6 Acceptable material: CGC, Donn DX.

.3 Exposed tee bar grid components: shop painted satin sheen. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.

.4 Hanger wire: galvanized soft annealed steel wire.

- .1 3.6 mm diameter for access tile ceilings.

.5 Hanger inserts: purpose made.

.6 Accessories: splices, clips, wire ties, retainers and wall moulding flush and reveal, to complement suspension system components, as recommended by system manufacturer.

Part 3 Execution

3.1 INSTALLATION

.1 Installation: in accordance with ASTM C636 except where specified otherwise.

.2 Install suspension system to manufacturer's instructions.

.3 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.

.4 Secure hangers to overhead structure using attachment methods acceptable to Consultant.

.5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.6 Typical lay out; centre line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width. Coordinate and layout system according to reflected ceiling plan.

.7 Ensure suspension system is co-ordinated with location of related components.

.8 Install wall moulding to provide correct ceiling height.

.9 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles and speakers.

.10 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.

.11 Interlock or attach dependant on system, to cross member to main runner to provide rigid assembly.

.12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.13 Install access splines to provide 25 percent ceiling access.

.14 Finished ceiling system to be square with adjoining walls and level within 1:1000.

.15 Expansion joints.

.1 Erect two main runners parallel, 25 mm apart, on building expansion joint line. Lay in strip of acoustic tile/board, painted black, 25% narrower than space between 2 'T' bars.

3.2 CLEANING

.1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM F1303-99, Specification for Sheet Vinyl Floor Covering with Backing.

1.2 SAMPLES

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

.2 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, treads, risers edge strips.

1.3 CLOSEOUT SUBMITTALS

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

1.4 EXTRA MATERIALS

.1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 2% of each colour, pattern and type flooring material required for project for maintenance use.

.3 Extra materials to be in one piece and from same production run as installed materials.

.4 Clearly identify each roll of sheet flooring and each container of adhesive.

.5 Deliver to Owner, upon completion of the work of this section.

.6 Store where directed by Owner.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20° for 48 hours before, during and 48 hours after installation.

.2 Install materials of this section only when surfaces and air temperatures have been maintained between 64.4°F (18°C) and 89.6°F (32°C) for 48 hours thereafter. Maintain a minimum temperature of 55.4°F (13°C) after above period.

.3 Ensure that adequate ventilation is provided during installation and curing or materials of this section.

.4 Conduct the tests in accordance with ASTM F710-11 and the following:

.1 Test for moisture vapour transmission in accordance with Section 09 60 05.

.2 Test for surface pH in accordance with Section 09 60 05.

.3 For each test type: Conduct 3 tests for flooring applications up to 1000 square feet in area, and 1 additional test for each addition 1000 square feet of flooring area.

.4 Testing shall be conducted by independent inspection and testing company and in accordance with Section 01 45 00.

.5 Concrete shall be prepared utilizing ASTM F710-11.

.6 In areas that are exposed to intense or direct sunlight, Products shall be protected during the conditioning, installation, and adhesive curing periods, by covering the light source.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Do not dispose of unused sealant and adhesive materials into landfill. Divert materials to municipal hazardous materials depot approved by Consultant.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Architect.

.4 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.5 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

1.7 GENERAL REQUIREMENTS

.1 Read and conform to:

.1 The Project Agreement.

.2 Comply with Division 1 requirements and documents referred to herein.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Subcontractor qualifications: Provide work of this section, executed by competent installers with minimum 10 years experience in application of Products, system and assemblies specified and with approval and training of Product manufacturer. Subcontractor to be approved in writing by manufacturer as a qualified applicator of the manufacturer's flooring system.

.2 Manufacturer qualifications; water jet cutting: Company specializing in water jet cutting with minimum 5 years experience. Submit a list of successful large scale projects using sheet vinyl. Company shall own and operate a water jet machine dedicated to cutting of resilient flooring materials.

.2 Conduct a pre-installation meeting in accordance with section 01 31 19.

.3 Conduct quality control in accordance with Section 01 45 00. Independent inspection and testing company shall attend the pre-installation meeting.

.4 Manufacturer's field review to be in accordance with Section 01 45 00.

1.9 SUBMITTALS

.1 Submit required submittals in accordance with Section 01 33 00.

.2 Product data sheets: Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.

.3 Test reports: Submit test result for moisture vapour transmission and pH testing in accordance with Section 09 60 05.

.4 Samples:

- .1 Submit samples of each type of flooring in each color and pattern and 6" length of transition trim.
- .2 For heat-welding bead, manufacturer's standard-size samples, but not less than long, of each color required.
- .3 Seam samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of sample applied to a rigid backing and prepared by installer for this project.

.5 Shop Drawings:

- .1 Submit shop drawings to show layout treatment at walls, floor drains, and other objects. Indicate details of proposed treatment, where flooring materials meet other floor materials.
- .2 Submit seaming shop drawings to show layout of seams. Indicate details of proposed seaming method, where flooring materials meet other floor materials.

.6 Floor Installation:

- .1 Prior to commencing flooring installation for this room, prepare the floor surface for the installation for acceptance by the Consultant and flooring manufacturer. The Installation shall include the resilient sheet application, edge treatment and relationships to adjoining surfaces.
- .2 Prior to commencing any more work, the flooring installation must be reviewed by the floor manufacturer.

.7 Closeout submittals:

- .1 Submit closeout submittals in accordance with Section 01 77 00.

.8 Maintenance data:

- .1 Provide data sheets for maintenance of flooring for incorporation into maintenance manual.

.9 Maintenance materials:

- .1 Deliver 2% of each color, pattern and type flooring specified, minimum length shall be 15'-0".
- .2 Suitably package for protection and storage, each identified with name of manufacturer and with its type, color. Note date.
- .3 Tag and store where directed by Owner.
- .4 Maintenance materials to be same production run as installed materials.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Package flooring materials and identify contents of each package.

.2 Store materials for minimum of 24 hours immediately before installation at no less than 64.4°F (18°C).

1.11 WARRANTY

.1 Warrant work of this section for a period of 10 years, in accordance with Section 01 78 36.

.2 Provide warranty that material will be free from manufacturing defects for ten (10) years from date of Substantial Completion.

Part 2 Products

2.1 MATERIALS

.1 Resilient Sheet Flooring

.1 **Type RS-01**: Acceptable Product: Polyflor / Polysafe Vogue Ultra PUR, Bisque 4860.

.2 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.3 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.

.1 Acceptable Products by: H.B. Fuller TEC TA 320 Perfect Finish.

.4 Metal edge strips:

.1 Aluminum extruded, smooth, mill finish stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.2 Acceptable Products by: Schluter Systems.

.5 Edging to floor penetrations: type recommended by flooring manufacturer.

.6 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.

2.2 SHEET FLOORING MATERIALS

.1 Sheet vinyl flooring:

.1 2mm heavy duty sheet vinyl flooring with sustainable slip resistance ASTM 1303 (standard specification for sheet vinyl flooring covering with a backing).

.2 ASTM D2047 (wet & dry >0.5).

.3 RRL Pendulum test 36+.

.4 Abrasion resistance Group T.

.5 PUR (polyurethane reinforced) for ease of maintenance.

.6 Floorscore Agbb.

.7 LEED, EPD.

.8 10 year warranty.

2.3 MISCELLANEOUS MATERIALS

.1 Primers: Low VOC adhesive, type in accordance with sheet flooring manufacturer's written installation instructions and compatible with adhesive and substrate.

.2 Adhesives: Low VOC adhesive, type in accordance sheet flooring with manufacturer's written installation instructions and compatible with primers.

.3 Substrate filler; minor patching and filling: Type as recommended by sheet flooring manufacturer and compatible with adhesive, primer and substrate.

.4 Seam construction: Solid colour welding rods (matching each type of flooring colour and pattern) to be later selected by consultant.

.5 Transition trim:

.1 Resilient trim:

.2 Tapered rubber type as manufactured by Ropee to suit site condition for smooth transition. Colour to later selection by consultant from manufacturer's full range. Substitutions: in accordance with Section 01 25 00.

.3 Metal trim: Refer to Section 09 31 00 for metal trim Products from tile to resilient flooring.

.6 Site fabricated flash cove base accessories:

.1 Resilient cove cap: Jognsonite SCC-XX-A or approved alternate, ¾" x 1/8" J-profile, colour to later selection by Consultant.

.2 Plastic filler; for sealing joints between top of wall base or integral cove cap and irregular wall surfaces: Low VOC, plastic filler applied according to flooring manufacturer's recommendations.

.3 Fillet support strip; for integral cove base: minimum radius of 1" of plastic.

.7 Sealant: mildew resilient silicone, colour to match where exposed, in accordance with section 07 92 00.

.8 Floor access covers/drains: in accordance with Divisions 21, 22, and 23.

.9 Water vapour reduction system: in accordance with Section 09 60 05.

2.4 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

2.5 PREPARATION

.1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 Comply with recommendations of ASTM F710-11.

.5 Where concrete substrate exhibits higher than permitted moisture and alkalinity levels, Provide water vapour reduction system to protect moisture sensitive flooring system from the devastating effects of elevated moisture and alkalinity levels/

.1 Water vapour reduction system: Preparation and application in accordance with Section 09 60 05.

.6 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

.7 Alkalinity and adhesion testing: Perform tests and proceed with installation only after substrates pass testing. Document tests performed and submit in writing to consultant.

.8 Fill cracks, holes, and depressions in substrates with trowel-applied levelling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate with no telegraphing, and flush transition when butting to adjacent flooring materials.

.9 At door opening locations where finished flooring is adjacent to weather-stripping or automatic door bottoms provide trowel-applied levelling compound to provide full contact between finished flooring and weather-stripping or automatic door bottoms. Taper trowel-applied levelling compound to transition with adjacent flooring substrate to provide smooth and seamless transition at maximum slope 3:1000 (height to distance) ratio.

.10 Do not install floor coverings until they are same temperature as space where they are to be installed.

.1 Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

.11 Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

.12 Remove chalking and dusting from concrete surfaces with wire brushes.

.13 Preparation of floor substrates to receive flooring including minor feathering of substrate adjacent floor materials of different thickness with cementitious bonding compound to make a flush transition between floor finishes.

.14 Where flooring adjoins thicker floor materials, apply epoxy levelling screed, feather out to make up difference in level between materials.

2.6 APPLICATION: FLOORING

.1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to the outside. Do not let contaminated air recirculate through a district or whole building air distribution system.

.2 To minimize emissions from adhesives, use water-based, solvent-free styrene-butadiene-rubber adhesive for linoleum. Butadiene exposure may cause eye and nose irritation, headaches, dizziness, and vomiting.

.3 Apply low VOC adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.4 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.5 Run sheets in direction of traffic and install according to manufacturer's printed instructions.

.6 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.

.7 Cut flooring neatly around fixed objects.

.8 Continue flooring over areas which will be under built-in furniture.

.9 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.10 Install metal edge strips at unprotected or exposed edges where flooring terminates.

2.7 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

.3 Perform initial maintenance according to the manufacturer’s printed instructions.

.4 Thoroughly clean surfaces in accordance with manufacturer’s recommendations.

.5 Do not wax the floor.

2.8 PROTECTION

.1 Protect new floors from time of final set of adhesive until final inspection. Install suitable protection sheeting, lap joints of material by 150 and seal with non-asphaltic tape.

.2 Prohibit traffic on floor for 48 hours after installation. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

.3 Install floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.

2.9 EXAMINATION

.1 Examine substrate to ensure clean lines, correct level and freedom from cracks, ridges, dusting, scaling and carbonation.

.2 Examine floors in advance of application of flooring to ensure that floors are protected against entry of water and moisture. Perform compatibility test with primer/adhesive and substrate.

.3 Ensure that environmental conditions have been provided as requested and specified.

2.10 SHEET FLOORING APPLICATION

.1 Apply adhesive uniformly and install flooring in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.2 Lay out floor coverings as follows:

- .1 Lay flooring with joints parallel to building lines to produce symmetrical pattern and minimum joints. Use full sheet size to produce minimum joints. Lay sheet flooring centered in corridors, with equal sized sheet to either side of center sheet. Weld all joints. Norder widths minimum 1/3 width of full material.
- .2 Install in accordance with Consultant's floor pattern.
- .3 Maintain uniformity of floor covering direction.
- .4 Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6" away from parallel joints in floor covering substrates.
- .5 Match edges of floor coverings for colour shading at seams.
- .6 Avoid cross seams.

.3 Cut pieces to length allowing approximately 3" excess for trimming.

.4 Cut the first piece to fit by freehand knife, direct scribing or pattern scribing method.

.5 Remove ½" off the factory seam edge using an edge trimmer or straight edge and knife.

.6 Position all remaining sheets so that the top sheet overlaps the previous sheet by ½". Trim ½" off opposite seam edge using an edge trimmer or straight edge and knife.

.7 Fold back the sheets and apply the adhesive to the subfloor and allow proper open time.

.8 Install flooring to entire area indicated or scheduled, including cover plates occurring within finished floor areas. Maintain overall continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Cut flooring to floor drains occurring within finished floor areas.

.9 Roll the flooring in both directions using 150 lb three-section roller. (Stay approximately 3" from the seam.)

.10 Cut and fit neatly around fixed or excessively heavy objects.

.11 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

.12 Install edge strips at unprotected or exposed edges where flooring terminates.

.13 Flooring installation shall not show telegraphing of substrate. Flooring installation shall be homogenous free of substrate lines, pockets, bumps and unevenness.

.14 Heat-welded seams:

.1 Weld seams in accordance with ASTM F1516-13.

.2 Wait minimum of 24 hours after flooring installation before grooving and heat welding seams.

.3 Prepare, weld, and trim seams to produce flat surfaces flush with adjoin floor covering surfaces.

.4 Rout joints to approximately 2/3 of the thickness of the material and use welding bead to permanently fuse sections into a seamless floor covering. Groove shall be between 8" and 0.138" wide.

.5 Using a weld plate and skiving knife to make first cut and allow weld rod to fully cure to room temperature.

.6 Using a skiving knife only, finish the trimming of the remainder of the weld. The finish should be smooth and on the same level as the flooring.

.7 Trimming of welded joint while warm is not permitted unless final trimming is performed after weld has cooled to flooring temperature. Excess weld shall be removed using a heated standard putty knife.

.8 Roll the seam area with 100 lb) three-section roller.

.9 Maximum variation of welds from plane or from straight ¼" in 10 ft length using a 10 ft straight edge.

2.11 INSTALLATION- TRANSITION TRIM

.1 Coordinate transitions with work of other sections and install transition trim to transitions between sheet flooring and adjacent flooring.

.2 Allow coiled resilient material to lay flat for at least 24 hours at 69.8°F(21°C) prior to installation.

.3 Set to ensure installation is free of gaps.

.4 Install in longest lengths possible.

.5 Install straight to maximum allowable variation of 1/8" over 10'-0"

.6 Scribe and fit to obstructions.

.7 Fit joints tightly, straight and vertical as applicable and not less than 24" from corners.

.8 Cope mitre corners.

.9 Metal trim:

.1 Refer to Section 09 31 00 for metal trim products from tile to resilient flooring.

.2 Tile and resilient flooring shall have flush transition with metal trim.

.3 Apply levelling screed to feather out to make difference in level between floor materials.

2.12 WALL BASE INSTALLATION

.1 Install wall bases in accordance with manufacturer's instructions.

.2 Site fabricated flash cove wall base; height to 100mm to align with adjacent Lab Casework:

- .1 Provide a fillet support strip.
- .2 Terminate top of coving with resilient cove cap.
- .3 Taper/trim cove former to reduce radius to less than 13 at door frame or similar abatement conditions.
- .4 Seal trim to wall substrate with sealant bead, colour to consultant's selection.

.3 For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

.4 Install straight and level to variation of 1:1000.

.5 Scribe and fit to door frames and other obstructions.

.6 Joints shall be tightly fitted, straight and vertical, and not less than 24" from corners.

.7 Provide joints in base over substrate control joints.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Environmental Protection Agency (EPA)
- .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

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

.4 Master Painters Institute (MPI)
- .1 MPI Architectural Painting Specifications Manual, 2004.

.5 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 QUALITY ASSURANCE

.1 Qualifications:
- .1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
- .3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Pre-Installation Meeting:
- .1 Convene pre-installation meeting one week prior to beginning on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Coordination with other building subtrades.
  - .4 Review [manufacturer's] installation instructions and warranty requirements.

.3 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.3 SCHEDULING

.1 Submit work schedule for various stages of painting to Architect for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Architect for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.4 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 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, and clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
.1 3 mm plate steel for finishes over metal surfaces.
.2 13 mm white birch plywood for finishes over wood surfaces.
.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
.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.

1.5 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 Architect requirements for delivery and storage of extra materials.

1.6 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 fire extinguisher adjacent to storage area.
  .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:
  .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan (WMP).
  .4 Separate for reuse and recycling and place in designated containers Steel, Metal, and Plastic waste in accordance with Waste Management Plan (WMP).
  .5 Place materials defined as hazardous or toxic in designated containers.
  .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, and Regional and Municipal regulations.
  .7 Ensure emptied containers are sealed and stored safely.
  .8 Unused paint and coating materials must be disposed of at official hazardous material collections site as approved by Architect.
  .9 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
  .10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
  .11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
  .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
  .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
  .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
.13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
.14 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by employees, or organizations for verifiable re-use or re-manufacturing.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:
  .1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  .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 Architect 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 Authority and product manufacturer, perform no painting when:
    .1 Ambient air and substrate temperatures are below 10 degrees C.
    .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
    .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
    .4 The relative humidity is under 85 % or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
    .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
    .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
  .2 Perform painting work when maximum moisture content of the substrate is below:
    .1 Allow new concrete and masonry to cure minimum of 28 days.
    .2 15 % for wood.

.3 12 % for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Architect such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Provide paint products meeting MPI "X-Green" Performance Standards.

.2 Paint materials listed in the MPI Green Approved Products List (APL) are acceptable for use on this project.

.3 Use MPI listed materials having minimum E3 rating where indoor air quality (odour) requirements exist.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Provide paint materials for paint systems from single manufacturer.

.1 Acceptable Manufacturers:

.1 Benjamin Moore.

.2 CAFCO Industries.

.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.

2.2 COLOURS

.1 Selection of colours from manufacturer's full range of colours.

.2 Where specific products are available in restricted range of colours, selection based on limited range.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

.4 Colour Schedule, based on Benjamin Moore.

.1 **PT-01:** Wedding Veil, 2125-70 (Field Colour)

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Architect 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 Level Category:	Units @ 60 Degrees:	Units 85 Degrees:
G1 – Matte finish (Flat)	0 to 5	Max. 10
G2 – Velvet finish	0 to 10	10 to 35
G3 – Eggshell finish	10 to 25	10 to 35
G4 – Satin finish	20 to 35	Min. 35
G5 – Semi-gloss finish	35 to 70	
G6 – Gloss finish	70 to 85	
G7 – High gloss finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete vertical surfaces: including horizontal soffits:
- .1 INT 3.1C - High performance architectural latex G3 finish.

.2 Concrete horizontal surfaces: floors and stairs:
- .1 INT 3.2C - Epoxy G5 finish.

.3 Concrete masonry units: smooth and split face block and brick:
- .1 INT 4.2D - High performance architectural latex G3 finish.

.4 Structural steel and metal fabrications: columns, beams, joists:
- .1 INT 5.1W - Alkyd G1 finish (over quick dry shop primer).

.5 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):
- .1 INT 5.2D - High heat resistant coating, maximum 593 degrees C.

.6 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
- .1 INT 5.3M - High performance architectural latex G5 finish.

.7 Dressed lumber: including doors, door and window frames, casings, mouldings:
- .1 INT 6.3H - Clear lacquer G5 finish.

.8 Wood paneling and casework: partitions, panels, shelving, millwork:
- .1 INT 6.4Y - Clear lacquer G5 finish.

.9 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
- .1 INT 9.2B - High performance architectural latex G2 and G3 finish.
  - .1 Ceilings: G2 finish.
  - .2 Walls: G3 finish.

2.6 SOURCE QUALITY CONTROL

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

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 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 Architect 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 Wood: 15 %.

3.4 PREPARATION

.1 Protection:
- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Architect.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation:
- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Architect.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
- .1 Remove dust, dirt, and other surface debris by wiping with dry, clean cloths.
- .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Architect.

3.5 APPLICATION

.1 Method of application to be as approved by Architect. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.
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.

.2 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.3 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 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.

.7 Finish inside of cupboards and cabinets as specified for outside surfaces.

.8 Finish closets and alcoves as specified for adjoining rooms.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRIC AL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

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

3.8 FIELD QUALITY CONTROL

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Architect and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Field inspection of painting operations to be carried out be independent inspection firm as designated by Architect.

.4 Advise Architect when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.5 Cooperate with inspection firm and provide access to areas of work.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Architect.

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 Architect. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Architect.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 22 42 01 – Plumbing Specialties and Accessories.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A208.1-2009, Particleboard.

.2 ASTM International

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M-11b, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

.3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 CSA International

.1 CSA O112.10-[08], Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

.4 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.5 National Electrical Manufacturers Association (NEMA)

.1 NEMA LD 3-2005, High-Pressure Decorative Laminates (HPDL).

.6 SEFA 8: Laboratory Furniture – Casework, Shelving and Tables Guidelines Science Equipment and Furniture Association (SEFA)

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 steel laboratory casework and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Details of laboratory casework construction and related and dimensional position, with sections.

.2 Location of each casework unit.

.3 Location of steel leg support.

.4 Location for roughing-in of plumbing, including sinks, faucets, strainers and cocks and electrical services.

.4 Samples:

.1 Submit duplicate samples of:

.1 Countertop material, 300 x 300 mm including external corner.

.2 Standard colour of cabinet finish on 300 x 300 mm steel sheet.

.3 Cabinet hardware.

.4 Plumbing brass and electrical outlets.

.2 Submit one base cabinet complete with cupboard and drawers minimum 600 mm long, including specified bench top, splashback, end return and curb shelf.

.3 Submit wall case minimum 600 mm long.

.5 Test Reports:

.1 Include test reports by independent testing laboratories indicating results of furniture finish tests.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect steel laboratory casework from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 PROJECT SITE CONDITIONS

.1 Building must be enclosed (windows and doors sealed and weather-tight);

.2 An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place;

.3 Adjacent and related work shall be complete;

.4 Ceiling, overhead ductwork and lighting must be installed;

.5 Site must be free of any further construction such as “wet work”;

.6 Required backing and reinforcements must be installed accurately and the project must be ready for casework installation.

1.6 WARRANTY

.1 Furnish a written warranty that work performed under this section shall remain free from defects as to materials and workmanship for a period of two (2) years from date of shipment. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner.

.2 Defects include, but are not limited to:

.1 Ruptured, cracked, or stained coating

.2 Discoloration or lack of finish integrity

.3 Cracking or peeling of finish

.4 Slippage, shift, or failure of attachment to wall, floor, or ceiling

.5 Weld or structural failure

.6 Warping or unloaded deflection of components

.7 Failure of hardware

Part 2 Products

2.1 MATERIALS

.1 Galvanized steel sheet: commercial quality to ASTM A653 with Z275 zinc coating.

.2 Sheet Steel: Mild steel, cold rolled furniture grade to requirements of ASTM A1008/A1008M, Grade C or higher, with smooth surfaces to furniture quality.

.3 Stainless Steel:

.1 Sheet: ASTM A240, type 304 or 316 alloy.

.2 Finish: All surfaces shall be painted or plated, whether they are exposed or not. Paint is to be a chemically resistant baked on epoxy powder coat enamel, conforming to CSi Lab Systems standards.

.4 Sealants: One component, RTV silicone sealant. Color to suit application and to SCAQMD Rule 1168.

.5 Acceptable Manufacturer: CSi Lab Systems.

2.2 SYSTEM DESCRIPTION

.1 The laboratory cabinet system along wall to be floor mounted with upper cabinets fasten to wall. The island laboratory cabinet system to be on caster wheels.

2.3 CASEWORK CONSTRUCTION

.1 Materials and Thickness: Use the following minimum steel thicknesses for furniture manufacturing:

.1 3mm (11 Ga) leveling bolt gusset plates.

.2 1.9mm (14 Ga) drawer slides and side suspension channels.

.3 1.5mm (16 Ga) for tubular rails, legs for tables, gusset plates, cabinet top and intermediate horizontal rails.

.4 1.2mm (18 Ga) for door and drawer fronts, cabinet floor, cabinet sides, vertical front members, service cover panels, table and kneehole frames, front rails, gable legs and dust caps, false panels, furring and filler panels.

.5 0.9mm (20 Ga) for drawer backs, door backs, vertical closure channel, removable back panels, shelves, drawer bodies, drawer dividers, bin bodies, and pull-out shelves.

.2 Base Cabinet:

.1 Cabinets shall be constructed of prime 1.2mm steel for the sides, backs, and toe space.

.2 25mm X 1.2mm steel tubing shall be used for the top front and back rails.

.3 Each front joint is to be welded and ground flush to provide a smooth surface.

.4 Four corners are to be fitted with a stamped and welded 14 gauge leveling gusset plate, and a plated leveling screw.

.5 Leveling screws are provided with a slot for easy adjustment, and non marking nylon glides.

.6 Removable back panels shall be furnished on all cabinets. Cabinet bottom will be panned up to contain spills and removable for easy cleaning and maintenance.

.3 Cabinet Hardware:

.1 Recessed Pulls: Provide recessed pull from extruded aluminum, colour satin black.

.2 Door Hinges: Provide five knuckle-type barrel door hinges of 1.9mm (14 Ga) steel screwed into door and fastened to cabinet side stile with two counter sunk #8-32 zinc plated machine screws & captive serrated tooth washer nuts. Standard hinge finish shall be bright chrome.

.4 Drawers:

.1 Drawer bodies shall be 0.81mm construction, fully coved on all four sides horizontally and formed out of one sheet of steal.

.2 Drawers shall operate on full extension, ball bearing, zinc plated, drawer suspension rated to withstand 10,000 cycles at 100 lbs

.5 Shelves:

.1 Shelves shall be constructed of 1.2mm steel, with channels formed on both the front and back edges.

.2 K & V shelf clips are made from 1.9mm steel and are to be adjustable vertically in 25mm increments.

.6 Fabricated Accessories:

.1 All accessories required for specific installations shall be fabricated and finished to the same material.

.7 Wall Cabinets:

.1 Wall Cabinets shall be made to the same quality standards as base units. Material used, as noted above.

.2 Shelve hangers are to be constructed of 1.9mm steel, and to easily adjust vertically in 25mm increments.

.3 Shelves in wall cabinets are to be constructed with channel type fronts and backs, as well as flanged ends with nylon button glides.

.4 All wall units are to be furnished with hanger brackets for ease of installation

.8 Table Set

.1 Fabricate tables from metal skirting panels formed into 95mm channel sections, and welded into a rigid frame construction. Notch corners and reinforce to receive 50mm square metal tubular legs bolted securely in place. Provide leg with 10mm leveling devices and slip-on type black PVC shoes.

.2 Construct mobile tables the same as standard laboratory tables, except for the table legs which shall be designed to receive swivel casters.

.3 Caster tires shall be made of non-marring type urethane tires in gray color.

.4 Table Bracing: Table bracing members shall consist of 25mm x 50mm removable tube members, installed between legs according to two table bracing configurations. Removable bracing shall be mechanically fixed to concealed "U" shaped mounting tabs that are integral with each leg. Where called for, provide table braces welded to legs as a fixed rigid bracing system.

.5 Table Drawers: Where called for, drawers located in table aprons shall be supplied in a maximum width of 381mm with two drawers supplied in tables 1219mm and wider. Drawer suspension shall be with 25mm nylon ball bearing rollers and self closing action, and custom manufactured 1.5mm (16 Ga) suspension system.

.9 Leg Sets:

.1 Leg sets shall consist of two 50mm square metal tubular legs complete with steel bolt levellers and slip on PVC shoes.

.2 Legs, when secured together, shall be provided with 25mm x 50mm steel rail centred 135mm up from bottom of leg.

.3 Top of legs, both standing and sitting heights, shall have a 1.9mm (14 Ga) triangular mounting plate welded in position for securing to underside of countertop.

.10 Apron Drawer Assembly:

.1 Apron drawer assembly shall be fabricated from metal channel shaped skirting panels of modular widths the same as standard base cabinets. Rails 95mm high channel ends shall be turned to fit into end mounting brackets. Drawer suspension framing shall be mechanically fixed to channels, welded integrally with front and back channel sections formed into a rigid one-piece frame.

.2 Where called for, drawers located in table aprons shall be supplied in a maximum width of 381mm with two drawers supplied in tables 1219mm and wider. Drawer suspension shall be with 25mm nylon ball bearing rollers and self-closing action, custom manufactured 1.5mm (16 Ga) suspension system.

.3 Front Rails:

.1 Front rail units shall be fabricated from a single metal channel-shaped skirting panel in modular widths the same as standard base cabinets. Channel ends shall be turned to fit into end mounting brackets. Rails are 95mm high.

.4 Gable Legs:

.1 Gable legs shall consist of two telescoping side panels totally enclosed on all four sides and welded to form a strong rigid unit.

.2 Gables shall be 38mm thick with 75mm x 100mm toe space and designed to be secured in a concealed fashion to the adjacent kneehole assembly or to the bench top material.

.3 Gable legs shall be provided with two leveling devices.

.5 Filler Panels:

.1 Fabricate front filler panels complete with flanges on both sides and a 75mm x 100mm toe space along the working face.

.2 Scribe filler panels shall be flanged on one side and flat on the other, to be cut on jobsite to suit wall conditions, and shall fit into double angles secured to the wall. No visible mounting screws permitted.

.3 Corner filler panels shall be a two-piece construction, one fixed panel and the other a variable panel to facilitate room dimensions. Each shall have flanges and an integral 75mm x 100mm toe space filler to interlock with its counterpart.

.4 End closing filler panels shall be flanged on one side 25mm and secured to back of cabinet. The edge extending to wall shall be flat and fit into a double angle secured to wall. No visible mounting screws permitted.

.6 Dust Cap:

.1 Dust caps shall be fabricated from 1.2mm (18 Ga) steel, and shall mount flush with the front edge of the cabinet and extend back at an angle of 30 degrees to a point perpendicular to the rear of the cabinet. Ends shall be finished and flanged so as to allow attachment to the cabinet below.

.11 Steel Furniture Finish: Powder Coated Paint Finish.

2.4 COUNTERTOP MATERIALS

.1 Solid plastic laminate: to NEMA LD 3, 19mm thick, black colour matt finish, acid resistant laboratory grade, Class 2 lab grade.

.2 Laminated plastic backing sheet: supplied by same manufacturer as facing sheet; same thickness and colour as face laminate.

.3 Particleboard core: to ANSI A208.1, Grade urea formaldehyde free sanded faces, of thickness indicated.

.4 Sealer: water resistant sealer or glue recommended by laminate manufacturer.

.5 Draw bolts and splines: as recommended by fabricator.

2.5 COUNTERTOP FABRICATION

.1 Fabricate laboratory countertops and splashbacks as indicated.

.2 Fabricate countertop and splashback sections in as long a length as practicable.

.3 Cut holes for fittings, accessories, and equipment.

.4 Round or chamfer exposed edges and corners of cutouts.

.5 Apply plastic laminate to core faces, backs and edges under pressure and heat.

.6 Connect steel reinforced tops to cabinets with bolts.

.7 Apply metal tops to waterproof particle board or plywood core using contact adhesive.

.8 Finish exposed edges and surfaces in same manner as specified for working surface of countertop material.

.9 Make allowances around periphery and where fixed objects pass through or project into countertop material to permit normal movement without restriction.

.10 Joints: field welded or mechanical watertight.

2.6 LABORATORY SINK

.1 Laboratory sinks are to be molded of a monolithic epoxy resin.

.2 Laboratory sink to be produced with a special curing stage that ensures a complete chemical reaction throughout the material resulting in a uniform work surface.

.3 Laboratory sink to be drop in sink, and to be double bowl.

2.7 FABRICATION

.1 Fabricate steel laboratory casework to details.

.2 Align end panels, top rails, bottoms and vertical posts, at intersections in same plane, without overlap.

.3 Grind exposed welds flush and smooth, burnish to match adjacent surfaces.

.4 Use 2 mm thick metal for tapping strips, gussets, drawer runners and hinge reinforcements.

.5 Use 1.5 mm thick metal for cabinet top rails, hanging brackets, frame and base.

.6 Use 1.2 mm thick metal for cabinet door outer pan and slide support, cross rails, cabinet fronts, scribe strips and fillers.

.7 Use 0.9 mm thick metal for drawer and door inner panels, drawer bodies and back panels to cabinets.

2.8 SCHEDULE

.1 The following lists the laboratory cabinet unit types, Model Number and width, as indicated on the drawings. Refer to drawings for right and left handed hinge locations:

.2 Base Cabinets

.1 Type LC-01: Door/Drawer Unit, Model No. B2930-220, 760mm wide,

.3 Wall Cabinets

.1 Type LC-02: Hinged door unit, Model No. W3036-2SH, 760mm wide,

.4 Sink Base Cabinets:

.1 Type LC-03: Door/Drawer Unit, Model No. B3530-20, 760 wide.

.5 Lab Counters:

.1 Type LC-04: Drawer Units, Model No. A044222-002, (Double drawer

.2 Type PL-01: Solid plastic laminate: to NEMA LD 3, 19mm thick, black colour matt finish, acid resistant laboratory grade, Class 2 lab grade., Throughout the following rooms:

.6 Lab Integrated Sink:

.1 Type EP-01: Epoxy laboratory sinks molded monolithic epoxy resin. Sink Colour, Black Onyx.

.7 Peg Board:

.1 Type EP-02: Epoxy Peg Board Colour, Black Onyx.

2.9 Finishes

.1 Factory, powder-coat paint system, cabinets, frame, drawers and door fronts:

.1 Colour: CSi Canadian Scientific Lab Systems: Wedgewood Blue

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for steel laboratory casework installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant 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 Consultant.

3.2 INSTALLATION

.1 Install laboratory casework plumb with countertops level to 1.5 mm in 3 m.

.2 Level base cabinets by adjusting levelling screws.

.3 Fit closure strips and scribe to irregularities of adjacent surfaces, maximum gap opening 0.5 mm.

.4 Support wall cabinets on continuous galvanized steel hanging brackets.

.5 Bolt adjoining cabinets together, maximum width of joint 1 mm.

.6 Apply small bead of sealant at junction of countertop and adjacent wall finish.

.7 After installation, adjust operating hardware.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

.1 Touch up marred or abraded finished surfaces.

.2 Wipe down surfaces to remove fingerprints and markings.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by steel laboratory casework installation.

END OF SECTION

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ENVIRONMENT AND CLIMATE CHANGE CANADA

335 River Road, Lab 124 Recapitalization
Project No.: RR-222

Electromechanical Specifications 7323-011-00

June 1st, 2017

FOR TENDER

2017-06-01
Mechanical

2017-06-01
Electrical

This document should not be used for construction purposes

Table of Contents

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Sections of Divisions 21, 22, 23 and 25.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for equipment and accessories prescribed herein and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:

.1 Drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for equipment and accessories prescribed herein for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93-Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Departmental Representative will provide 1 copy of mechanical drawings. Provide sets of drawings as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to record drawings to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 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 accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect equipment, accessories and materials from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation of materials 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 PAINTING REPAIRS AND RESTORATION

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

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - 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.

3.5 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Entire System.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Departmental Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

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

3.7 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

1.2 REFERENCE STANDARDS

.1 National Fire Prevention Association (NFPA)

.1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.

.2 NFPA 25-2013, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

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 data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

.2 The Contractor is responsible to hire a professional engineer specialized in fire protection, entitled to practice in the Province of Ontario, Canada, to produce, sign and seal complete installation drawings and specifications, in accordance with NFPA 13-2013.

.3 Seismic installation drawings and specifications for sprinkler systems will have to be sealed and stamped by a professional engineer entitled to practice in the Province of Ontario, Canada.

.4 Test reports:

.1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

.7 Field Quality Control Submittals:

.1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 CLOSEOUT SUBMITTALS

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

.2 Provide Contractor's Material and Test Certificate for aboveground piping, as well as other deliverables for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, in accordance with NFPA 13.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in wet sprinkler systems with documented experience and approved by manufacturer.

.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

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

.2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.7 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:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by pipe schedules for light hazard occupancy.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for light hazard occupancy.

.2 Uniformly space sprinklers on branch.

.7 Water Distribution:

.1 Make distribution uniform throughout the area in which sprinkler heads will open.

.8 Density of Application of Water: As identified

.9 Sprinkler Discharge Area: As identified

2.2 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.

.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.

.2 Perform welding in shop; field welding will not be permitted unless otherwise indicated by Departmental Representative.

.3 Conceal piping in areas with suspended ceiling.

2.3 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Ferrous: to NFPA 13.

.2 Fittings and joints to NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.

.2 Provide threaded or grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

.3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.

.4 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32mm and larger.

.5 Fittings: ULC approved for use in wet pipe sprinkler systems.

.6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.

.7 Side outlet tees using rubber gasketted fittings are not permitted.

.8 Sprinkler pipe and fittings: metal.

.3 Pipe hangers:

.1 ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Sprinkler Head Type:

.1 Pendant chrome glass bulb type.

.3 Provide nominal 1.2cm orifice sprinkler heads.

.1 Release element of each head to be of temperature rating suitable for specific application.

.2 Provide polished chromium-plated pendent sprinklers below suspended ceilings.

.3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.

.4 Deflector: not more than 75 mm below suspended ceilings.

.5 Ceiling plates: not more than 25 mm deep.

.6 Ceiling cups: not permitted.

2.5 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.

.1 Firmly pack space with mineral wool insulation.

.2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass.

.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide hot-dip galvanized steel sleeves.

.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide 0.61 mm thick galvanized steel sheet.

2.6 ESCUTCHEON PLATES

.1 Provide one piece type metal plates for piping passing through ceilings and walls in exposed spaces.

.2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

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, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

3.3 PIPE INSTALLATION

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

3.4 ELECTRICAL CONNECTIONS

.1 Electrical work associated with this section by division 26.

3.5 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

.1 Notify Contracting Officer in writing at least 15 days prior to connection date.

.2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.

.3 Bolt sleeves around main piping.

.4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.

.5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

3.6 FIELD PAINTING

.1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:

.1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.

3.7 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 1380 kPa for a 2hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with contract requirements.

.5 Furnish appliances, equipment, instruments, connecting devices and personnel for tests.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

.2 Site Tests:

.1 Field test system in accordance with NFPA 20. Testing shall include:

.1 Verification of proper installation and system initiation.

.2 Verification of the sequence of alarm systems.

3.8 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 05 – Installation of Pipework.

1.2 REFERENCE STANDARDS

.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.

.2 ASTM International Inc.

.1 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).

.2 ASTM D4101-14e2 – Standard Specification for Polypropylene and Extrusion Materials.

.3 ASTM D2247-15 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

.4 ASTM D2657-07(2015) – Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

.3 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Research Council (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop drawings: submit in accordance with Section 01 33 00 – Submittal Procedures.

.3 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.

.4 Closeout Submittals:

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Handle and dispose of hazardous materials in accordance with, TDGA, Regional and Municipal, CEPA regulations.

Part 2 Products

2.1 DOMESTIC WATER PIPING

.1 Piping: hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 Fittings

.1 Cast bronze threaded fittings, Class 250: to ANSI/ASME B16.15.

.2 Cast copper, solder type: to ANSI/ASME B16.18.

.3 Joints

.1 Solder: tin-antimony copper silver.

.2 Teflon tape: for threaded joints.

.3 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

.4 Ball valves

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01- Valves - Bronze.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01- Valves - Bronze.

2.2 LABORATORY PIPING

.1 Piping

.1 The de-ionized water piping shall be manufactured from natural unpigmented virgin polypropylene copolymer compounds as identified in ASTM D4101.

.2 All pipe shall be Schedule 80 (IPS) conforming to ASTM D2247.

.2 Fittings

.1 Fittings shall be manufactured from natural unpigmented virgin polypropylene copolymer compound as identified in ASTM D4101.

.2 All fittings shall be Schedule 80 conforming to ASTM D2657.

.3 Joints

.1 Threaded joints shall conform to ASTM D2657 and be complete with an elastomeric face seal, snap ring and nut. Connections between pipes and fittings are to be made in accordance with the Manufacturer's instructions.

.2 All components requiring service and/or replacement (including isolation ball valves, etc) shall be "True-Union" connections.

.4 Ball Valve

.1 Material

.1 The valves shall be manufactured from natural unpigmented virgin polypropylene copolymer compound as identified in ASTM D4101.

.2 Pressure Tested

.1 All valves shall have been pressure tested in both the open and closed positions by the manufacturer.

.3 Pressure Rating

.1 Valve shall be rated at 1054 kPa at 23 ^{o}C.

.4 Markings

.1 All valves shall be marked to indicate size, material designation, and manufacturers name or trade mark.

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 applicable code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05- Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Flush out system prior to returning to operation.

.8 When CWS and HWS piping are installed under counters, piping distribution is to be installed as tight to the underside of the counter as possible.

3.3 VALVES

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

3.4 PRESSURE TESTS

.1 Test pressure: greater of 1 time maximum system operating pressure or 860 kPa.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

3.6 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Certificate of static completion has been issued.

.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 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.7 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05- Installation of Pipework.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 05- Installation of Pipework.

1.2 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM B32, Standard Specification for Solder Metal.

.2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA-B125.3, Plumbing Fittings.

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

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 adhesives, 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.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground vent Type DWV to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.3.

.2 Solder: tin/antimony 95/5, to ASTM B32.

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 In accordance with Section 23 05 05- Installation of Pipework.

.2 Install in accordance with all applicable codes and local authority having jurisdiction.

3.3 PERFORMANCE VERIFICATION

.1 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 05 – Installation of Pipework.

1.2 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM F1673 – 10(2016) – Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste.

.2 ASTM D3222 – 05(2015) – Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.

.3 ASTM B117-16 – Standard Practice for Operating Salt Spray (Fog) Apparatus.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-Series B1800-06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015(NPC).

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 piping and adhesives, 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 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 For drainage piping:

.1 Schedule 40 polypropylene waste piping manufactured to the dimensions and tolerances of ASTM F1673. The material will conform to ASTM D3222. Pipe and fittings shall bare the ULC label for flame spread and smoke development.

2.2 JOINTS

.1 Pipe and fittings will all be plain end and shall be joined using no-hub couplings. Each coupling will have an outer band of 300 series stainless steel with 5/16” bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117. The joints will conform to the requirements of ASTM F1673.

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 In accordance with Section 23 05 05- Installation of Pipework.

.2 Install in accordance with all applicable codes and local authority having jurisdiction.

3.3 TESTING

.1 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Test to ensure traps are fully and permanently primed.

.2 Ensure fixtures are properly anchored, connected to system and effectively vented.

.3 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP).

.1 IPMVP 2007 Version.

.2 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with 01 33 00 – Submittal Procedures.

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

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEDIMENT INTERCEPTOR (SI.1)

.1 Polypropylene soil and sediment interceptor tank, minimal dimensions 400 x 400 x 400, for floor mount application.

.2 Polypropylene construction with double welds for all seams and joints.

.3 Removable solid basket constructed of 6 mm polypropylene with lifting handle and perforated defusing screens.

.4 Top lid constructed of 19 mm polypropylene complete with gasketing and hardware to secure lid to tank body.

.5 Internal baffle on outlet opening with integral vent.

.6 50 mm inlet and outlet opening.

.7 Flow rate: 30 GPM.

2.2 BACK FLOW PREVENTERS

.1 Double check valve assembly backflow preventer to CSA B.64.5.

.2 NSF 61/ANSI 372 compliant.

.3 NPS 19 mm (¾") to NPS 50 mm (2"): bronze body, stainless steel trim, rubber discs and water tight seats and ball test valves. Maximum pressure 1200 kPa.

2.3 VACUUM BREAKERS

.1 Dual check vacuum breakers for laboratory faucets to CSA B64.7

.2 NSF 61/ANSI 372 compliant.

.3 Brass body construction with polished chrome finish, stainless steel working parts and durable rubber diaphragm and disc. Primary check valve with soft disc which seats against a soft rubber mating part. Secondary check valve with a soft disc-to-metal seating. Maximum pressure 1034 kPa.

2.4 STRAINERS

.1 860 kPa, cleanable Y type with 20 mesh, bronze or stainless steel removable screen.

.2 NSF 61/ANSI 372 compliant

.3 NPS 2 and under, bronze body, screwed ends, with brass cap.

2.5 EMERGENCY SHOWER (ES.1)

.1 Combination showerhead and eyewash.

.2 ABS plastic showerhead with stay open chrome plated valve activated by stainless steel pull rod.

.3 Stainless steel eye washbowl with stay open chrome plated valve activated by either push flag or foot treadle.

.4 Thermostatic mixing valves: high and low manifold pre-assembled system including low flow and high flow thermostatic valves, piping, manifold, unions, angle check stops on both valves, integral wall supports, adjustable high temperature limit stop, thermometers. Supply temperature to showers: 35 °C (95 °F).

Part 3 Execution

3.1 EXAMINATION

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

3.3 INSTALLATION

.1 Install in accordance with all applicable codes and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.4 SEDIMENT INTERCEPTORS

.1 Install with sufficient space, as indicated, for maintenance.

3.5 START-UP

.1 Provide continuous supervision during start-up.

3.6 TESTING AND ADJUSTING

.1 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.2 Grease interceptors:

.1 Test, using manufacturer's recommended procedures and materials.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

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

3.8 PROTECTION

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

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 22 13 18 –Drainage, Waste and Vent Piping – Plastic.

.2 Section 22 42 01 – Plumbing Specialties and Accessories.

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 Canada (NRC)

.1 National Building Code of Canada 2015(NBC).

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, labelled with manufacturer's name, address.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.2 Exposed plumbing to be chrome plated.

.3 Number, locations: architectural drawings to govern.

.4 Trim to be product of one manufacturer.

2.2 LABORATORY SINKS.

.1 Sink: Refer to architectural casework.

.2 Trim: Deckmount mixing faucet with swivel spout, 2 hole installation at 70 mm centers, brass body chrome plated, with vandal resistant dual shanks, chrome plated brass reneable seats, two arm metal handle, CW/HW indexed, 300 mm height gooseneck spout with 150 mm reach and laboratory faucet vacuum breaker in accordance with Section 22 42 01 – Plumbing Specialties and Accessories.

.1 Hot and cold water supplies to each fixture: Chrome plated flexible supply pipes each with handwheel stop, reducers, escutcheon.

.3 Laboratory de-ionized trim: Deckmount pure water faucet with 150mm reach heavy duty rigid brass goosneck, chrome finish, forged brass body, flexible diaphragm seat and double action spring loaded handle for self-closing and full lock open operation on built-in serated nozzle. All components to be lined with inert material to prevent contact of water and metal parts.

.4 Waste:

.1 In accordance with Section 22 13 18 – Drainage, Waste and Vent Piping - Plastic.

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 Coordinate laboratory sink faucet installation with Depertmental Representative.

.2 Mounting heights:

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

.2 Physically handicapped: to comply with most stringent of either NBC or CAN/CSA-B651.

3.3 ADJUSTING

.1 Adjustments:

.1 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.2 Checks:

.1 Vacuum breakers, backflow preventers: operation under all conditions.

3.4 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 84 00- Firestopping.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 NOT USED

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 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 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, 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 19 gate or ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.8 Install, except where indicated, to permit separate thermal insulation of each pipe.

.9 Group piping wherever possible.

.10 Ream pipes, remove scale and other foreign material before assembly.

.11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.12 Provide for thermal expansion as indicated.

.13 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball or gate valves at branch take-offs for isolating purposes except where specified.

3.6 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Sizes: 6mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.4 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.5 Sealing:

.1 Ensure no contact between copper pipe or tube and sleeve.

3.7 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.

3.8 PREPARATION FOR FIRE STOPPING

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

.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.

3.9 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.10 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

3.11 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.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 A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.6 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

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, 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.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized or painted with zinc-rich paint after manufacture.

.2 Use hot dipped galvanizing process or electro-plating galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 50 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.

.1 Rod: 9 mm UL listed or 13 mm FM approved.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 50 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, FM approved or ULC listed.

.4 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 22mm or 28mm rod.

.5 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated or epoxy coated steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.6 Adjustable clevis: material to MSS SP69 ULC listed or FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.7 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.8 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.

2.4 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.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.8 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel.

.2 Submit structural calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.5 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 all applicable code and authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

.4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.5 Within 300mm 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	

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Install hangers at concentrated loads to eliminate high stress concentrations on the pipe. Should this be impractical, the pipe must then be supported immediately adjacent to the load.

.5 Install hangers at changes in direction as close as possible to the fitting to avoid introducing excessive torsional stresses into the system.

.6 Hangers should provide as much bearing surface as possible. Sharp supports or sharp edges on supports shall not be used.

.7 For piping having an operating fluid temperature of 18°C or less, install saddles or hangers on top of insulation over prefabricated insulation shields for each saddle and/or support.

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 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

.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.

3.8 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.

.3 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00- Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Submit shop drawings in accordance with Section 01 33 00- Submittal Procedures.

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada and hired by the Contractor. The shop drawings must also include a report on the evaluation and mitigation of seismic effects related to the seismic force resisting systems

.2 The hired Professional Engineer shall demonstrate recognized expertise in seismic protection. Contractor shall provide his contract details no more than two (2) weeks after contract signature.

.3 Provide separate shop drawings for each isolated system shop drawings complete with performance and product data.

.4 Provide detailed drawings of seismic control measures for equipment and piping.

.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 The Professional Engineer who prepared the evaluation and mitigation of seismic effects report shall inspect the work related to the seismic force resisting systems.

.3 Obtain from the seismic protection engineer a written and signed certification indicating that the seismic force resisting systems have been installed as per the report and the amendments to the report. Submit this certification before submitting the work certificate of compliance.

1.3 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

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 a 30 degrees arc without metal to metal contact.

.2 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

2.3 SEISMIC CONTROL MEASURES

.1 General:

.1 Seismic control systems to work in every direction.

.2 Fasteners and attachment points to resist same maximum load as seismic restraint.

.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.

.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 depending upon site conditions:

.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.

.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:

.1 Approved by Departmental Representative.

.2 Structural angles or channels.

.3 Cable restraint 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.

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 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

.1 Obtain from the seismic protection engineer a written and signed certification indicating that the seismic force resisting systems have been installed as per the report and, if applicable, amendments to the report.

3.4 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 National Fire Protection Association (NFPA)

.1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.2 Submittals: in accordance with Section 01 33 00- Submittal Procedures.

.3 Product data to include paint colour chips, other products specified in this section.

1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00- Submittal Procedures.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

.1 Dispose of unused paint and coating material at official hazardous material collections site approved by Departmental Representative.

.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 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Identification for PSPC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.5 Equipment Identification

.1 Nameplate shall include Environment Canada equipment number as identified on drawing legend. Obtain equipment number from Departmental Representative for any new unidentified equipment in schedule on drawing legend.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Sprinklers: to NFPA 13.

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) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS
Laboratory waste	Yellow	LAB. WASTE
Plumbing vent	Green	SAN. VENT
Deionized water	Green	DI. WATER
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English and French.

.2 Use one nameplate and label for each language.

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 TIMING

.1 Provide identification only after painting specified Section 09 91 23- Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PSPC PMSS.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 DEFINITION

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.3 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.4 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.5 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

.4 Prior to TAB start-up conduct the following examination:

.1 Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor, and functioning.

1.6 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.7 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.8 START OF TAB

.1 Notify Departmental Representative 7 working days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Fire, smoke, volume control dampers installed and open.

.5 Access doors, installed, closed.

.6 Outlets installed, volume control dampers open.

1.9 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory HVAC systems: plus 10%, minus 0%.

.2 Other HVAC systems: plus 5%, minus 5%.

1.10 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2% of actual values.

1.11 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.12 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.13 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 3 copies of TAB Report to Departmental Representative for verification and approval, in both official languages in D-ring binders, complete with index tabs.

1.14 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide personnel and instrumentation to verify up to 100% of reported results.

.3 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.15 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.

1.16 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.17 TAB PROCEDURES FOR EXISTING SYSTEMS

.1 Perform a preconstruction inspection of existing equipment that is to remain and be reused.

.1 Measure and record the airflow of each terminal unit to remain.

.2 Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

.2 Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

.1 Deficiencies noted in the preconstruction report are corrected.

.3 Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

.1 Compare the indicated airflow of the renovated work to the measured airflows.

.2 Adjust airflow to existing work as per measured airflow and balance system to design airflows indicated

1.18 AIR SYSTEMS

.1 Standard: TAB to most stringent of SMACNA or ASHRAE.

.2 Do TAB of systems, equipment, components, controls specified Division 23

.3 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss).

.4 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, terminal units, other equipment causing changes in conditions.

.5 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.19 OTHER TAB REQUIREMENTS

.1 Laboratory fume hoods:

.1 TAB procedures: as described in standard as described in Section 23 38 16.13-Fume Hoods (For Laboratories).

1.20 POST-OCCUPANCY TAB

.1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

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 RELATED SECTIONS

.1 Section 23 05 93 – Testing, Adjusting and balancing for HVAC.

1.2 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to Departmental Representative for approval at least one month before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.

.2 Prepare report of results and submit to Departmental Representative within 24 hours of completion of tests. Include:

.1 Schematic of entire system.

.2 Schematic of section under test showing test site.

.3 Required and achieved static pressures.

.4 Orifice differential pressure at test sites.

.5 Permissible and actual leakage flow rate (L/s) for test sites.

.6 Witnessed certification of results.

.3 Include test reports in final TAB report.

.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 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.07- Construction Progress Schedules - Bar (GANTT) Chart.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.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 30 - Health and Safety Requirements.

Part 2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3% of flow rate and pressure.

.3 Submit details of test instruments to be used to Departmental Representative at least three months before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.

2.2 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and system components such as VAV boxes, duct heating leakage: 2%

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 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:

.1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: leakage 2%.

.2 VAV box and duct on downstream side of VAV box: leakage 2%.

.3 Large low pressure duct systems up to 500 Pa: leakage 2%.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

.4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its product[s]and submit written reports, in acceptable format, to verify compliance of Work with Contract.

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

.3 Schedule site visits, to review Work, at stages listed:

.1 Twice during progress of Work at 60% complete.

.2 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

.2 Performance Verification:

.1 Departmental Representative to witness tests and to verify reported results.

.2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

3.6 CLEANING

.1 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 SECTIONS

.1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.2 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.4 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.5 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

CAN/ULC-S102-2012, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 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.

1.4 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 duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Description of equipment giving manufacturer's name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

.3 Shop Drawings:

.1 Submit drawings in accordance with section 01 33 00 – Submittal procedures.

.4 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

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.

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 factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.3 ULC listed

.4 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.5 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.

.6 Contact adhesive: quick-setting

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 12 mm wide, 0.5 mm thick stainless steel.

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, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-1	no	25

.2 Finishes: conform to following:

.1 Indoor exposed air duct: canvas jacket

.2 Outside air duct: aluminium jacket

3.5 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C547, Mineral Fiber Pipe Insulation.

.4 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2005).

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.3 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 in accordance with Section 01 33 00- Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00- Submittal Procedures.

.3 Shop Drawings:

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

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00- Submittal Procedures.

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

.2 Instructions: submit manufacturer's installation instructions.

.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing work of this Section.

.3 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Place excess or unused insulation and insulation accessory materials in designated containers.

.2 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547.

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C547.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

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 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.4 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: Tape or SS 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: Tape or SS bands at 300 mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 Thickness of insulation as listed in following table.

.1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)				
			to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HWS		A-1	25	25	25	38	38
Domestic CWS with vapour retarder		A-3	25	25	25	25	25

.5 Finishes:

.1 Exposed indoors: canvas jacket.

.2 Exposed in mechanical rooms: canvas jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

3.5 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment.

.2 Section 23 05 94- Pressure Testing of Ducted Air Systems.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International

.1 ASTM A480/A480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 2007.

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

.3 Shop Drawings:

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

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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	A

.2 Seal classification:

.1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 SEALANT

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius or short radius with single thickness turning vanes.

.2 Round: smooth radius, centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400mm: with single thickness turning vanes.

.2 Over 400mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 30 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 As indicated or full radiused elbows.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA, no duct thinner than 26 gauge will be accepted.

.3 Joints: to SMACNA.

2.7 STAINLESS STEEL

.1 To ASTM A480/A480M, Type 316.

.1 Use of stainless steel duct: for fume hood exhaust duct.

.2 Finish: number 2B.

.3 Thickness, fabrication and reinforcement: to SMACNA except for the minimum thickness which shall not be smaller than 18 ga.

.4 Joints: to be continuous welded to SMACNA.

.5 Application: Chemical fume hood exhaust ductworks.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment.

.1 Hanger configuration: to SMACNA.

.2 Hangers: galvanized steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.3 Upper hanger attachments:

.1 For steel joist: manufactured joist clamp.

.2 For steel beams: manufactured beam clamps.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with SMACNA.

.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA and as follows:

Duct Size	Spacing
(mm) up to 450	(mm) 2400
450 to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA.

.2 Bed tape in sealant and recoat with minimum of 1coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94- Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete test before performance insulation or concealment Work.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.3 Shop Drawings

.1 Submit drawings ion accordance with Section 01 33 00 – Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks [complete with safety chain].

.2 301 to 450 mm: four sash locks [complete with safety chain].

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Hold open devices.

2.3 TURNING VANES

.1 Factory or shop fabricated, to recommendations of SMACNA and as indicated.

2.4 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.5 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 As indicated.

.2 Length of connection: 150 mm.

.3 Minimum distance between metal parts when system in operation: 75mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 610 x 610 for person size entry.

.2 460 x 460 for servicing entry.

.3 205 x 305 for viewing.

.2 Locations:

.1 Devices requiring maintenance.

.2 Required by code.

.3 Reheat coils.

.4 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Inlets and outlets of fan systems.

.5 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for dampers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.3 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.4 Dampers: vibration free.

.5 Ensure damper operators are observable and accessible.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 38 16.13 – Fume Hoods (For Laboratories).

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM E477-13e1, Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

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 air terminal units and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings in accordance with Section 01 33 00 – Submital Procedures.

.2 Indicate the following:

.1 Capacity.

.2 Pressure drop.

.3 Noise rating.

.4 Leakage.

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 air terminal units 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.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect air terminal units from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

2.2 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

2.3 PRESSURE INDEPENDENT MOTORIZED TERMINAL UNITS WITH VARIABLE/CONSTANT FLOW RATE (VENTURI TYPE)

.1 General

.1 Pressure independent terminal units with flow regulators for constant or variable flow rate operation.

.2 Pressure independent operation with an immediate response mechanical assembly allowing required flow rate to be maintained.

.3 High speed shut-off electronic actuator, set on fail-open, fail-closed or last operating position, depending on the case. Normally, supply and return components will respectively need to be turned off and on.

.2 Acceptable material

.1 For the air terminal units no. SACV-1003,GECV-208, and FECV-100 the only acceptable materials are:

.1 SACV-1003: Phoenix, model MAVA114L

.2 GECV-208: Phoenix, model EXVA210L

.3 FECV-100: Phoenix, model EXVB112L

.3 Construction

.1 Design of unit complies with ducts arrangement, of size and capacity as indicated in terminal units table.

.2 Smooth aluminum/Teflon bearing surface with swivels at the ends. Shaft, control arm, shaft supports and internal mounting hardware in 316 stainless steel.

.3 Evacuation terminal units in contact with corrosive products must be covered with a phenolic coating.

.4 Envelope leakage shall not exceed 1 % of design volume at a static pressure of 1.494 kPa (6 inches wg).

.5 Control margin to be from 20 to 1.

.6 Valves must be mounted with 14 gauge stainless steel swivels. All weather-stripping must be approved by the FDA standard.

.7 Provide watertight valves for complete closure when required.

.4 Performance

.1 Valves must be CSA certified and comply with ASTM E477 standards.

.2 Provide and install identification tags for each valve which mention the minimum and maximum flow rates in L/s, the minimal and maximal factory set configurations and identification numbers. Each unit must be factory conceived and mounted and adjustable on site.

.3 The precision of the flow rate control must be ± 5 % of the required flow rate as determined by the control point signal within the interval of 150 to 750 Pa.

.4 Provide components in quantities and sizes as presented in plans.

.5 Air terminal unit to be compatible with fumehood and room control interface specified in Section 23 38 16.13 – Fume Hoods (For Laboratories).

2.4 DOUBLE DUCT TERMINAL UNIT (DDT-1205)

.1 General

.1 Double duct terminal unit with volume control, for variable volume operation.

.2 Pressure independent operation to maintain required flow.

.3 Electronic actuated.

.2 Construction

.1 Casing: 0.8 mm thick galvanized steel, fully insulated with 20 mm thick thermal and acoustic insulation, with metal damper, installed on a steel shaft pivoted in self-lubrificating bearings, air leakage 2% at 720 Pa inlet static pressure.

.2 Filler material for thermal and acoustic insulation: inert, vermine and moisture proof, glass fiber or mineral wool of density required for acoustic performance, standard to manufacturer and protected from air flow by neoprene.

.3 Air flow sensor, cross configuration, located at the inlet of the assembly, accuracy within 5%.

.4 Actuator and electronic controller, by Division 25.

.3 Unit performance

.1 Maximum air flow 613 l/s

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air terminal units 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 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with a minimum of four duct diameters of straight inlet duct, same size as inlet.

.4 Locate controls, dampers and access panels for easy access.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

1.2 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

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

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated in equipment schedule.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: as directed by Departmental Representative.

2.3 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Type 1: aluminum, 32 mm border, 12 x 12 mm egg crate type face bars. Finish: to be standard white powder coat.

2.5 DIFFUSERS

.1 Type A: One (1) way flat face displacement ventilation diffuser, installed horizontally at ceiling level, constructed with an equalization baffle behind the operative diffuser face for uniform, low velocity, distribution of supply air. Both the equalization baffle and face shall be securely retained in the diffuser frames. There shall be no visible fasteners on the front or side panels. The operative face shall be constructed of painted 16 gauge perforated steel, rear side and end panels shall be provided in painted 20 gauge steel. The frame and internal baffling elements shall be constructed of aluminum. The duct connection shall be on the side with a factory cut inlet collar. Finish to be standard white powder coat polyester paint. The diffuser shall be supplied with a rail mounting system that does not require puncturing the diffuser for installation.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille 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 Install in accordance with manufacturers instructions.

.2 Install with cadmium plated screws in countersunk holes where fastenings are visible.

3.3 CLEANING

.1 Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 48 – Vibration and Seismic controls for HVAC Piping and Equipment.

.2 Section 23 36 00 – Air terminal units

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI/ASHRAE 110-1995, Method of Testing Performance of Laboratory Fume Hoods.

.2 ANSI/AIHA Z9.5-2003, Laboratory Ventilation.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1-M90, Tempered and Laminated Safety Glass.

.3 CSA International

.1 CAN/CSA-C22.2 No.61010-1-12, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.

.4 National Fire Protection Association (NFPA)

.1 NFPA 45-2015, Standard on Fire Protection for Laboratories Using Chemicals.

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.6 Public Works and Government Services Canada (PSPC)

.1 PSPC MD15126, Minimum Guidelines for Laboratory HVAC and Exhaust Systems.

.2 PSPC MD15128 2013, Laboratory Fume Hoods.

.3 PSPC CP.1 to CP.13-2003, Commissioning Manuals and Guidelines.

.7 Underwriter Laboratories of Canada (ULC)

.1 UL 723-08, Tests for Surfaces Burning Characteristics of Building Materials.

.2 UL 1275-14, Standard for Flammable Liquid Storage Cabinets.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fume hood components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit list of fume hood materials, components and accessories to be incorporated into Work.

.3 Include product names, types and series numbers for fume hood components and accessories.

.4 Include contact information for manufacturer for fume hood components and accessories used on this Project.

.5 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 30 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Submit drawings IN ACCORDANCE WITH Section 01 33 00 – Submittal Procedures.

.2 Include on drawings:

.1 Materials and profiles and provide full-size, scaled details of components for each type of fume hood.

.2 Details of construction with dimensions, cross sections, and adjacent equipment.

.3 Roughing-in dimensions for plumbing, laboratory services, and electrical.

.4 Test and Evaluation Reports:

.1 Submit detailed performance reports in accordance with PSPC MD15128, fume hood design criteria and materials thickness. Include hood superstructure details.

.1 Indicate exhaust air flow rate.

.2 Indicate pressure drop through fume hood.

.5 Field reports: submit manufacturer's field reports within 3 days of manufacturer representatives' site visit.

.6 Submit detailed seismic anchorage and attachment drawings and calculations complying with requirements and regulations for seismic restraint (where applicable).

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Supply operation and maintenance data for incorporation into manual specified in 01 78 00- Closeout Submittals.

.1 Submit information for instructions for safe and proper operation of fume hoods. Include:

.1 Written instructions booklet showing additional information on safe, proper operation and maintenance, components parts list, and nearest local manufacturer's representative for components and emergency repairs.

.3 Record Documentation:

.1 Submit list of materials used in fume hood work.

.2 Submit methodology for sealing joints.

.4 Warranty: submit warranty documents specified.

.5 Acceptance verification check sheet.

.6 Operator Training Guide: provide DVD with training presentation, highlighting proper operating practices of laboratory fume hood.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Supply special tool for opening sash beyond normal opening position.

1.7 QUALITY ASSURANCE

.1 Fume hood, components and accessories to be manufactured by single manufacturer.

.2 Certification: submit catalogued or published certified ratings obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying performance capabilities, including "As Manufactured (AM)" tests in accordance with PSPC MD15128.

1.8 DELIVERY, STORAGE AND HANDLING

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

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

.1 Upon arrival and before installation, demonstrate that fume hood is consistent with prototype and product data, and has not been damaged in transit.

.2 Ensure fume hood bears CSA label.

.3 Inspect fume hood and record condition using approved check sheet.

.3 Storage and Handling Requirements:

.1 Store and protect fume hood, components and accessories from nicks, scratches, and blemishes.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESCRIPTION

.1 Laboratory fume hood: ventilated, enclosed work space, designed for continuous use to capture, confine and exhaust fumes, vapours and particulates generated within fume hood cavity.

.2 Factory fabricated package, piped and wired for single connections to exhaust system and to electrical power.

2.2 DESIGN CRITERIA

.1 Fume hood, controls and alarms: ULC labelled.

.2 Fume hood face velocity: 0.35m/s.

.1 Design sash position (normal operating sash height) at 450 mm.

.2 Noise level (with sash in normal operating position) at 450 mm from sash: 70 dBA maximum.

.3 Seismic: ensure fume hood manufacturer supplies anchor bolts and templates.

.1 Ensure anchor bolts are sized to withstand seismic zone acceleration and velocity requirements as specified by seismic protection engineer as specified in Section 23 05 48 – Vibration and Seismic controls for HVAC Piping and Equipment.

.4 Meet performance criteria in PSPC MD15128.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

.1 High performance/high efficiency fume hood: fume hood with containment levels equal to or better than ASHRAE 110 with tracer gas ratings of 4.0 am 0.05, and 4.0 ai/au 0.10 with sash at 457 mm at a face velocity of 0.2 m/s.

.1 Integral air flow controller, to be supplied by the fume hood manufacturer.

.2 Fume Hood Caracteristics:

.1 Type: VAV

.2 Width: 1500 mm nominal.

.3 Height: 1375 mm nominal.

.4 Depth: 840 mm nominal.

.5 Sash: type: vertical. Operating position of sash: 450 mm.

.6 Underside acid storage cabinet

.7 Electrical: 120V, amperage: 20 amp.

.3 Fume Hood Performances

AIR FLOW (L/s)	SASH OPENING HEIGHT (mm)	FACE VELOCITY (m/s)	STATIC PRESSURE (Pa)
297	749	0,3	17.5

2.4 GENERAL

.1 Equipment: complete in every respect ready for operation. Provide power, lighting, control and alarm devices, terminal boxes and other devices specified to be mounted on equipment. Provide components as required by code, complete with number terminals, on equipment, for service ready for field connection.

.2 Provide reinforcing and anchorage for built in products.

.3 Insulate between dissimilar metals, and metal and concrete or masonry to prevent electrolysis.

.4 Include electrical components, ULC or CSA approved, required by Authority having Jurisdiction, and to protect equipment from damage during operation.

.5 Coordinate position of disconnects with walls, equipment and modular panels to allow full and free access.

.6 Location and quantity of equipment: indicated on the drawings

2.5 MATERIALS

.1 Exterior Panels Framing Members, and Furring Panels: Cold rolled and levelled mild steel and shall conform to ASTM A1008/A1008M.

.2 Screws: Interior fastening devices; stainless steel screws complete with corrosion resistant plastic caps.

.3 By-Pass: 1.2mm thick mild steel down draft curved, finished same as exterior panels.

.4 Lower Foil: For hoods, form using 1.9mm Type 316-4 stainless steel.

.5 Safety Glass: Laminated type 6mm thick.

.6 Sash guides: Track shall be corrosion resistant polyvinyl chloride (PVC).

.7 Sash Chain: #35 hardened

.8 Sprocket system for Sash Chain: Hardened sprockets with one full width shaft per sash running in ball bearings.

.9 Baffle support brackets: Fiberglass reinforced polyester thermoset resin of 5mm thickness.

.10 Baffle support brackets: Same material as hood lining.

.11 Duct Stubs: bell shaped Type 316, 1.2mm stainless steel.

.12 Light Switches: commercial grade or higher and shall be ULC and CSA approved.

.13 Electrical receptacles: commercial grade or higherand shall be ULC and CSA approved.

.14 Cover Plates: Electrical cover plates shall be ULC and CSA approved.

.15 Fluorescent Fixture: Fixture shall be two tube rapid start or better. Energy saving cool white T8 lamps shall be provided. Ballast shall be sound rated to limit noise.

.16 Fume Hood Liner: Hood linings and baffles shall be fiberglass reinforced polyester thermoset resin of 5mm thickness. The fiberglass reinforced polyester panel shall have a minimum flexural strength of 103,400 kPa, with a flame spread of 25 or less as per ASTM #E84. Final appearance shall be smooth and white in colour.

2.6 FABRICATION - GENERAL

.1 Fume hood superstructure shall be double wall construction consisting of an outer shell of sheet steel and an inner hood liner. Double wall shall house and conceal steel framing members, attaching brackets and remote operating service fixture mechanisms. Overall double wall thickness; 120 mm maximum.

.2 Front double-wall posts shall be pre-punched to accept up to 4 plumbing fittings per side, two electrical duplex outlets, light switch and optional monitor alarm. Electrical outlets and light switch shall be factory-wired and terminate at a junction box on the roof of hood. All electrical components shall be ULC listed/classified.

.3 Exterior panel members shall be fastened by means of concealed devices. Exposed screws are not acceptable.

.4 Provide access to remote-controlled fixture valves concealed between walls through removable panels on hood exterior and access panels on both inside liner walls. Assemble hood superstructure, fasten and connect inner and outer frame into a rigid self supporting entity.

.5 Install fluorescent lighting fixture on exterior of roof. Provide a 6 mm safety glass panel on hood "roof", sealed to isolate the lighting fixture from fume chamber. The 2-lamp fixture in each hood shall be largest possible for fume hood size, and shall be rapid start type, ULC listed/classified. Provide lamps to fixtures. Average interior illumination levels within the fume chamber shall be 80 foot candles minimum. Ballast shall be sound rated to limit noise level. Finish fixture interior with white baked enamel.

.6 Work areas shall be defined as that area inside the superstructure from side to side and from face of baffle to the inside face of sash and from the work surface to a height of 710 mm.

.7 Fume hood sash shall be full view type providing a clear and unobstructed side to side view of fume hood interior.

.1 Sash shall be laminated safety glass set into extruded polyvinyl chloride guide. Bottom and side sash rails shall be 18 Ga stainless steel. Glass shall be set into rails with PVC glazing channel.

.2 Bottom rail shall be an integral, formed, full width, flush pull and shall be anchored on each side to sash chains at bottom.

.3 A single weight, sprocket and chain counter balance system shall be used for vertical operation of sash and prevent jamming to permit one finger operation at any point along full width sash pull and to maintain sash at any position below working height without creep.

.4 Sash system shall be designed to prevent sash drop in the event of chain failure.

.5 Superstructure shall have a single sash and counter balance system

.6 Sash shall open and close against rubber bumper stops.

.7 Bench model hoods shall be equipped with a sash lowering device designed to lower the sash when released to below the safe working height (450 mm).

.8 Sash shall operate normally below that height.

.8 Self Closing sash: A mechanism shall be provided which automatically lowers the sash to the chosen working height. A latch shall be provided to hold the sash fully open for setup/teardown of experiments. Below the chosen working height, the sash shall be neutrally balanced and function as a conventional sash.

.9 Hood shall be variable volume type with a restrited by-pass. Restricted Bypass shall supplement the standard front panel by the addition of an adjustable panel behind louvered area. Adjustable panel shall be made of stainless steel grade 316 or fiberglass reinforced polyester. It shall be possible to achieve bypass opening ranging from a nominal 25mm (1") to the maximum available opening of 406mm (16"). Lower edge of the adjustable bypass panel shall be equipped with a flexible rubberized fabric flap to reduce leakage. The adjustable bypass panel shall be moved to the final setting by the ventilation contractor who is responsible for fume hood controls.

.10 Three-piece main baffles shall provide controlled air vectors into and through the fume hood and be fabricated of the same material as the liner. Provide exhaust slots on the full perimeter of baffles. A fixed, permanently-open, horizontal slot located at 31-1/2" above the work surface shall be provided at the overlapping mid-point of the main baffles. Floor mounted hoods shall be equipped with a three piece baffle system.

.11 For safety, fume hood shall maintain essentially constant exhaust volume at any baffle position. Changes in average face velocity and exhaust volume as a result of baffle adjustment shall not exceed 5% for any baffle position at the specified face velocity.

.12 Design fume hoods to minimize static pressure loss with adequate slot area around the baffle and the bell shaped exhaust collar configuration. Measured average static pressure loss reading taken three diameters above the hood outlet from four points, 90° apart, shall not exceed a measured static pressure loss of 45.8 Pa at a face velocity of 0,3 m/s based on 1500 mm wide hood.

.13 Electrical convenience duplex outlets shown mounted on the face of fume hoods shall be installed in front posts and pre-wired to a junction box mounted on top of fume hood superstructure. Electrical devices shall be ULC classified/listed.

2.7 FUME HOOD FURRING PANEL

.1 Provide matching furring panels to enclose the space between top edge of fume hood and the finished ceiling.

.2 Panels shall be flanged, notched and reinforced where required to form a well-fitted enclosure, free from oil-canning. Secure panels using cadmium-plated, self-tapping screws; panels shall be removable for maintenance purposes.

.3 Provide 150 mm high panels. Coordinate exact dimension on site.

.4 Finish shall match fume hood.

2.8 ACCESSORIES

.1 Safety accessories:

.1 Label indicating maximum sash height.

.2 Label indicating proper exhaust volume reading required for safe operation.

.2 Control exhaust air flow using sash position sensor and presence detector located as per manufacturer's instructions. Sash position sensor and presence detector are to be compatible with air valve controls and is to be provided by air valve supplier as per Section 23 36 00 – Air terminal units.

.1 Calibrate sash position sensor after field installation of fume hood.

.3 Controls integrater:

.1 Exhaust air valve provider is to provide a data exchange controler between the fume hood exhaust air terminals, room air terminal units, sash position sensor, presence detector and the BAS. Controller must be CSA approved and BACnet I/P compatible.

.4 Monitors and alarms:

.1 For each fume hood provide monitor with alarm capability.

.2 Monitor to provide visual display showing average face velocity and provide visual and audible alarms configured to alert when flow or velocity varies more than ± 20% from design flow set point.

.1 Monitor accuracy: ± 5% of measured parameter.

.2 Include manual silencing switch for audible alarm only, designed to automatically reset to recommence monitoring function.

.3 Ensure visual alarm remains lit until alarm condition has been rectified.

.3 Include test circuits, relays, switches, and other controls required to permit maintenance personnel to test signal function.

.4 Field set-up: minimum 3 point calibration.

.5 Analog output, 0-10 V, proportional to face velocity.

.6 Visual displays:

.1 Display of velocity reading; resolution 0.01 m/s.

.2 Green LED for safe operation.

.3 Red LED for alarm or unsafe operation.

2.9 EXHAUST VAV TERMINAL

.1 Exhaust air valve provided by Section 23 36 00 – Air terminal units for fume hood.

.2 Fume hood airflow controller: to be supplied and programmed by the Exhaust air valve manufacturer. Full integration with automatic sash closing system and supplemental airflow to adjust airflow based on changing fume hood opening area to ensure constant face velocity.

.3 Exhaust air terminals must contain the following characteristics:

.1 Measured airflow measurement with an error of no more than 5% actual value.

.2 Airflow to range from 155 to 1780 l/s.

.3 Monitor the position of the sash and adjust airflow in the event of a sash failure.

2.10 SOURCE QUALITY CONTROL - AM TESTING

.1 Departmental Representative reserves the right to require manufacturer to demonstrate hood performance and submit testing results verified by an independent engineering testing laboratory prior to shipment to prove compliance with contract requirements. Test hoods to verify performance requirements in accordance with ASHRAE 110 and ANSI Z 9.5. Failure to meet performance requirements shall be cause for rejection. Testings shall include:

.1 Face velocity test with sash at design positions;

.2 VAV face velocity control test;

.3 Dynamic VAV airflow response tests;

.4 VAV fume hood minimum flow with sash at closed position;

.5 Smoke visualization test;

.6 Tracer gas test:

.1 Mannequin test;

.2 Peripheral Scan;

.3 Sash movement effect.

.2 Performs "am" testing on one (1) unit of each different size and type of fume hood.

2.11 ACID CABINETS

.1 Provide a standard steel construction base cabinets with the addition of a molded polyethylene interior liner.

.2 The lining on the back of doors shall be fitted so that it overlays the flange on the front of the molded cabinet liner to protect all metal areas of the cabinet from corrosive vapors.

.3 Acid storage cabinets shall contain one full-width phenolic shelf. It shall be possible to locate shelf in four positions on 75mm increments. Shelf supports shall be integrally molded into cabinet liner.

.4 Provide the door with a decal signifying “ACID” storage. On acid cabinets with two doors, provide one decal signifying “ACID” storage on each door.

.5 Molded liner shall incorporate a 25mm high lip along bottom edge to contain spills.

.6 Provide cabinets with four adjustable levelling devices to compensate for approximately 25mm base building floor differential.

.7 Provide one threaded connection fusion welded to the rear of the cabinet. Thread shall be 50mm NPT for connection to exhaust source.

.8 Provide an entirely plastic door catch.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fume hood 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 Install plumb, with work surface level to within 1.5 mm in 3000 mm by adjusting base unit levelling screws.

.2 Secure fume hood to base furniture using stainless steel fasteners spaced at 750 mm maximum on centre maximum, 3 minimum per side.

.1 Use 4 minimum for each fume hood.

.3 Secure fume hood to meet seismic criteria.

.4 Connect electrical services and exhaust system to fume hood.

.5 BAS connection to data exchange controller shall be executed by Division 25.

.6 Provide service clearance of 900 mm in front electrical disconnects for a width of 760mm. Coordinate with division 26.

3.3 FIELD (AI) TESTING

.1 Provide independent third-party field testing of each unit after completion of installation to verify operation of hoods in accordance with requirements specified herein. Perform tests in accordance with ASHRAE 110 method of testing performance of laboratory fume hoods and ANSI Z 9.5.

.2 Confirm performance requirements.

.3 Provide report of results by testing agency.

3.4 FUME HOOD SYSTEM INTEGRATION - GENERAL REQUIREMENTS

.1 General Requirements: fully integrate fume hood exhaust systems into laboratory HVAC system and into BAS in order to maintain specified pressurization requirements and to maintain fume hood performance.

.1 Minimum air flow with sash closed: 94 L/s

.2 Minimum air flow with 450 mm sash opening: 163 L/s.

.2 Operating Modes:

.1 Occupied - in use: generation of hazardous products occurring.

.2 Occupied - not in use: as when apparatus is being assembled.

.3 Unoccupied - in use: generation of hazardous products occurring while fume hood is unattended. Sash is closed.

.4 Standby: fume hood not in use: no active generation of hazardous products, minimum air flow. Sash closed.

.3 Monitor:

.1 Green light to indicate "power on" and "safe to operate".

.2 Audible and visual alarms: horn, buzzer or bell and red light to indicate air velocity out of range and "not safe to operate".

.1 Use fume hood only when safety controls are satisfied.

.2 Override audible alarm using silencing relay switch (red light to remain on) until abnormal condition is rectified.

.3 Reset alarm system automatically when safe conditions restored.

.3 Ensure complete operating instructions for alarm system are secured to fume hood.

.4 Interlock fume hood exhaust system with HVAC system.

.1 Ensure fume hood exhaust fan continues to run upon activation of building fire alarm system.

.4 Fume Hood System Integration with Manifolded Fume Hood Exhaust System:

.1 No local control of exhaust fans permitted.

.2 Monitor:

.1 Green light to indicate "power on" and "safe to operate".

.3 Audible and visual alarms: horn, buzzer or bell and red light to indicate air velocity out of range and "not safe to operate".

.1 Use fume hood only when safety controls are satisfied.

.2 Override audible alarm using silencing relay switch (red light to remain on) until abnormal condition is rectified.

.3 Reset alarm system automatically when safe conditions restored.

.4 Ensure complete operating instructions for alarm system are secured to fume hood.

.5 Interlock fume hood exhaust system with HVAC system.

.1 Ensure fume hood exhaust system continues to run upon activation of building fire alarm system.

.6 Connect 1 manifolded fume hood exhaust fan to emergency power.

3.5 ADJUSTING

.1 Adjust operable hardware for correct function.

.2 Ensure sash does not bind while opening and closing.

3.6 FIELD QUALITY CONTROL

.1 Field Inspection: co-ordinate field inspection in accordance with Section 01 45 00- Quality Control.

.2 Manufacturer's Services:

.1 Co-ordinate manufacturer's services with Section 01 45 00- Quality Control.

.1 Have manufacturer review work involved in handling, installation, protection, and cleaning of fume hood components and accessories, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.

.2 Manufacturer's Field Services: include manufacturer's field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer's instructions.

.1 Report inconsistencies from manufacturer's recommendations immediately to Departmental Representative.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of fume hood components and accessories, and when preparatory work on which Work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

.4 Obtain reports within three days of review and submit immediately to Departmental Representative.

.3 Commissioning test for integrated fume hood system

.1 Manufacturer to provide start-up and commissioning assistance for complete laboratory integrated HVAC system. Fume hood, air valve and controls manufacturer representative to be present for system start-up and commissioning.

.2 Test fume hoods in conjunction with complete laboratory integrated HVAC and exhaust systems commissioning testing including, room air flow patterns, temperature, humidity, pressurization, noise, and vibration.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

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

3.8 PROTECTION

.1 Protect installed fume hood components from damage during construction.

.2 Repair damage to adjacent materials caused by fume hood installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE STD 135-2012, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).

.1 CEA-709.1-B-2002, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Grey Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 DESIGNATED CONTRACTOR

.1 Hire the services of Régulvar or its authorized representative to complete the work of all EMCS sections.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:

.1 AEL - Average Effectiveness Level.

.2 AI - Analog Input.

.3 AIT - Agreement on International Trade.

.4 AO - Analog Output.
.5 BACnet - Building Automation and Control Network.
.6 BC(s) - Building Controller(s).
.7 BECC - Building Environmental Control Centre.
.8 CAD - Computer Aided Design.
.9 CDL - Control Description Logic.
.10 CDS - Control Design Schematic.
.11 COSV - Change of State or Value.
.12 CPU - Central Processing Unit.
.13 DI - Digital Input.
.14 DO - Digital Output.
.15 DP - Differential Pressure.
.16 ECU - Equipment Control Unit.
.17 EMCS - Energy Monitoring and Control System.
.18 HVAC - Heating, Ventilation, Air Conditioning.
.19 IDE - Interface Device Equipment.
.20 I/O - Input/Output.
.21 ISA - Industry Standard Architecture.
.22 LAN - Local Area Network.
.23 LCU - Local Control Unit.
.24 MCU - Master Control Unit.
.25 NAFTA - North American Free Trade Agreement.
.26 NC - Normally Closed.
.27 NO - Normally Open.
.28 OS - Operating System.
.29 O&M - Operation and Maintenance.
.30 OWS - Operator Work Station.
.31 PC - Personal Computer.
.32 PCI - Peripheral Control Interface.
.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
.34 PID - Proportional, Integral and Derivative.
.35 RAM - Random Access Memory.
.36 SP - Static Pressure.
.37 ROM - Read Only Memory.
.38 TCU - Terminal Control Unit.
.39 USB - Universal Serial Bus.
.40 UPS - Uninterruptible Power Supply.
.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.

.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:

.1 AI (analog input).

.2 AO (analog output).

.3 DI (digital input).

.4 DO (digital output).

.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.

.2 Refer also to Section 25 05 54- EMCS: Identification.

1.5 SYSTEM DESCRIPTION

.1 Refer to control schematics for system description.

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Control devices as listed in I/O point summary tables.

.3 OWS(s).

.4 Data communications equipment necessary to effect EMCS data transmission system.

.5 Field control devices.

.6 Software/Hardware complete with full documentation.

.7 Complete operating and maintenance manuals.

.8 Training of personnel.

.9 Acceptance tests, technical support during commissioning, full documentation.

.10 Wiring interface co-ordination of equipment supplied by others.

.11 Miscellaneous work as specified in these sections and as indicated.

.3 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.

.3 Location of controllers as reviewed by Departmental Representative prior to installation.

.4 Provide utility power to EMCS as indicated.

.5 Metric references: in accordance with CAN/CSA Z234.1.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit for review:

.1 Equipment list within 10days after award of contract.

.3 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 33 00 - Submittal Procedures. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental 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 intended for re-use: submit test report.

1.7 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Waste Management and Disposal:

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.

.3 Label location of salvaged material's storage areas and provide barriers and security devices.

.4 Ensure emptied containers are sealed and stored safely.

.5 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.6 Fold up metal banding, flatten and place in designated area for recycling.

1.9 EXISTING- CONTROL COMPONENTS

.1 Utilize existing control wiring piping as indicated.

.2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.

.1 Do not modify original design of existing devices without written permission from Departmental Representative.

.2 Provide for new, properly designed device where re-usability of components is uncertain.

.3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.

.1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.

.2 Failure to produce test report will constitute acceptance of existing devices by contractor.

.4 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.

.5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.

.1 Be responsible for items repaired or replaced by Departmental Representative.

.2 Be responsible for repair costs due to negligence or abuse of equipment.

.3 Responsibility for existing devices terminates upon final acceptance of applicable portions of EMCS as approved by Departmental Representative.

.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

Part 2 Products

2.1 MATERIALS

.1 There is an existing Delta system presently installed in the building. All materials must be selected to ensure compatibility with the existing Delta system.

2.2 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.3 ADAPTORS

.1 Provide adaptors between metric and imperial components.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.2 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.

- .1 Location of local office.
- .2 Description and location of installing and servicing technical staff.
- .3 Location and qualifications of programming design and programming support staff.
- .4 List of spare parts.
- .5 Names of sub-contractors and site-specific key personnel.
- .6 Sketch of site-specific system architecture.
- .7 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
- .8 Descriptive brochures.
- .9 Sample CDL and graphics (systems schematics).
- .10 Response time for each type of command and report.
- .11 Item-by-item statement of compliance.
- .12 Proof of demonstrated ability of system to communicate utilizing BACnet.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within 5 working days after contract award, for review by Departmental Representative.

.3 Shop Drawings to consist of 1 soft copy of design documents, shop drawings, product data and software.

1.4 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:

- .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
- .2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.

.3 Spare point capacity of each controller by number and type.

.4 Controller locations.

.5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

.7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).

.8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

.9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.

1.5 DETAILED SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:

.1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.

.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules and terminations.

.4 Complete Point Name Lists.

.5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.

.6 Software and programming details associated with each point.

.7 Manufacturer's recommended installation instructions and procedures.

.8 Input and output signal levels or pressures where new system ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, as specified.

.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.9 Listing and example of specified reports.

.10 Listing of time of day schedules.

.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

1.6 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

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 RELATED SECTIONS

.1 Section 25 05 01 – EMCS: General Requirements.

1.2 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acryonyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 78 00 - Closeout Submittals, supplemented and modified by requirements of this Section.

.2 Submit As-built drawings to Departmental Representative in English.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.4 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Departmental Representative.

.3 Provide before acceptance 4 Hard and 1 soft copy incorporating changes made during final review.

1.5 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.4 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.5 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device.

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

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 RELATED SECTIONS

.1 Section 25 05 01 –EMCS: General Requirements.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-2015, The Canadian Electrical Code, Part I (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01- EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00- Submittal Procedures supplemented and modified by requirements of this Section.

.2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick, matt white finish, core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name and point address.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Departmental Representative.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative's.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Departmental Representative during "Preliminary Design Review".

Part 3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

.2 Nameplate shall include equipment number as identified on equipment schedules and Environment Canada equipment number as identified on drawing legend.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 25 05 01 –EMCS: General Requirements.

1.2 REFERENCES

.1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.

.2 Canadian Standards Association (CSA International).

.1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings.

1.3 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit detailed preventative maintenance schedule for system components to Departmental Representative.

.3 Submit detailed inspection reports to Departmental Representative.

.4 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.

.2 Device type and range.

.3 Measured value.

.4 System displayed value.

.5 Calibration detail.

.6 Indication if adjustment required.

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.5 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:

.1 Initiate service calls when EMCS is not functioning correctly.

.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS within 4 hours after receiving request for service.

.5 Perform Work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.5 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) during the 24 month warranty period. Provide detailed written report to Departmental Representative as described in Submittal article.

.2 Perform inspections during regular working hours, 8:00 to 4:30 h p.m., Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

- .1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
- .2 Check each field input/output device in accordance with Canada Labour Code - Part I.
- .3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

- .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
- .2 Check equipment cooling fans as required.
- .3 Visually check for mechanical faults, and leaks.
- .4 Review system performance with Operations Supervisor to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

- .1 Minor inspection.
- .2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
- .3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
- .4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.
- .5 Provide mechanical adjustments, and necessary maintenance on printers.
- .6 Run system software diagnostics as required.
- .7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.
  - .1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE 2015, Applications Handbook, SI Edition.

.2 Canadian Standards Association (CSA International).

.1 C22.2 No.205, Signal Equipment.

.3 Public Works and Government Services Canada (PSPC)/Real Property Branch/Architectural and Engineering Services.

.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01- EMCS: General Requirements.

1.3 DESCRIPTION

.1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controllers: stand-alone intelligent Control Units.

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

.1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.4 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring (if remote units).

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20mA;

.2 0 - 10V DC;

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than [60]dB to [60]Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20mA.

.2 0 - 10V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5amps at 24 V AC.

.4 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.

.5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Departmental Representative for ceiling mounting.

.6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.7 Provide surge and low voltage protection for interconnecting wiring connections.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section Section 25 05 02- EMCS: Shop Drawings, Product Data and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

1.6 MAINTENANCE

.1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03- EMCS: Project Record Documents.

Part 2 Products

2.1 MASTER CONTROL UNIT (MCU)

2.2 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

.1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

.3 VAV Terminal Controller.

.1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.

.2 Controller to support point definition; in accordance with Section 25 05 01-EMCS: General Requirements.

.3 Controller to operate independent of network in case of communication failure.

.4 Controller to include damper actuator and terminations for input and output sensors and devices.

Part 3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Departmental Representative.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures as directed by Departmental Representative.

.2 Provide necessary power from local 120V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS:

.1 Section 25 05 01- EMCS: General Requirements.

.2 Section 25 05 54- EMCS: Identification.

.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 27 26- Wiring Devices.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI).

.1 ANSI/IEEE C57.13-2008, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148 2014, 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-2012, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2015, Canadian Electrical Code, Part 1, 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 in accordance with Section 01 33 00- Submittal Procedures.

.2 Pre-Installation Tests.

.1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 00- Execution Requirements supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

.3 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, heat resistant assembly.

.3 Operating conditions: $-30^0 – 40^0$ C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

2.2 TEMPERATURE SENSORS

.1 Room temperature sensors and display wall modules.

.1 LCD display to show space temperature and temperature setpoint.

.2 Buttons for occupant selection of temperature setpoint.

.3 Integral thermistor sensing element 10,000ohm at 24degrees.

.4 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.

.5 Stability 0.02 degrees C drift per year.

.6 Separate mounting base for ease of installation.

2.3 LOW VOLTAGE TRANSFORMER

.1 CSA approved 120/24 V, 60 Hz transformer with a coil of continuous copper conductor and high dielectric strength isolation.

.2 Meet NEMA standards.

.3 Include all transformers with sufficient capacity to insure a complete automatisation of electromechanical systems.

2.4 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.5 WIRING

.1 In accordance with Section 26 27 26- Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #18AWG.

.2 Analog input and output: shielded #18 minimum solid copper.

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.

.5 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00- Firestopping. Maintain fire rating integrity.

.6 Electrical:

.1 Complete installation in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Refer to electrical control schematics included as part of control design schematics on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.

.3 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.4 Install communication wiring in conduit.

.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.5 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

.7 VAV Terminal Units: supply, install and adjust as required.

.1 Air probe, actuator and associated vav controls.

.2 Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators.

.3 Co-ordinate air flow adjustments with balancing trade.

3.2 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.

3.3 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54- EMCS: Identification.

3.4 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Public Works and Government Services Canada (PSPC) / Real Property Branch / Architectural and Engineering Services.

.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.2 GENERAL REQUIREMENTS FOR ALL SYSTEMS

.1 The set points stated in this Section are given as working assumptions. They shall be fully editable within the EMCS according to actual building operation and experience.

.2 Set point ramping

.1 Upon a start of the system or on any changes of set point, provide a control algorithm to gradually bring the set point from its start value to its desired value.

.2 The ramping progression speed must be adjustable.

.3 All sequences of operation and programming standards presently in effect in the building apply, unless otherwise stated in this document.

1.3 SEQUENCING – LAB 124

.1 SACV, GECV and FECV air valves are modulated through the data exchange controller in accordance with the Fume hood sash position to maintain room negative pressurization (-47 l/s).

.2 For dual duct unit DDT-1205, cooling air flow is modulated through the TCU from the maximum to the minimum flow to maintain the room temperature set point (adjustable). The minimum air flow at DDT-1205 is dictated by the required flow at air valve SACV based on the fume hood sash position. If the cold deck is at the minimum required air flow and the room temperature continues to fall below the set point, the hot deck is modulated to provide heating supply air while the cold deck modulates down to zero. Hot deck and cold deck air supply can modulate from 0 to maximum while always maintaining a constant minimum air flow dictated by the sash position.

.3 When DDT-1205 is fully opened to the cooling or heating deck and the room air temperature cannot be maintained, the BAS shall override the data exchange controller and modulate SACV to satisfy the room temperature set point. The BAS shall never override the data exchange controller to supply less air that is required by the fume hood.

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 RELATED SECTIONS

.1 Sections of Divisions 01.

.2 Sections of Divisions 26.

1.2 REFERENCES

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 Reference Standards:

.1 CSA Group

.1 Ontario Electrical Safety Code (26nd Edition) consisting of CSA C22.1-15, Canadian Electrical Code, Part 1 (23nd Edition), Safety Standard for Electrical Installations and Ontario Amendments to CSA C22.1-15, Canadian Electrical Code, Part I.

.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.

1.3 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.

.3 Shop drawings:

.1 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.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.4 Submit the required quantity of copies of 600 x 600 mm minimum size drawings and product data to inspection authorities.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified of equipment and material.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.5 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 78 00 - Closeout Submittals.

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

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English and in French.

.4 Use one nameplate for both languages.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors only.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamicoid 3 mm melamine, black face, white core, lettering accurately aligned and engraved into core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Lamicoid Informations: equipment details, from which panel the equipment is fed and what the equipment is feeding if applicable.

.5 Nameplate shall include Environment Canada equipment number. Obtain equipment number from Departmental Representative for any new unidentified equipment in schedule on drawing legend.

.6 Allow for minimum of twenty-five (25) letters per nameplate.

.7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.8 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. (_____)" as directed by Departmental Representative.

.9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.10 Terminal cabinets and pull boxes: indicate system and voltage.

.11 Transformers: indicate capacity, primary and secondary voltages.

2.7 120/208 V SERVICES PANELS

.1 **F**or modified electric panels, supply a new updated typewritten list.

2.8 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.9 SEPARATE NEUTRALS

.1 All new circuits include the hot wire (black wire) and separate neutral (white wire) from the outlet or equipment to the respective terminal strips in electrical panels.

.2 All new isolated circuits include the hot wire (black wire), separate neutral (white wire) and separate isolated ground (green wire in EMT conduit; red wire in "BX" cable including green tape on both ends and at all junction and outlet boxes) from the outlet or equipment to the respective terminal strips in electrical panels.

2.10 VOLTAGE DROP IN BRANCH CIRCUIT

.1 A voltage drop greater than 2% in branch circuit wiring for receptacle or equipment, shall be considered unacceptable and will have to be corrected by the electrical contractor at his own expense.

2.11 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

.4 If there is color code identification already in the building, use the same color code according to the network.

2.12 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment.

.2 Paint indoor switchgear and distribution enclosures light gray.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

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

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.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 CONDUIT AND CABLE INSTALLATION

.1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 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 Refer to the drawings for equipments mounting height.

.2 Panelboards: as required by Code or as indicated.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as over current trips, relays and fuses are installed to required values and settings.

3.8 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, dry-core transformers and motor control centres, 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 45 00 - Quality Control.

- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm and the UPS.
- .6 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 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.

3.9 SYSTEM STARTUP

.1 Instruct in the preference language of the Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.18-2012, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65-2013, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).

.2 National Electrical Manufacturers Association (NEMA)

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 wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

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 wire and box connectors 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.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

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 round copper conductors.

.2 Clamp for round copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, flexible conduit under metallic sheathed, as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors 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.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketted.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.

.5 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 using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

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 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

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 The run shall be limited to 3 m maximum at each final connection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Ontario Electrical Safety Code (26th Edition) consisting of CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations and Ontario Amendments to CSA C22.1-15, Canadian Electrical Code, Part I.

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

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

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on turned edge covers.

2.3 CABINETS

.1 Construction: welded sheet steel, as indicated, hinged door, handle.

.2 Type E Empty: surface return flange and flush overlapping sides mounting, as indicated.

.3 Type T Terminal: surface return flange and flush overlapping sides mounting, as indicated containing sheet steel 19 mm backboard.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating system name, admissible current, voltage and number of phase or as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Ontario Electrical Safety Code (26th Edition) consisting of CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations and Ontario Amendments to CSA C22.1-15, Canadian Electrical Code, Part I.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 120 V or 347 V outlet boxes for 120 V or 347 V switching devices.

.6 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 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

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

2.5 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 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 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA-C22.2 No.18-2012, Outlet Boxes, Conduit Boxes and Fittings.
- .2 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .3 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.
- .4 CSA C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings and with expanded ends.

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal aluminum.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.2 Two hole steel straps for conduits larger than 50 mm.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits at 1.5 m on centre.

.5 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 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 Watertight steel connectors and couplings (compression) for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 or 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 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 Use electrical metallic tubing (EMT) throughout unless otherwise indicated.

.3 Use rigid pvc conduit outside, in corrosive areas.

.4 Use flexible metal conduit for connection to motors in dry areas, connection to surface or recessed fluorescent fixtures, work in movable metal partitions.

.5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.6 Minimum conduit size for lighting and power circuits: 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 At each ends, provide and install for telecommunication and security conduits plastic bushings.

.11 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.12 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 suspended and/or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29-15, Panelboards and Enclosed Panelboards.

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

.3 Shop Drawings:

.1 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

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 panelboards 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.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

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

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 10KA (symmetrical) interrupting capacity or as indicated

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of double ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel.

.11 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

.12 Acceptable material: The only acceptable materials are Schneider (Square D).

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

.4 Lock-on devices for stairway and night lighting circuits located on and under the exterior mezzanine.

.5 Acceptable material: The only acceptable materials are Schneider (Square D).

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 For modified electric panels, supply a new updated typewritten list.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

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

.2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-15, Special Use Switches.

.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

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 wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

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 wiring devices 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.

.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 wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SWITCHES

.1 15 or/and 20 A, 120 V or/and 347 V, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 .

.2 Manually-operated grade industrial (Industrial Specification Grade) AC switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, industrial grade (Industrial Specification Grade), 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, industrial grade (Industrial Specification Grade), 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.

.3 Self-contained with CSA type 5-20 R, 125 V, 20 A, GFIC, U ground, circuit interrupter and duplex receptacle, industrial grade (Industrial Specification Grade), complete with:

- .1 Solid state ground sensing device.
- .2 Facility for testing and reset.
- .3 CSA Enclosure 1, flush mounted with stainless steel face plate.

.4 Other receptacles with ampacity and voltage as indicated.

.5 Receptacles of one manufacturer throughout project.

2.3 LAB BENCH PEDESTAL

.1 Mounted on the counter with two 15/20 A -120V power receptacles. Refer to the Appendix for the reference product.

.2 Alternative material: Approved by addendum in accordance with instructions to Tenderers.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Lab bench pedestal

.1 Install pedestal and receptacles as indicated on the drawing.

.4 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 The adhesive marker shall be made with a label printer. It shall have black lettering on clear substrate, normal 16 points lettering. The information shall be the circuit number and panel identification.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

3.4 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.

Part 4 Appendix

.1 Lab bench pedestal

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No. 5-2013, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2013).

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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 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 of contract and 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 under the contract, and to Contractor's expense.

.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: (_____)

.2 End user's reference number: (____)

.3 List of circuit breakers: (____)

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store circuit breakers off ground indoors 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.

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.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Circuit breakers to have symmetrical rms interrupting capacity rating as indicated.

.5 Acceptable material: The only acceptable materials are Schneider (Square D).

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 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 Reference Standards – Devices

.1 Photometric tests in accordance with IES LM-79 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.2 Light depreciation determined according to IES LM-80 Approved Method: Measuring Lumen Maintenance of LED Light Sources.

.3 Long-term light depreciation determined according to IES TM-21 *Projecting Long Term Lumen Maintenance of LED Light Sources*.

.4 UL 8750 Light Emitting Diode Equipment for Use in Lighting Products.

.2 Reference Standards – Drivers

.1 UL 1310 Class 2 Power Units or equivalent CSA.

.2 ANSI C62.41 Category A IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 FCC Title 47 CFR Part 18 Electronic Code of Federal Regulations – Telecommunication – Industrial, Scientific, and Medical Equipment.

.3 All LED devices and their components must, at minimal meet all reference standards listed above.

.4 Each fixture must be equipped with a compatible factory installed driver. Everything must be approved for plenum use.

.5 Supply units shall be equipped with colour connectors determined in accordance with the standard requirements ANSI C82.11.

.6 Driver technical data:

.1 120 V ±5 %, 60 Hz.

.2 Power factor: 90 % minimum.

.3 Total harmonic distortion: 20 % maximum.

.4 Class A nominal sound volume.

.5 Operation ambient temperature: 10 to 40 °C, 90 % R.H.

.6 The housing temperature: 0 at 62 ºC, 90 % H.R.

.7 Must tolerate without damage a condition of open circuit or short circuit without of fuses or other external protection devices.

.8 Must not contain any PCB.

.7 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.8 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.9 Canadian Standards Association (CSA International)

.10 ICES-005-07, Radio Frequency Lighting Devices.

.11 Underwriters' Laboratories of Canada (ULC)

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

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Divert unused metal materials from landfill to metal recycling facility.

1.6 WARRANTY

.1 12 month warranty period.

Part 2 Products

2.1 LUMINAIRE TYPE LED1

.1 1220 x 600 mm lighting fixture with LED source, 120V. Refer to the Appendix for the reference product. The fixture selection shall be equal or more efficient.

.2 Alternative material: Approved by addendum in accordance with instructions to Tenderers.

2.2 LUMINAIRE TYPE LED2

.1 600 x 600 mm lighting fixture with LED source, 120V. Refer to the Appendix for the reference product. The fixture selection shall be equal or more efficient.

.2 Alternative material: Approved by addendum in accordance with instructions to Tenderers.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible seal tight or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 4 Appendix

.1 LED 1

.2 LED 2.

END OF SECTION

DIA 2x4 LED RECESSED T-Bar & Drywall

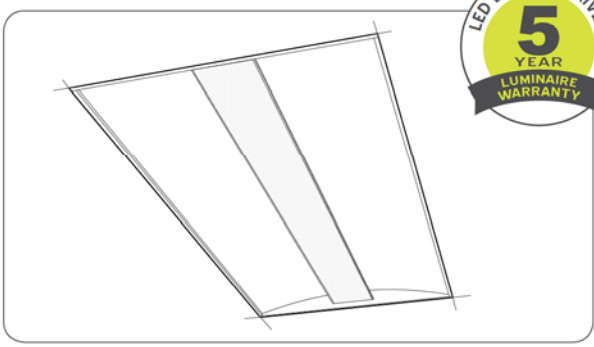
ÉCLAIRAGE axis LIGHTING
1.800.263.AXIS
[T] 514.948.6272
[F] 514.948.6271
www.axislighting.com

PROJECT INFORMATION

Project:

Type: LED1

Notes:

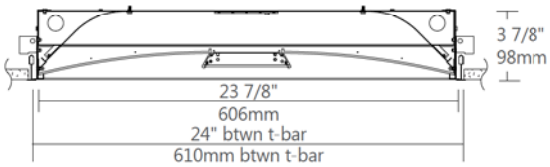


LED BOARD & DRIVER 5 YEAR LUMINAIRE WARRANTY

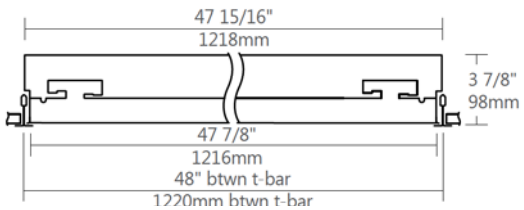
Approved by: Date:

DIMENSIONS -SECTION VIEWS

SECTION VIEW



SIDE VIEW



PERFORMANCE AT 4000K

NOMINAL LUMEN OUTPUT	INPUT WATTS*	EFFICACY
3100 lm	31 W	100 lm/W
4500 lm	38.37 W	117 lm/W
5000 lm	44 W	114 lm/W
7000 lm	62.76 W	112 lm/W
9000 lm	81.36 W	111 lm/W

* Based on a 2'x4' luminaire using one driver
Please consult factory for customize lumen output and wattage.

IC
cULus Listed
Type I.C.

ORDERING CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

PRODUCT SPECIFICATIONS

1 PRODUCT ID		2 SIZE		3 VERSION		4 NOMINAL LUMENS		5 CRI		6 COLOUR TEMP.		7 SHIELDING		8 FINISH	
DIALED	dia led	24	2'X4'	B3	version 3	3100	3100 lm	80	80 CRI	30	3000 K	VL	VL optics	W	white
						4500	4500 lm	90	90 CRI (1)	35	3500 K			C	custom
						5000	5000 lm			40	4000 K				
						7000	7000 lm								
						9000	9000 lm								
									(1) Not available with 4000K						

9 VOLTAGE		10 DRIVER		11 CIRCUITS		12 MOUNTING		13 BATTERY (OPTIONAL)	
120	120 V	D	dimming (0-10V) standard	1	1 circuit	TB9	t-bar 9/16"	B#	Battery Pack
277	277 V	DP	dimming (0-10V) 1%	+E(#)	emergency circuit(4)	TB15	t-bar 15/16"		
347	347 V	LT	lutron (2)	+NL(#)	night light circuit(4)	ST	screw slot t-bar		
UNV	universal	BI	bi-level dimming	+GTD(#)	generator transfer device(4)	TG9	tegular 9/16"		
		O	other (3)			TG15	tegular 15/16"		
						DF	drywall flange		
		(2) Specify system (3) Please consult factory		(4) Specify quantity				Please consult factory	

14 OTHER (OPTIONAL)		15 IC CONTROLS (OPTIONAL)		16 CUSTOM (OPTIONAL)	
F	fuse(5)	DS#	daylight sensor	C	custom
FW(#)	flex whip (6' std)	OS#	occupancy sensor		
AR	air return	DOS#	daylight & occupancy sensor		
CP	chicago plenum	EN#	enlighted integral (6)		
		ENR#	enlighted remote (6)		
(5) Requires 120V or 277V		(6) Please consult factory Specify quantity. Requires 8" blank. See page 3 for more details.		Please specify	

SPECIFY DRIVER NAME (if needed)

SPECIFY BATTERY NAME (if needed)

FILE NAME:DIA24.LED-B3.SPEC March 8, 2016

DIA 2x4 LED RECESSED T-Bar & Drywall

ÉCLAIRAGE axis LIGHTING
1.800.263.AXIS
[T] 514.948.6272
[F] 514.948.6271
www.axislighting.com

SPECIFICATIONS

Housing Die formed cold rolled sheet steel (20 ga)
Central Lens Housing
Extruded aluminum (0.060" nominal)
Center Lens PMMA Precision formed microconical structure
92 percent transmission, cuts off glare above 55°.
Side lens 0.08" PMMA satin blend
Reflectors Die formed cold rolled sheet steel (22 ga)
Interior Brackets
Die formed cold rolled sheet steel (20 ga)
Drywall Flange Kit
Extruded aluminum (0.060" nominal)

ELECTRICAL

Lutron driver L3D - Hi-Lume A-Series EcoSystem 3-Wire Control (1%)
LDE1 - EcoSystem H-Series (1%)
LDE5 - EcoSystem 5-Series (5%)
LTE - Hi-Lume® A-series 2Wires Forward Phase (1%)

Other drivers DALI - Digital Addressable Lighting Interface
DMX - Digital Multiplex
ELV - Electronic Low Voltage dimming
LV - line voltage - Advance Mark 10
redwood - Building Intelligence Platform
Xitanium SR - For wireless sensor

Emergency Integral emergency battery pack or emergency circuit optional.

Input Voltage 120V, 277V, 347V, UNV.

Incorporating these components may have limitations or effect the length of the luminaire, please contact factory for more details.

FINISH

Highly reflective, matte powder coat white paint for high efficiency. Matte texture to diffuse glare and lamp image on the surface within the optical chamber exterior. Custom finishes are also available.

WARRANTY

Axis lighting will warrant defective LEDs, boards, and drivers for 5 years from date of purchase. Warranty is valid if luminaire is installed and used according to specifications.
If defective, Axis will send replacement boards or drivers at no cost along with detailed replacement instructions and instructions on how to return defective components to Axis.

APPROVALS

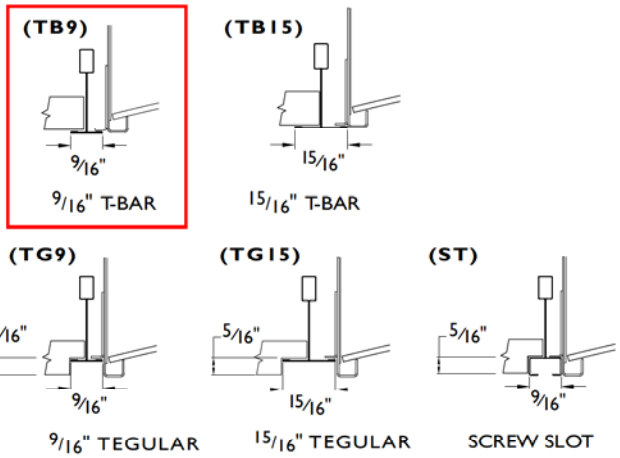
Certified to UL and CUL standards
Chicago Plenum Certified (CCEA)
Meets NYC requirements
Suitable for damp locations.
IC Rated (Insulated ceiling)

WEIGHT

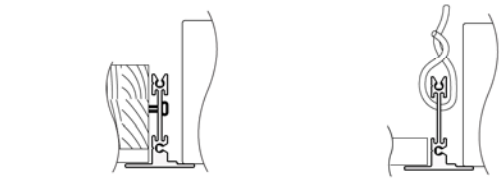
Standard	19 lbs / 8.6 kg
Drywall with Kit	21 lbs / 9.6 kg

CEILING SYSTEM

T-BAR STYLE MOUNTING

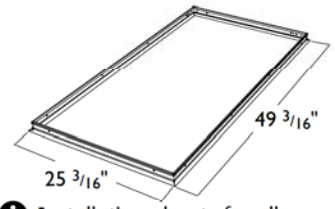


DRYWALL WITH FLANGE KIT (DF)



WITH WOOD FRAME DRYWALL MOUNTING KIT

WITHOUT WOOD FRAME



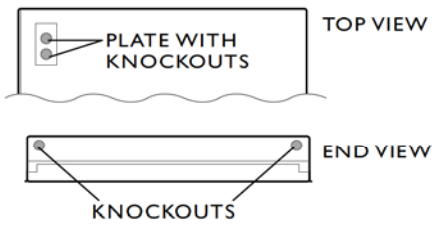
FIXTURE DIMENSIONS
47 3/8"/23 3/8"

CUT HOLE DIMENSIONS
48 7/16"/24 7/16"

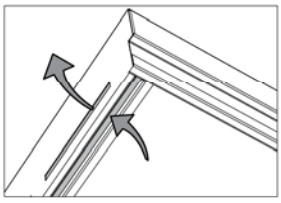
Installation sheets for all mounting options are available at: www.axislighting.com

STANDARD AND END MOUNT POWER FEED

Knockouts for BX cable connection are provided both on the top and on the ends of the luminaire. This allows for an end mount power feed solution if it is required.
(BX CABLE BY OTHERS)



AIR RETURN



The air return (AR) option consists of discrete slots along the sides of the luminaire. These slots allow air to exhaust into the plenum and eliminate the need for unsightly air return grilles, and create a clean and well organized ceiling.

DIA 2x4 LED RECESSED T-Bar & Drywall

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INTEGRATED CONTROL OPTIONS

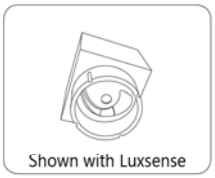
DIA luminaires allow the use of integrated controls such as daylight sensors (DS), occupancy sensors (OS), individual daylight sensors and occupancy sensors (DS+OS) and combination daylight/ occupancy sensors (DOS). These options can be seamlessly integrated into our luminaires. The control system could be used to optimize the lighting of the space by reducing energy consumption through daylight harvesting and occupancy, thereby improving the overall interior environment and allowing for LEED credits.

- Consult factory for other options.
- Refer to IC brochure for more information.

The integrated control systems offered are:

DAYLIGHT HARVESTING (DS):

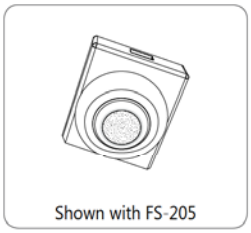
With daylight sensors, maximum lamp output is reduced according to the available amount of natural light. By reducing maximum lamp output, energy consumption is reduced by up to 20 percent in a process known as "Daylight Harvesting".


Shown with Luxsense

EC-DIR-WH, FD-301
Luxsense, Micro Luxsense

OCCUPANCY (OS):

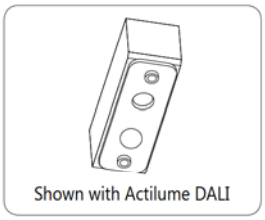
When a room is vacated, occupancy sensors ensure the light will be turned off after a programmed delay as well as ensuring that light remains on while the room is occupied.


Shown with FS-205

FS-205, FS-355,
FS-155 - Line Voltage
FS-505, FS-505C

DAYLIGHT HARVESTING AND OCCUPANCY (DOS):

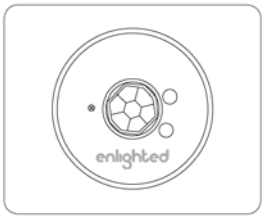
A combination of Daylight & Occupancy sensor from Philips, ACTILUME along with 0-10V or DALI ballasts can be used in one form factor.


Shown with Actilume DALI

Actilume 1-10V
Actilume DALI

ENLIGHTED INTEGRAL (EN) / ENLIGHTED REMOTE (ENR):

A combination of Daylight , Occupancy & Temperature autonomously control illumination levels, monitor occupancy and environmental conditions. Data is transmitted wirelessly to the Enlighted networked management system.



SENSORS	BRAND	Model	TYPE	COMPATIBLE DRIVER
Daylight Sensor (DS)	Wattstopper	FD-301	Daylight	Dimming 0-10V
	Philips	Luxsense	Daylight	Dimming 0-10V
Occupancy Sensor (OS)	Wattstopper	FS-205	PIR Occupancy	Dimming or non-dimming
		FS-355	PIR Occupancy	Dimming or non-dimming
		FS-155	PIR Occupancy	Dimming or non-dimming
		FS-505C	Ultrasonic Occupancy	Dimming or non-dimming
Daylight and Occupancy Sensor (DOS)	Philips	Actilume	Daylight & PIR Occupancy	DALI or 0-10V
Enlighted sensor (EN, ENR)	Enlighted integral / remote	SU-3E-00	Daylight, Occupancy & temperature	

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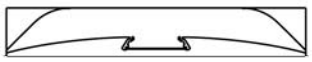
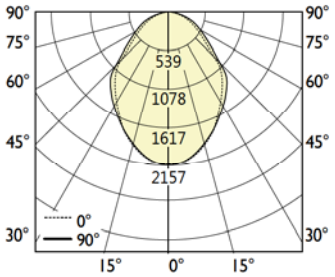
PHOTOMETRIC DATA

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 4500 lm
Input Watts: 38.37 W
Efficacy: 117 lm/W
IES FILE: DIALED-24-B3-4500-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	2155	2155	2155	2155	2155	
10	2069	2068	2067	2072	2071	99
20	1814	1814	1817	1826	1830	171
30	1558	1547	1532	1511	1496	210
40	1304	1304	1280	1225	1199	223
50	850	824	804	776	729	168
60	561	540	518	495	457	122
70	361	342	324	305	277	83
80	159	163	162	142	134	41
90	0	0	0	0	0	

LUMINANCE DATA (CD/M²)

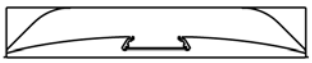
	Horizontal Angles		
Vertical Angle	0	45	90
45	2255	2177	2038
55	1719	1647	1439
65	1566	1434	1243
75	1507	1356	1145
85	713	909	1007

COEFFICIENTS OF UTILIZATION (%)

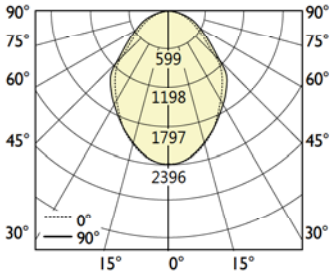
Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	112	112	112
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	92	86	79	88	83	77
3	93	83	75	67	90	81	74	66	79	73	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	74	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 5000 lm
Input Watts: 44 W
Efficacy: 114 lm/W
IES FILE: DIALED-24-B3-5000-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	2394	2394	2394	2394	2394	
10	2298	2298	2297	2302	2301	109
20	2015	2015	2019	2028	2033	190
30	1731	1718	1702	1679	1662	233
40	1449	1449	1422	1361	1332	248
50	944	916	894	862	810	186
60	623	600	575	550	508	136
70	401	380	360	339	308	92
80	177	182	180	158	149	46
90	0	0	0	0	0	

LUMINANCE DATA (CD/M²)

	Horizontal Angles		
Vertical Angle	0	45	90
45	2506	2419	2264
55	1910	1830	1599
65	1740	1593	1381
75	1675	1507	1272
85	793	1010	1119

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	112	112	112
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	92	86	79	88	83	77
3	93	83	75	67	90	81	74	66	79	73	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	74	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

All IES files are available for download at: www.axislighting.com

DIA 2x4 LED RECESSED T-Bar & Drywall

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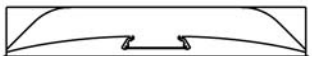
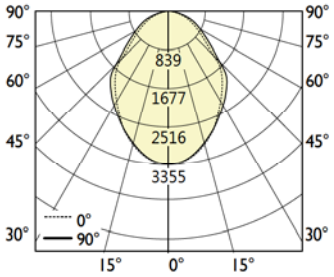
PHOTOMETRIC DATA

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 7000 lm
Input Watts: 62.76 W
Efficacy: 112 lm/W
IES FILE: DIALED-24-B3-7000-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	3352	3352	3352	3352	3352	
10	3218	3217	3215	3223	3222	153
20	2822	2822	2827	2840	2846	265
30	2423	2406	2382	2351	2326	326
40	2028	2028	1991	1905	1865	347
50	1322	1282	1251	1207	1134	261
60	872	839	805	770	712	190
70	562	532	504	474	431	129
80	248	254	252	222	209	64
90	0	0	0	0	0	

LUMINANCE DATA (CD/M2)

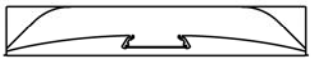
	Horizontal Angles		
Vertical Angle	0	45	90
45	3508	3387	3170
55	2675	2562	2238
65	2436	2230	1934
75	2345	2110	1780
85	1110	1414	1567

COEFFICIENTS OF UTILIZATION (%)

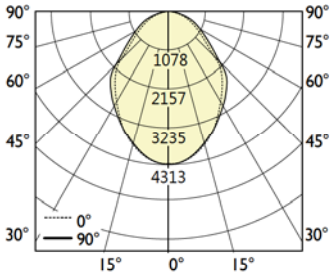
Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	112	112	112
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	92	86	79	88	83	77
3	93	83	75	67	90	81	74	66	79	73	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	74	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 9000 lm
Input Watts: 81.36 W
Efficacy: 111 lm/W
IES FILE: DIALED-24-B3-9000-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	4310	4310	4310	4310	4310	
10	4137	4136	4134	4144	4142	197
20	3628	3628	3635	3651	3660	341
30	3115	3093	3063	3023	2991	419
40	2607	2607	2560	2450	2398	446
50	1699	1649	1609	1552	1458	335
60	1121	1079	1036	990	915	245
70	722	684	648	610	555	166
80	318	327	323	285	268	83
90	0	0	0	0	0	

LUMINANCE DATA (CD/M2)

	Horizontal Angles		
Vertical Angle	0	45	90
45	4510	4355	4075
55	3439	3294	2878
65	3133	2867	2486
75	3014	2713	2289
85	1427	1818	2014

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	112	112	112
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	92	86	79	88	83	77
3	93	83	75	67	90	81	74	66	79	73	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	74	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

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www.axislighting.com

PROJECT INFORMATION

Project:

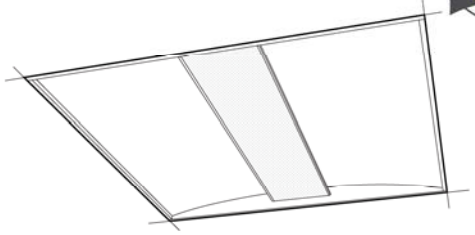
Type: LED2

Notes:

RECOGNIZED BY

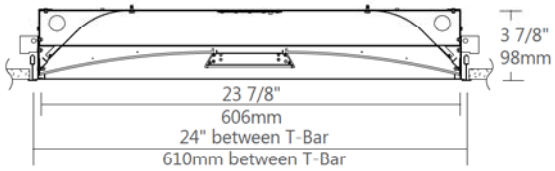
NGL

LED BOARD & DRIVER 5 YEAR LUMINAIRE WARRANTY

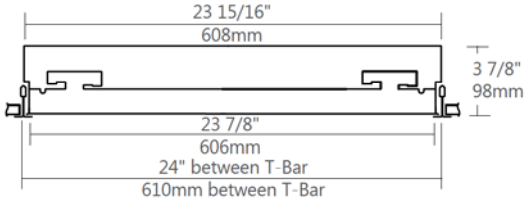


DIMENSIONS -SECTION VIEWS

SECTION VIEW



SIDE VIEW



Approved by: Date:

PERFORMANCE AT 4000K

NOMINAL LUMEN OUTPUT	INPUT WATTS*	EFFICACY
2500 lm	23.1 W	109 lm/W
3000 lm	28.49 W	105 lm/W
4000 lm	39.22 W	102 lm/W
4400 lm	43.64 W	101 lm/W

* Based on a 2'x2' luminaire using one driver
Please consult factory for customize lumen output and wattage.

IC
cULus Listed
Type I.C.

DLC DLC LISTED

*Check the latest update on the DLC website for complete information. Not all versions may be DLC qualified.

ORDERING CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

PRODUCT SPECIFICATIONS

1 PRODUCT ID		2 SIZE		3 VERSION		4 NOMINAL LUMENS		5 CRI		6 COLOUR TEMP.		7 SHIELDING		8 FINISH	
DIALED	dia led	**22**	2'X2'	**B3**	version 3	**2500**	2500 lm	**80**	80 CRI	**30**	3000 K	**VL**	VL optics	**W**	white
						3000	3000 lm	**90**	90 CRI (1)	**35**	3500 K			**C**	custom
						4000	4000 lm			**40**	4000 K				
						4400	4400 lm								

(1) Not available with 4000K

9 VOLTAGE		10 DRIVER		11 CIRCUITS		12 MOUNTING		13 BATTERY (OPTIONAL)	
120	120 V	**D**	dimming (0-10V) standard	**1**	1 circuit	**TB9**	t-bar 9/16"	**B#**	Battery Pack
277	277 V	**DP**	dimming (0-10V) 1%	**+E(#)**	emergency circuit(4)	**TB15**	t-bar 15/16"		
347	347 V	**LT**	lutron (2)	**+NL(#)**	night light circuit(4)	**ST**	screw slot t-bar		
UNV	universal	**BI**	bi-level dimming	**+GTD(#)**	generator transfer device(4)	**TG9**	tegular 9/16"		
		O	other (3)			**TG15**	tegular 15/16"		
						DF	drywall flange		

(2) Specify system
(3) Please consult factory

(4) Specify quantity

Please consult factory

14 OTHER (OPTIONAL)		15 IC CONTROLS (OPTIONAL)		16 CUSTOM (OPTIONAL)	
F	fuse(5)	**DS#**	daylight sensor	**C**	custom
FW(#)	flex whip (6' std)	**OS#**	occupancy sensor		
AR	air return	**DOS#**	daylight & occupancy sensor		
CP	chicago plenum	**EN#**	enlighted integral (6)		
		ENR#	enlighted remote (6)		

(5) Requires 120V or 277V

(6) Please consult factory
Specify quantity. Requires 8" blank.
See page 3 for more details.

Please specify

SPECIFY DRIVER NAME (if needed)

SPECIFY BATTERY NAME (if needed)

FILE NAME:DIA22.LED-B3.SPEC March 8, 2016

DIA 2x2 LED RECESSED T-Bar & Drywall

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SPECIFICATIONS

Housing Die formed cold rolled sheet steel (20 ga)
Central Lens Housing
Extruded aluminum (0.060" nominal)
Center Lens PMMA Precision formed microconical structure
92 percent transmission, cuts off glare above 55°.
Side lens 0.08" PMMA satin blend
Reflectors Die formed cold rolled sheet steel (22 ga)
Interior Brackets
Die formed cold rolled sheet steel (20 ga)
Drywall Flange Kit
Extruded aluminum (0.060" nominal)

ELECTRICAL

Lutron driver L3D - Hi-Lume A-Series EcoSystem 3-Wire Control (1%)
LDE1 - EcoSystem H-Series (1%)
LDE5 - EcoSystem 5-Series (5%)
LTE - Hi-Lume® A-series 2Wires Forward Phase (1%)

Other drivers DALI - Digital Addressable Lighting Interface
DMX - Digital Multiplex
ELV - Electronic Low Voltage dimming
LV - line voltage - Advance Mark 10
redwood - Building Intelligence Platform
Xitanium SR - For wireless sensor

Emergency Integral emergency battery pack or emergency circuit optional.

Input Voltage 120V, 277V, 347V, UNV.

Incorporating these components may have limitations or effect the length of the luminaire, please contact factory for more details.

FINISH

Highly reflective, matte powder coat white paint for high efficiency. Matte texture to diffuse glare and lamp image on the surface within the optical chamber exterior. Custom finishes are also available.

WARRANTY

Axis lighting will warrant defective LEDs, boards, and drivers for 5 years from date of purchase. Warranty is valid if luminaire is installed and used according to specifications.
If defective, Axis will send replacement boards or drivers at no cost along with detailed replacement instructions and instructions on how to return defective components to Axis.

APPROVALS

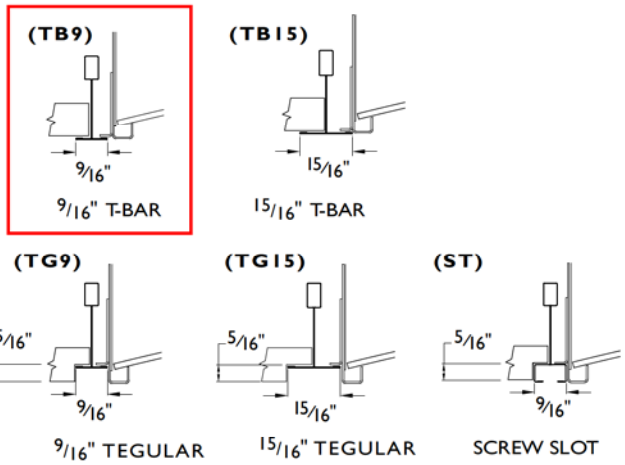
Certified to UL and CUL standards
Chicago Plenum Certified (CCEA)
Meets NYC requirements
Suitable for damp locations.
IC Rated (Insulated ceiling)

WEIGHT

Standard	19 lbs / 8.6 kg
Drywall with Kit	21 lbs / 9.6 kg

CEILING SYSTEM

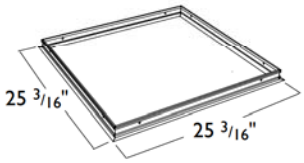
T-BAR STYLE MOUNTING



DRYWALL WITH FLANGE KIT (DF)

WITH WOOD FRAME WITHOUT WOOD FRAME

DRYWALL MOUNTING KIT



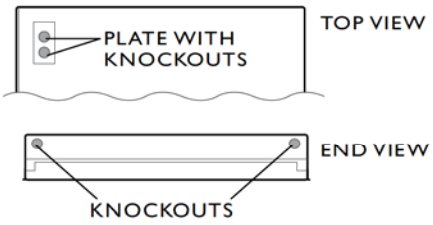
FIXTURE DIMENSIONS
23 3/8"/23 3/8"

CUT HOLE DIMENSIONS
24 7/16"/24 7/16"

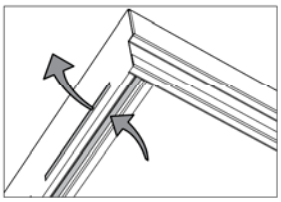
Installation sheets for all mounting options are available at: www.axislighting.com

STANDARD AND END MOUNT POWER FEED

Knockouts for BX cable connection are provided both on the top and on the ends of the luminaire. This allows for an end mount power feed solution if it is required.
(BX CABLE BY OTHER)



AIR RETURN



The air return (AR) option consists of discrete slots along the sides of the luminaire. These slots allow air to exhaust into the plenum and eliminate the need for unsightly air return grilles, and create a clean and well organized ceiling.

DIA 2x2 LED RECESSED T-Bar & Drywall

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INTEGRATED CONTROL OPTIONS

DIA luminaires allow the use of integrated controls such as daylight sensors (DS), occupancy sensors (OS), individual daylight sensors and occupancy sensors (DS+OS) and combination daylight/ occupancy sensors (DOS). These options can be seamlessly integrated into our luminaires. The control system could be used to optimize the lighting of the space by reducing energy consumption through daylight harvesting and occupancy, thereby improving the overall interior environment and allowing for LEED credits.

- Consult factory for other options.
- Refer to IC brochure for more information.

The integrated control systems offered are:

DAYLIGHT HARVESTING (DS):

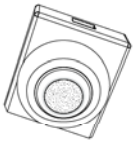
With daylight sensors, maximum lamp output is reduced according to the available amount of natural light. By reducing maximum lamp output, energy consumption is reduced by up to 20 percent in a process known as "Daylight Harvesting".


Shown with Luxsense

EC-DIR-WH, FD-301
Luxsense, Micro Luxsense

OCCUPANCY (OS):

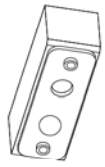
When a room is vacated, occupancy sensors ensure the light will be turned off after a programmed delay as well as ensuring that light remains on while the room is occupied.


Shown with FS-205

FS-205, FS-355,
FS-155 - Line Voltage
FS-505, FS-505C

DAYLIGHT HARVESTING AND OCCUPANCY (DOS):

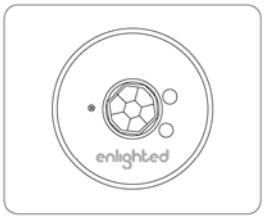
A combination of Daylight & Occupancy sensor from Philips, ACTILUME along with 0-10V or DALI ballasts can be used in one form factor.


Shown with Actilume DALI

Actilume 1-10V
Actilume DALI

ENLIGHTED INTEGRAL (EN) / ENLIGHTED REMOTE (ENR):

A combination of Daylight , Occupancy & Temperature autonomously control illumination levels, monitor occupancy and environmental conditions. Data is transmitted wirelessly to the Enlighted networked management system.



SENSORS	BRAND	Model	TYPE	COMPATIBLE DRIVER
Daylight Sensor (DS)	Wattstopper	FD-301	Daylight	Dimming 0-10V
	Philips	Luxsense	Daylight	Dimming 0-10V
Occupancy Sensor (OS)	Wattstopper	FS-205	PIR Occupancy	Dimming or non-dimming
		FS-355	PIR Occupancy	Dimming or non-dimming
		FS-155	PIR Occupancy	Dimming or non-dimming
		FS-505C	Ultrasonic Occupancy	Dimming or non-dimming
Daylight and Occupancy Sensor (DOS)	Philips	Actilume	Daylight & PIR Occupancy	DALI or 0-10V
Enlighted sensor (EN, ENR)	Enlighted integral / remote	SU-3E-00	Daylight, Occupancy & temperature	

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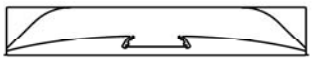
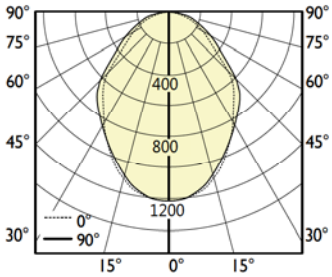
PHOTOMETRIC DATA

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 2500 lm
Input Watts: 23.1 W
Efficacy: 109 lm/W
IES FILE: DIALED-22-B3-2500-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	1209	1209	1209	1209	1209	
10	1164	1163	1162	1161	1160	55.31
20	1015	1011	1014	1017	1016	95.11
30	820	832	853	869	875	116.56
40	650	671	708	727	733	123.24
50	400	425	445	470	487	93.63
60	249	273	293	313	323	69.14
70	152	167	182	197	212	46.88
80	69	76	86	87	86	22.04
90	0	0	0	0	0	

LUMINANCE DATA (CD/M²)

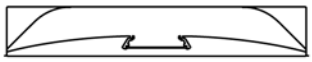
	Horizontal Angles		
Vertical Angle	0	45	90
45	2250	2464	2570
55	1594	1885	2046
65	1410	1642	1875
75	1312	1554	1819
85	957	923	786

COEFFICIENTS OF UTILIZATION (%)

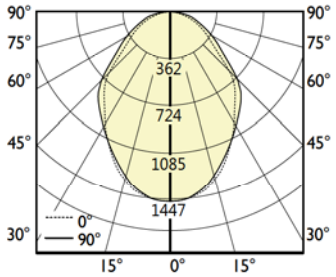
Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	111	111	111
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	91	86	79	88	83	77
3	93	83	75	67	90	81	74	66	78	72	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	73	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 3000 lm
Input Watts: 28.49 W
Efficacy: 105 lm/W
IES FILE: DIALED-22-B3-3000-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	1447	1447	1447	1447	1447	
10	1393	1392	1391	1390	1389	66
20	1215	1210	1214	1217	1216	114
30	982	996	1021	1040	1047	140
40	778	803	848	870	877	148
50	479	509	533	563	583	112
60	298	327	351	375	387	83
70	182	200	218	236	254	56
80	83	91	103	104	103	26
90	0	0	0	0	0	

LUMINANCE DATA (CD/M²)

	Horizontal Angles		
Vertical Angle	0	45	90
45	2693	2950	3076
55	1909	2257	2450
65	1688	1966	2245
75	1571	1860	2177
85	1146	1105	941

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	111	111	111
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	91	86	79	88	83	77
3	93	83	75	67	90	81	74	66	78	72	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	73	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

All IES files are available for download at: www.axislighting.com

DIA 2x2 LED — RECESSED T-Bar & Drywall

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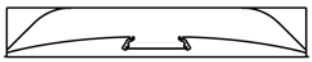
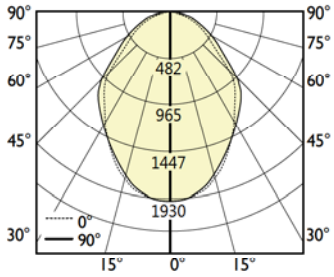
PHOTOMETRIC DATA

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 4000 lm
Input Watts: 39.22 W
Efficacy: 102 lm/W
IES FILE: DIALED-22-B3-4000-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	1930	1930	1930	1930	1930	
10	1858	1856	1855	1853	1852	88
20	1620	1614	1619	1623	1622	152
30	1309	1328	1362	1387	1397	186
40	1038	1071	1130	1160	1170	197
50	638	678	710	750	777	149
60	397	436	468	500	516	110
70	243	267	291	314	338	75
80	110	121	137	139	137	35
90	0	0	0	0	0	

LUMINANCE DATA (CD/M2)

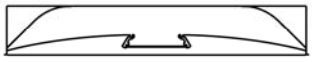
	Horizontal Angles		
Vertical Angle	0	45	90
45	3591	3934	4102
55	2545	3009	3266
65	2250	2621	2993
75	2094	2480	2903
85	1528	1473	1255

COEFFICIENTS OF UTILIZATION (%)

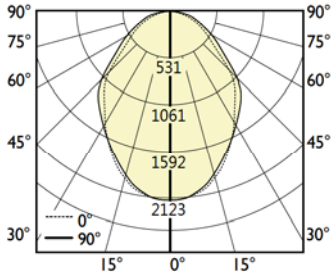
Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	111	111	111
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	91	86	79	88	83	77
3	93	83	75	67	90	81	74	66	78	72	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	73	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

LED



PHOTOMETRIC CURVE



Lumaire Lumens: 4400 lm
Input Watts: 43.64 W
Efficacy: 101 lm/W
IES FILE: DIALED-22-B3-4400-80-40-VL.ies

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles					Zonal Lumens
Vertical Angle	0	22.5	45	67.5	90	
0	2123	2123	2123	2123	2123	
10	2044	2042	2040	2038	2037	97
20	1782	1775	1780	1786	1784	167
30	1440	1461	1498	1526	1536	205
40	1141	1178	1243	1276	1287	216
50	702	746	781	825	855	164
60	437	479	514	550	567	121
70	267	293	320	346	372	82
80	121	133	151	153	151	39
90	0	0	0	0	0	

LUMINANCE DATA (CD/M2)

	Horizontal Angles		
Vertical Angle	0	45	90
45	3950	4357	4512
55	2799	3310	3593
65	2475	2884	3292
75	2304	2728	3193
85	1680	1620	1380

COEFFICIENTS OF UTILIZATION (%)

Ceiling	80				70				50		
Wall	70	50	30	10	70	50	30	10	50	30	10
0	119	119	119	119	117	117	117	117	111	111	111
1	110	106	102	97	107	103	100	95	99	96	92
2	101	93	87	79	98	91	86	79	88	83	77
3	93	83	75	67	90	81	74	66	78	72	65
4	86	74	66	57	83	73	65	57	71	64	56
5	79	67	59	50	77	66	58	50	64	57	49
6	73	61	52	44	72	60	52	44	58	51	44
7	68	56	47	39	67	55	47	39	53	46	39
8	64	51	43	35	62	50	43	35	49	42	35
9	60	47	39	32	59	47	39	32	45	39	32
10	56	44	36	29	55	43	36	29	42	35	29

Based on floor reflectance of 20

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