



**Public Services and
Procurement Canada**

Requisition No. EZ899-202574/A

DRAWINGS & SPECIFICATIONS
For
Project No.: R.097976.001
Mission Medium Institution
Building M - Canteen Relocation

APPROVED BY:
Paul, Preetipa Digitally signed by: Paul, Preetipa
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/ c = VISC / STPSG/C
Date: 2019.12.19 09:02:15 -0800

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Regional Manager, AES Date _____

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Construction Safety Coordinator 2019.12.05
Date

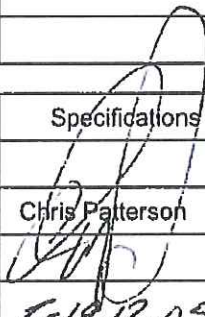
TENDER:
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Project Manager 2020.01-06
Date

PACIFIC REGION – Professional and Technical Services (PTS)	Form	EDRM #:	
		Business Unit: AES	Page: 2 of 2
Title: Technical Review Sign-off Cover Sheet¹			

Civil	Design	Drawings	Specifications	Estimate
Prepared By:				
Reviewed By:				
Signature:				
Date:				

Fire Protection Engineer	Design	Drawings	Specifications	Estimate
Prepared By:				
Reviewed By:				
Signature:				
Date:				

OHSEM	Design	Drawings	Specifications	Estimate
Prepared By:				
Reviewed By:			Chris Patterson	
Signature:				
Date:			2019-12-05	

Commissioning	Design	Drawings	Specifications	Estimate
Prepared By:				
Reviewed By:				
Signature:				
Date:				

¹ Reviewed In accordance with Pacific Region Quality Management Procedures and PWGSC Contract Requirements for Consultant Services. Design Manager to add other disciplines if necessary for a specific project.

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Appendix:

A	Pre-renovation hazardous building material-assessment	N/A
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List of Drawings (Bound Separately):

A01	Site plan
A02	Building M floor plan
A03	Demolition plan
A04	New canteen floor plan
A05	Photos of existing condition
A06	Photos of existing condition
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E01	Site Plan
E02	Building M Floor Plan
E03	Demolition Plan
E04	New canteen floor plan
E05	Details

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY OF WORK

- .1 Work covered by Contract Documents:
 - .1 This Contract covers the following work at the Mission Medium Institution, new inmate canteen in the building M, 8751 Stave Lake Street, Mission BC V2V 4L8.
 - .1 Remove existing furniture and equipment from the scope area to a designated area within Building M to facilitate demolition and construction.
 - .2 Demolish existing storage room and vestibule partitions and associated building components as indicated on drawings.
 - .3 Salvage or dispose demolition debris according to specified procedures within.
 - .4 Construction new canteen and vestibule with few site improvements such as a new canopy and metal railing.
 - .5 Relocate few specified equipment from existing canteen room in Building A to the new canteen room in Building M.
- .2 Work to be performed under this Contract includes, but not limited to, the following items covered further in the Contract documents:
 - .1 Provide a detailed work plan including a project schedule and phasing. This detailed work plan shall be submitted to the Departmental Representative for review to verify that there will be no interruption of service.
 - .2 Do not start work until all essential equipment is delivered to the site and the work can proceed without delays.
 - .3 Provide as-built drawings and closeout submittals.
- .3 Contractor's Use of Premises:
 - .1 Contractor has limited use of site for work of this contract until Substantial Completion:
 - .1 Contractor use of premises for storage and access, as approved by the Departmental representative.
 - .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
 - .2 Vehicular access through the Sally Port will be restricted during the inmate "count" at breakfast, lunch and dinner hours. Confirm times with Departmental Representative. Delays may occur when entering and exiting the Institution with vehicles due to security situations and heavy traffic.

1.2 WORK RESTRICTIONS

- .1 Notify Departmental Representative of intended interruption of power, communication and water services and provide schedule of interruption times.
- .2 Where Work involves breaking into or connecting to existing services, give departmental Representative 48 hours of notice for necessary interruption of services throughout course of work. Keep duration of interruptions to a minimum. Coordinate interruptions

- with local authority having jurisdiction and local residences and businesses affected by the disruption.
- .3 Provide for access by pedestrian and vehicular traffic on and around site where work is in progress.
 - .4 Construct barriers in accordance with Section Temporary Barriers and Enclosures.
 - .5 Security Requirements: refer to Section 01 14 10 - Security Requirements.
 - .6 Hours of work:
 - .1 Perform work during normal working hours of the Institution 0730 to 1600, Monday through Friday except holidays.
 - .2 When it is necessary, arrange in advance with Departmental Representative to work outside of normal working hours.

1.3 CONSTRUCTION WORK SCHEDULE

- .1 Commence work immediately upon official notification of acceptance of offer and complete the work within 16 weeks from the date of such notification.
- .2 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Substantial Certificate and Final Certificate as defined times of completion are of essence of this contract.
- .3 Submittal:
 - .1 Submit to Departmental Representative within 10 working days of Award of Contract, a Bar (GANNT) Chart as Master Plan for planning, monitoring and reporting of construction progress.
 - .2 Identify each trade or operation.
 - .3 Show dates for delivery of items requiring long lead time.
 - .4 Departmental Representative will review schedule and return one copy.
 - .5 Re-submit two (2) copies of finalized schedule to Departmental Representative within five (5) working days after return of reviewed preliminary copy.
- .4 Project Scheduling Reporting:
 - .1 Update Project Schedule on bi-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.
- .5 Project Meetings:
 - .1 Discuss Project Schedule at bi-weekly 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.
 - .3 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price. After approval by Departmental Representative cost breakdown will be used as

basis for progress payments. Only PSPC paper work is acceptable. The suggested breakdowns per specification divisions:

- .1 General conditions
- .2 Existing condition and demolition
- .3 Metals, Structural
- .4 Wood and Millwork
- .5 Thermal and Moisture Protection
- .6 Door, Frame and Hardware
- .7 Finishes
- .8 Specialties
- .9 Mechanical
- .10 Electrical

1.4 SUBMITTAL PROCEDURES

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

- .1 Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate sections.
 - .2 Submit drawings associated with structural components shown in drawings S01 to S12, stamped and signed by professional engineer registered or licensed in British Columbia, 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 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
 - .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .3 Product Data:
- .1 Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings, provided that the product concerned is clearly identified. Submit in sets, not as individual submissions.
- .4 Samples:
- .1 Submit samples in sizes and quantities specified.
 - .2 Where colour is criterion, submit full range of colours.
 - .3 Submit all samples as soon as possible after the contract is awarded, to facilitate production of complete colour scheme by the Departmental Representative.
- .5 Mock-ups:
- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
 - .2 Construct in location as specified in specific Section.
 - .3 Prepare mock-ups for Departmental Representative' review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
 - .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.
- .6 Progress Photographs:
- .1 Provide construction photographs in accordance with procedures and submission requirements specified in this clause.
 - .2 Progress Photographs:

- .1 Provide digital photographs with images of minimum 3.1 mega pixel resolution and stored in Jpeg format with minimal compression.
 - .2 Number of viewpoints: four (4), locations of viewpoints directed by Departmental Representative.
 - .3 Frequency: monthly, submitted on disk with monthly progress statement, sent via e-mail or as directed by Departmental Representative.
 - .4 Identify photos by location, date and sequential numbering system.
- .3 Final Photographs:
- .1 Provide digital photographs with images of minimum 3.1 mega pixel resolution and stored in Jpeg format with minimal compression. Where photos are e-mailed compression can be increased.
 - .2 Number of viewpoints:
 - .1 Interior of rooms and finishes for a total of 8.
 - .2 Exterior views of new canopy, railing and windows for a total of 8.
 - .3 Locations of viewpoints determined by Departmental Representative.
 - .3 Submit final photographs in digital format on CD, before final acceptance of building.
 - .4 Label disks and identify with name and project number of project. Indicate exposure dates and viewpoints of each photo and photo number.
- .7 Submission Requirements:
- .1 Schedule submissions at least ten days before dates reviewed submissions will be needed.
 - .2 Submit number of copies of product data, shop drawings which Contractor requires for distribution plus four (4) copies which will be retained by Departmental Representative.
 - .3 Submissions to 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 Relationship to adjacent work.
- .4 Accompany submissions with transmittal letter in duplicate.
- .5 Submit bond copies (hard copy) as directed by Departmental Representative.
- .8 Coordination of Submissions:
 - .1 Review shop drawings, product data and samples prior to submission.
 - .2 Coordinate with field construction criteria.
 - .3 Verify catalogue numbers and similar data.
 - .4 Coordinate each submittal with requirements of the work of all trades and contract documents.
 - .5 Responsibility for errors and omissions in submittal is not relieved by Departmental Representative's review of submittal.
 - .6 Responsibility for deviations in submittal from requirements of Contract documents is not relieved by Departmental Representative's review of submittal, unless Departmental Representative gives written acceptance of specified deviations.
 - .7 Notify Departmental Representative, in writing at time of submission, of deviations in submittal from requirements of Contract documents.
 - .8 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and re-submit as directed by Departmental Representative.
 - .9 After Departmental Representative's review, distribute copies.

.10 Shop Drawings Review:

- .1 Review of shop drawings by Public Services and Procurement Canada (PSPC) is for the sole purpose of ascertaining conformance with the general concept.
- .2 The Departmental Representative's review does not mean that PSPC approves the detail design inherent in the shop drawings, responsibility remains with the contractor submitting same, and such review will not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents.
- .3 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work of all subtrades.

1.5 HEALTH AND SAFETY

- .1 Specified in Section 01 35 33.

1.6 ENVIRONMENTAL PROCEDURES

- .1 Fires and burning of rubbish on site not permitted.
- .2 Do not bury rubbish and waste materials on site unless approved by Departmental Representative.
- .3 Do not dispose of waste or volatile materials such as oil, paint thinner or mineral spirits into waterways, storm or sanitary systems.
- .4 Provide temporary drainage and pumping as necessary to keep excavations and site free from water during excavation and grading activities.
- .5 Control disposal of run-off of water containing suspended materials or other harmful substances in accordance with local authority requirements. Construct settlement ponds and silt fences as required by the Provincial Environmental authority.
- .6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .7 Under no circumstances dispose of rubbish or waste materials on adjoining property.

1.7 REGULATORY REQUIREMENTS

- .1 References and Codes:
 - .1 Perform Work in accordance with National Building Code of Canada (NBCC2015) and where applicable British Columbia Building Code (BCBC2018) including all amendments up to bid 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.

1.8 QUALITY CONTROL

- .1 Inspection:
 - .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress..
 - .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work
 - .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
 - .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- .2 Independent Testing Agencies
 - .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative
 - .2 Access to Work will be provided to inspection/testing agencies.
 - .2 Provide equipment required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
 - .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Owner. Pay costs for retesting and reinspection.
- .3 Procedures:
 - .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay 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.
- .4 Rejected Work:
 - .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .5 Reports:
 - .1 Submit (4) four copies of inspection and test reports to Departmental Representative.
- .6 Tests and Mix Designs:
 - .1 Furnish test results and mix designs as may be requested.
- .7 Mill Tests
 - .1 Submit mill test certificates as required of specification Sections 05 12 23.
- .8 Mock-ups:
 - .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
 - .2 Construct in locations acceptable to Departmental Representative and as specified in specific Section.
 - .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
 - .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.
 - .6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.
- .9 Equipment and Systems:
 - .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
 - .2 Refer to specific Section for definitive requirements.

1.9 TEMPORARY UTILITIES

- .1 Installation and Removal:
 - .1 Provide temporary utilities controls in order to execute work expeditiously.
 - .2 Remove from site all such work after use.
- .2 Water Supply:
 - .1 Arrange, pay for and maintain temporary water supply in accordance with local authority, governing regulations and ordinances.
 - .2 Existing permanent water supply system may be used for construction requirements at no extra cost, provided that guarantees are not affected thereby. Replace damaged components.
- .3 Temporary Power and Light:
 - .1 Arrange, pay for and maintain temporary electric power supply in accordance with local power authority governing regulations and ordinances.

- .2 Existing Electrical power and lighting installed under this contract may be used for construction purposes at no extra cost, provided that guarantees are not affected thereby and electrical components used for temporary power are replaced when damaged.
- .3 Replace lighting bulbs/tubes and clean reflectors and lenses used for more than three months.
- .4 Temporary Communication Facilities:
 - .1 Provide and pay for temporary telephone and fax hook up, line(s) necessary for own use.
- .5 Fire Protection:
 - .1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

1.10 CONSTRUCTION FACILITIES

- .1 Installation and Removal:
 - .1 Provide construction facilities in order to execute work expeditiously.
 - .2 Remove from site all such work after use.
- .2 Scaffolding:
 - .1 Design, construct and maintain scaffolding in rigid, secure and safe manner, in accordance with WorkSafeBC regulations and Section 01 35 33.
 - .2 Erect scaffolding independent of walls. Remove promptly when no longer required.
- .3 Hoisting:
 - .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
 - .2 Hoists to be operated by qualified operator.
- .4 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 a weight or force that will endanger the Work.
- .5 Construction Parking:
 - .1 Make good damage to existing roads used for access to project site.
 - .2 Build and maintain temporary access where required and provide snow removal during period of Work.
 - .3 Park vehicles outside perimeter fence in designated parking areas.
- .6 Contractor's Site Office and enclosure:
 - .1 Provide a clearly marked and fully stocked first-aid case in a readily available location.
 - .2 Provide temporary fenced area to enclose site and operations.

- .7 Equipment, Tools and Material Storage:
 - .1 Provide and maintain, in a 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 a manner to cause least interference with work activities.
- .8 Sanitary Facilities:
 - .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
 - .2 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures. Permanent facilities may be used on approval of Departmental Representative.

1.11 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Hoarding:
 - .1 Erect temporary site enclosure using new 1.8 m high temporary construction fencing. Provide lockable truck gate. Maintain fence in good repair.
- .2 Enclosure of Structure:
 - .1 Provide temporary weathertight enclosures and protection for exterior openings until permanently enclosed. Design enclosures to withstand wind pressure. Provide lockable entry as required for moving personnel equipment and materials.
 - .2 Provide temporary enclosures to secure building from entry of unauthorized personnel during construction period.
- .3 Guardrails and Excavations:
 - .1 Provide secure, rigid guard rails and barricades around open edges of floors and roofs etc.
 - .2 Provide as required by governing authorities.
- .4 Access to Site:
 - .1 Maintain immediate local access roads in clean condition used during work of this contract.
- .5 Protection for Off-Site and CSC Property:
 - .1 Protect surrounding CSC property from damage during performance of Work.
 - .2 Be responsible for damage incurred.
- .6 Protection of Building Finishes:
 - .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
 - .2 Provide necessary screens, covers, and hoardings.
 - .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
 - .4 Be responsible for damage incurred due to lack of or improper protection.

1.12 COMMON PRODUCT REQUIREMENTS

- .1 Reference Standards:
 - .1 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
 - .2 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
 - .3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
- .2 Quality:
 - .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
 - .2 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.
 - .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative 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.
 - .6 The use of asbestos containing materials is prohibited in this project. Contractor shall provide a letter to the Departmental Representative prior to Substantial Completion confirming that asbestos containing materials are not used in this project.
- .3 Storage, Handling and Protection:
 - .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
 - .4 Store cementitious products clear of earth or concrete floors, and away from walls.
 - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
 - .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
 - .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
 - .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .4 Transportation:
- .1 Pay costs of transportation of products required in performance of Work.
 - .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.
- .5 Manufacturer's Instructions:
- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
 - .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
 - .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- .6 Quality of Work:
- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
 - .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
 - .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.
- .7 Co-ordination:
- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
 - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- 8 Concealment:
- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

- .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.
- .9 Remedial Work:
 - .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
 - .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner neither to damage nor to put at risk any portion of Work.
- .10 Location of Fixtures:
 - .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
 - .2 Inform Departmental Representative of conflicting installation. Install as directed.
 - .3 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.
- .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.
 - .7 Where exposed fasteners are required to secure components, use “Tamper Resist TORX Plus screws (5 lobe design)” manufactured by Camcar, Textron of Rockford, Illinois.
- .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.

- .13 Protection of Work in Progress:
 - .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.
- .14 Existing Utilities:
 - .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.
 - .2 Before commencing work, establish location and extent of service lines in areas of work and notify Departmental Representative of findings.
 - .3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
 - .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
 - .5 Record locations of maintained, capped and re-routed services lines.
- .15 Contractors Options for Selection of Products:
 - .1 Products specified by "**Prescriptive**" specifications: select any product meeting or exceeding specifications.
 - .2 Products specified under "**Acceptable Products**": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
 - .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
 - .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Instructions to Bidders".
 - .5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.
- .16 Substitution after award of Contract:
 - .1 No substitutions are permitted without prior written approval of the Departmental Representative.
 - .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
 - .3 Proposals will be considered by the Departmental Representative if:
 - .1 products selected by tenderer from those specified are not available;
 - .2 delivery date of products selected from those specified would unduly delay completion of Contract, or

- .3 alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
- .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.
- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

1.13 EXAMINATION AND PREPARATION

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

1.14 EXECUTION REQUIREMENTS

- .1 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 may be exposed by uncovering work; maintain excavations free of water.
- .2 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 purpose made saw or core drill. Pneumatic or impact tools not allowed on brittle materials 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, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.15 CLEANING

- .1 Project Cleanliness:
 - .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
 - .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
 - .3 Clear snow and ice from access to building.
 - .4 Provide on-site containers for collection of waste materials and debris.
 - .5 Provide and use clearly marked separate bins for recycling. Refer to-Construction/Demolition Waste Management And Disposal.
 - .6 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
 - .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
 - .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
 - .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
 - .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

- .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 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.
 - .5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
 - .6 Clean lighting reflectors, lenses, and other lighting surfaces.
 - .7 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
 - .8 Wax, seal, vacuum clean, shampoo or prepare floor finishes, as recommended by manufacturer.
 - .9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
 - .10 Remove snow and ice from access to building.

1.16 CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

- .1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials and waste.
 - .1 Separate non-salvageable materials from salvaged items.
 - .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
 - .3 Transport and deliver non-salvageable items to licensed disposal facility.
- .2 Provide containers to deposit reusable and/or recyclable materials. Locate containers in locations, to facilitate deposit of materials without hindering daily operations. Provide containers to deposit reusable and/or recyclable materials.
- .3 Collect, handle, store on-site and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility and/or users of material for recycling.
- .4 Locate waste and salvage bins on site as directed by Departmental Representative.

1.17 CLOSEOUT PROCEDURES

- .1 Inspection and Declaration:
 - .1 Contractor's Inspection: Conduct an inspection of Work with all subcontractors, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .2 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

- .3 Request Departmental Representative's Inspection.
- .2 Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Substantial 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 Fire alarm verification report per CAN/ULC-S537, confirmation of proper installation of fire alarm panel to CAN/ULC-S527 signed off by the fire alarm technician and confirmation of fire alarm emergency power capacity. 24-hour battery test as described in CAN/ULC-S537, signed off by fire alarm technician.
 - .5 Confirmation of emergency power lighting, operating on emergency power for the required amount of time as dictated by NBCC, signed off by technician.
 - .6 Operation of systems have been demonstrated to Departments personnel.
 - .7 Work is complete and ready for Final Inspection.
 - .8 Asbestos containing materials are not used in this project.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.18 CLOSEOUT SUBMITTAL

- .1 Record Drawings:
 - .1 As work progresses, maintain accurate records to show all deviations from the Contract Drawings. Note on as-built drawings as changes occur. At completion supply:
 - .1 Four (4) sets of CD's in AutoCad file format (version: 2015) and PDF format with all as-built information on the diskettes.
 - .2 Four (4) sets of printed as-built drawings.
 - .3 Submit one copy of check plots to Departmental Representative prior to final printing of as-built drawings.
 - .4 Departmental Representative will supply copies of the original AutoCad files.
 - .5 Retain original logo and title block on the as-built drawings. Contractor may place on the upper right-hand title block area a small company logo, the text "AS-BUILT" and the date.
 - .2 Costs for transferring as-built information from marked up working set of drawings to electronic format using ACAD and plotting service is included in the Contract.
- .2 Operation and Maintenance Manuals:

- .1 On completion of project submit to Departmental Representative four (4) CD R/disk copies and four (4) paper copies (in loose leaf type binder) of Operation and Maintenance Manual, made up as follows:
 - .1 Provide maintenance manual on CDs using pdf, or other approved format for descriptive writing, page size images and page size drawings. Organize manuals into industry standard maintenance manual tabs with links in index to each descriptive section describing the component or maintenance procedure etc.
 - .2 Organize files into CSI Masterformat numbering system or other approved descriptive titles.
 - .3 Label disk "Operation and Maintenance Data", project name, date, names of Contractor, subcontractors, consultants and subconsultants.
 - .4 Include scanned guarantees, diagrams and drawings.
 - .5 Organize contents into applicable sections of work to parallel project specification break-down. Mark each section by labeled tabs (navigational buttons).
 - .6 Drawings, diagrams and manufacturer's literature must be legible.
 - .7 Refer to Mechanical and Electrical Divisions for specific details for Mechanical and Electrical data.
- .3 Maintenance Materials, Special Tools and Spare Parts:
 - .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections.
 - .2 Deliver maintenance materials, special tools and spare parts to Departmental Representative and store in designated area as directed by Departmental Representative.
 - .3 Prepare lists of maintenance materials, special tools and spare parts for inclusion in Manual specified in Clause 18.2.
 - .4 Maintenance materials:
 - .1 Deliver wrapped, identify on carton or package, colour, room number, system or area as applicable where item is used.
 - .5 Special tools:
 - .1 Assemble as specified;
 - .2 Include identifications and instructions on intended use of tools.
 - .6 Spare parts:
 - .1 Assemble parts as specified;
 - .2 Include part number, identification of equipment or system for which parts are applicable;
 - .3 Installation instructions;
 - .4 Name and address of nearest supplier.
- .4 Warranties and Bonds:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing in maintenance manual.

- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Interim Completion is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Retain warranties and bonds until time specified for submittal.

1.19 DEMONSTRATION AND TRAINING

- .1 Demonstration and Training:
 - .1 Demonstrate operation and maintenance of equipment and systems to maintenance personnel following interim Completion and prior to date of final certificate of completion
 - .2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.20 GENERAL COMMISSIONING

- .1 Commission installed systems prior to Demonstration and Training.

END OF SECTION

PART 1 GENERAL

1.1 Purpose

- .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

1.2 Purpose

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
 - .3 an explosive or a bomb or a component thereof,
 - .4 currency over any applicable prescribed limit, \$25.00, and
 - .5 any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 Unauthorized smoking and related article 1.15 herein the section means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, and cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Director or Warden of the Institution as applicable or their representative.
- .6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.
- .8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .9 "Construction zone" means the area, as indicated in the contract documents, that the contractor will be allowed to work". This area may or may not be isolated from the security area of the institution. Limits to be confirmed at construction start-up meeting.

1.3 Preliminary Proceedings

- .1 At construction start-up meeting:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.

- .2 The Contractors' responsibilities:
 - .1 Ensure that all construction employees are aware of the CSC security requirements.
 - .2 Ensure that a copy of the CSC security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

1.4 Construction Employees

- .1 Submit scanned copy of government issued ID for each employee to the Departmental Representative.
- .2 Allow 10 working days for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution except as approved otherwise.
- .3 The Director may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Director may require that Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked upon arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are at the institution.
- .4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 appear to be under the influence of alcohol, drugs or narcotics.
 - .2 behave in an unusual or disorderly manner.
 - .3 are in possession of contraband.

1.5 Vehicles

- .1 All unattended vehicles on CSC property must have windows closed; fuel caps locked, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle.
- .2 The director may limit at any time the number and type of vehicles allowed within the Institution.
- .3 Drivers of delivery vehicles for material required by the project will require security clearances and must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or PSPC Construction Escorts while in the Institution.
- .4 If the Director permits trailers to be left inside the secure perimeter of the Institution, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied. Cover all windows with expanded metal mesh. When not in use lock all storage trailers located inside and outside the perimeter. All storage trailers inside and outside the perimeter must be locked when not in use.

1.6 Parking

- .1 The parking area(s) to be used by construction employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 Shipments

- .1 To avoid confusion with the institution's own shipments, address all shipments of project material, equipment and tools in the Contractor's name and have a representative on site to receive any deliveries or shipments. CSC or PSPC staff will **NOT** accept receipt of deliveries or shipments of any material equipment or tools for the contractor.

1.8 Telephones

- .1 The installation of telephones, facsimile machines and computers with Internet connections is not permitted within the Institution perimeter unless prior approved by the Director.
- .2 The Director will ensure that approved telephones, facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.
- .3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, PDAs, telephone used as 2-way radios are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.
- .4 The Director may approve but limit the use of 2-way radios.

1.9 Work Hours

- .1 Work hours within the Institution are: conform to General Instructions Section 01 01 50.
- .2 Work is not permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Director.

1.10 Overtime Work

- .1 Conform to Section 01 01 50.
- .2 Provide 48 hours advance notice to Director for all work to be performed after normal working hours of the Institution. Notify Director immediately if emergency work is required, such as to complete a concrete pour or make the construction site safe and secure.

1.11 Tools and Equipment

- .1 Maintain a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required by the Institution.
- .2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.

- .3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .4 Store all tools and equipment in approved secure locations.
- .5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor. Secure and lock scaffolding when not erected and when erected Secure in a manner agreed upon with the Institution designate.
- .6 Report all missing or lost tools or equipment immediately to the Departmental Representative/Director.
- .7 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
 - .1 At the beginning and conclusion of every work day or shift upon entering and exiting the Institution.
 - .2 At any time when contractor is on Institution property.
- .8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day. Maintain up to date inventory of all used blades/cartridges.
- .9 If propane or natural gas is used for heating the construction, the institution will require that the contractor supervise the construction site during non-working hours.

1.12 Keys

- .1 Security Hardware Keys.
 - .1 Arrange with the security hardware supplier/installer to have the keys for the security hardware to be delivered directly to Institution, specifically the Security Maintenance Officer (SMO).
 - .2 The SMO will provide a receipt to the Contractor for security hardware keys.
 - .3 Provide a copy of the receipt to the Departmental Representative.
- .2 Other Keys
 - .1 Use standard construction cylinders for locks for his use during the construction period.
 - .2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.
- .3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:
 - .1 Prepare an operational keying schedule
 - .2 Accept the operational keys and cylinders directly from the lock manufacturer.
 - .3 Arrange for removal and return of the construction cores and install the operational core in all locks.
- .4 Upon putting operational security keys into use, the PSPC construction escort will obtain these keys as they are required from the SMO and open doors as required by the

Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the PSPC construction escort.

1.13 Security Hardware

- .1 Turn over all removed security hardware to the Director of the Institution for disposal or for safekeeping until required for re-installation.

1.14 Prescription Drugs

- .1 Employees of the contractor who are required to take prescription drugs during the workday shall obtain approval of the Director to bring a one day supply only into the Institution.

1.15 Smoking Restrictions

- .1 Smoking is not permitted inside correctional facilities or outdoors within the perimeter of a correctional facility and persons must not possess unauthorized smoking items within the perimeter of a correctional facility.
- .2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist will be directed to leave the Institution.
- .3 Smoking is permitted outside the perimeter of a correctional facility in an area designated by the Director.

1.16 Contraband

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.
- .4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

1.17 Searches

- .1 All vehicles and persons entering institutional property may be subject to search.
- .2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband, he may order that person to be searched.
- .3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

1.18 Access and Removal from Institution Property

- .1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Director.

1.19 Movement Vehicles

- .1 Construction vehicles are not to leave the Institution until an inmate count is completed. Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:
 - .1 AM: 0745 hrs. to 1100 hrs.
 - .2 PM: 1300hrs. to 1530 hrs.
- .2 The contractor will advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .3 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or PSPC construction escorts working under the authority of the Director.
- .4 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.
- .5 Vehicles will be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution. Arrange with Director for parking of contractor's vehicles at minimum security Institutions.
- .6 Private vehicles of construction employees will not be allowed within the security wall or fence of medium or maximum security institutions without the authorization of the Director.
- .7 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.

1.20 Movement of Construction Employees on Institutional Property

- .1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Director may:
 - .1 Prohibit or restrict access to any part of the institution.
 - .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff or PSPC Construction Escort Officer.
- .3 During the lunch and coffee/health breaks, all construction employees will remain within the construction site. Construction employees are not permitted to eat in the Institution cafeteria and dining room.

1.21 Surveillance and Inspection

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

1.22 Stoppage of Work

- .1 The director may request at any time that the contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor will note the name of the staff member giving the instruction, the time of the request and obey the order as quickly as possible.
- .2 The contractor shall advise the Departmental Representative of this interruption of the work within 24 hours.

1.23 Contact with Inmates

- .1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.
- .2 Digital cameras (or any other type) are not allowed on CSC property.
- .3 Notwithstanding the above paragraph, if the director approves of the use of cameras, it is strictly forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

1.24 Completion of Construction Project

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 Government of Canada.
 - .1 Canada Labour Code - Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC 2015):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 The Canadian Electric Code (as amended)
- .4 Canadian Standards Association (CSA) as amended:
 - .1 CSA Z797-2009 Code of Practice for Access Scaffold
 - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
 - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
 - .4 CSA Z1006-10 Management of Work in Confined Spaces.
 - .5 CSA Z462- Workplace Electrical Safety Standard
- .5 National Fire Code of Canada 2015 (as amended)
 - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
- .6 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .7 Province of British Columbia:
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation

1.2 Related Sections

- .1 Refer to the following current NMS sections as required:
 - .1 Section 01 01 50 General Instructions

1.3 Workers' Compensation Board Coverage

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

1.4 Compliance with Regulations

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

1.5 Submittals

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 01 50.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 10 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 Responsibility

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

- .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 Health and Safety Coordinator

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

1.8 General Conditions

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

1.9 Project/Site Conditions

- .1 Work at site will involve contact with:
 - .1 Multi-employer work site.
 - .2 Federal employees and general public.
 - .3 Energized electrical services.
 - .4 Working from heights
 - .5 Persons incarcerated in the federal institutional system

1.10 Utility Clearances

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

1.11 Regulatory Requirements

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. When a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.12 Work Permits

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

1.13 Filing of Notice

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

1.14 Site Specific Health and Safety Plan

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a Site-Specific Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and record keeping procedures.
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .5 Identify personal protective equipment (PPE) to be used by workers.
 - .6 Identify personnel and alternates responsible for site safety and health.
 - .7 Identify personnel training requirements and training plan, including site orientation for new workers.

- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Services and Procurement Canada (PSPC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 Emergency Procedures

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

1.16 Hazardous Products

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

regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 01 50.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
 - .3 Provide adequate means of ventilation in accordance with Section 01 01 050.
 - .4 The contractor shall ensure that the product is applied as per manufacturers recommendations.
 - .5 The contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

1.17 Asbestos Hazard

- .1 Carry out any activities involving asbestos in accordance with applicable Provincial Regulations.
- .2 Removal and handling of asbestos will be performed as indicated in Division 2 specifications.

1.18 PCB Removals

- .1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.
- .2 Remove, handle, transport and dispose of as indicated in Division 2 specifications.

1.19 Removal of Lead-Containing Paint

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition activities involving lead-containing paints in accordance with applicable provincial regulations.
- .3 Work with lead containing paints shall be completed as per provincial and federal regulations.

1.20 Electrical Safety Requirements

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
 - .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.
 - .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.21 Electrical Lockout

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.22 Overloading

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

1.23 Falsework

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

1.24 Scaffolding

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 Code of Practice for Access Scaffold and BC Occupational Health and Safety Regulations.

1.25 Confined Spaces

- .1 Carry out work in confined spaces in compliance with Provincial regulations.

1.26 Power-Actuated Devices

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

1.27 Fire Safety and Hot Work

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

1.28 Fire Safety Requirements

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
- .3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the Departmental Representative is required prior to any gas or diesel tank being brought onto the work site.

1.29 Fire Protection and Alarm System

- .1 Fire protection and alarm systems shall not be:
 - .1 Obstructed.
 - .2 Shut off.
 - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.30 Unforeseen Hazards

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

1.31 Posted Documents

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans. Must be posted in a non-inmate access area and locked up when not being used.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).
 - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.32 Meetings

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

1.33 Correction of Non-Compliance

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

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 35 33 Health and Safety Requirements

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 WorksafeBC
 - .1 Safe Handling of Asbestos, A Manual of Standard Practices.

1.3 Health and Safety

- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.4 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with 01 01 50 – General Instructions.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .5 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan
- .6 Fold up metal banding, flatten and place in designated area for recycling.
- .7 Do not dispose of waste or volatile materials such as mineral spirits, oil petroleum based lubricant, or toxic cleaning solutions into storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

1.5 Environmental Protection

- .1 Do not dispose of waste or volatile materials into watercourses, storm or sanitary sewers.
- .2 Prevent extraneous materials from contaminating air beyond deconstruction area, by providing temporary enclosures during Work.
- .3 Employ reasonable means necessary to protect salvaged materials from vandalism, theft, adverse weather, or inadvertent damage.
- .4 Organize site and workers in matter which promotes efficient flow of materials through disassembly, processing, stockpiling, and removal.
- .5 Remove and transport toxic or dangerous materials from site in accordance with authority having jurisdiction.

1.5 Site Condition

- .1 The existing site and buildings will be in use by Institution during work of this Contract. Maintain building access at all doorways and corridors.
- .2 Investigate site and building to determine dismantling, processing and storage logistics required prior to beginning of Work.
- .3 Develop strategy for deconstruction to facilitate optimum salvage of reusable and recyclable materials.
- .4 Notify Departmental Representative before disrupting building access or services.
- .5 Locate any existing conduit, rebar, etc. within floor or walls prior to drilling and/or coring. Contractor is responsible for repairing any such conduit, rebar, etc. that is damaged in the course of construction.
- .6 Take preventative measures during demolition process and do not disturb pipe elbow insulation, duct mastic or other suspicious substance which may contain hazardous materials. Exercise caution when cutting existing duct insulation.

1.6 Hazardous Materials

- .1 Contractors shall expect to encounter Asbestos Containing Materials (ACM) and other hazardous building materials throughout the course of work. Appendix A contains Hazmat Reports relevant to this site and these reports identify ACM and hazardous materials that the Contractors will encounter. If even one surveyed sample of a material at a particular location is identified to be ACM and/or hazardous material, Contractors shall treat this material throughout the rest of the site as “identified” ACM and/or hazardous material. Removal of these identified ACM and hazardous materials that the Contractors will encounter shall be the responsibility of the Contractors.
- .2 Contractor shall prepare and submit a Site Specific Asbestos and Lead Exposure Control Plan to Departmental Representative within ten (10) working days of Award of Contract for review and approval, prior to start of construction. The Site Specific Asbestos and Lead Exposure Control Plan (ECP) shall be prepared by a specialist or a third party company with experience in preparing ECP’s, and the Contractors shall implement the approved Site Specific Asbestos and Lead Exposure ECP.
- .3 Submit “Contractor Notification and Acknowledgement” for hazardous materials on site.
- .4 Should other suspected hazardous building substances not identified in the Contract Document be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Do not proceed until written instructions have been received from Departmental Representative.
 - .2 Removal of ACM and hazardous materials not identified in the Contract Document and Hazmat Reports will be under the control of the Departmental Representative and may be a change order to the contract price in accordance with General Conditions, or removed under a separate contract by the Departmental Representative.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 Preparation

- .1 Inspect site 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.

3.2 Protection

- .1 Prevent movement, settlement, or damage to adjacent structures, utilities 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 33 - Health and Safety Requirements.
- .6 Prevent debris from blocking drainage which must remain in operation.
- .7 Take precaution during demolition to protect all adjacent finished surfaces. Make good any damage to adjacent surfaces.

3.3 Salvage

- .1 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .2 Remove items to be reused and protect items from damage.

3.4 Disposal

- .1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.
- .2 The Owner reserves the option to request some or all existing equipment being removed and not required to be relocated to remain the property of the Owner. When directed by the Departmental Representative, remove such equipment and turn over to the Owner. Provide receipt verifying disposition of such equipment.

END OF SECTION

PART 1 - GENERAL

1.1 Related Requirements

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

1.2 References

- .1 All referenced standards shall be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 Canadian Standards Association (CSA International):
 - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A23.3, Design of Concrete Structures.
 - .3 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 Reinforcing Steel Institute of Canada (RSIC):
 - .6 Reinforcing Steel Manual of Standard Practice.

1.3 Quality Control

- .1 Submit in accordance with Section 01 01 50 – General Instructions.
- .2 Source Quality Control Submittals:
 - .1 Upon request, inform the Departmental Representative of proposed source of reinforcement material to be supplied.

1.4 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

PART 2 - PRODUCTS

2.1 Materials

- .1 Reinforcing steel: carbon steel, deformed bars to CSA G30.18., unless indicated otherwise.
- .2 Welded steel wire fabric: to ASTM A1064/A1064M. Provide in flat sheets only.
- .3 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

PART 3 - EXECUTION

3.1 Fabrication

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice.

3.2 Field Bending

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by the Departmental Representative.
- .2 Replace bars which develop cracks or splits.

3.3 Placing Reinforcement

- .1 Place reinforcing steel in accordance with CSA A23.1/A23.2.
- .2 Support bars, chairs and spacers:
 - .1 Provide sufficient support bars, chairs, carriers and side form spacers as necessary to secure against displacement of reinforcement and maintain concrete cover before and during concrete placement.
 - .2 Use precast concrete chairs where supports rest on the ground. Where welded wire fabric is used in slabs-on- grade, place precast concrete chairs at 600 mm (2'-0") on centre each way. Do not attempt to position welded wire fabric by lifting it after concrete is poured.
- .3 Obtain Departmental Representative field review of all reinforcing materials and placement before pouring concrete.

END OF SECTION 03 20 00

PART 1 - GENERAL

1.1 Related Requirements

- .1 Section 03 20 00: Concrete Reinforcing.
- .2 Section 05 12 23: Structural Steel for Buildings.

1.2 References

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 Canadian Standards Association (CSA International):
 - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .3 ASTM International Inc.:
 - .1 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .2 ASTM C920 – Standard Specification for Elastomeric Joint Sealants
 - .3 ASTM E1155M Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Number (Metric)
- .4 Canadian General Standards Board (CGSB):
 - .1 CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 Quality Assurance

- .1 Qualifications
 - .1 Concrete supplier to have a valid “Certificate of Ready Mixed Concrete Production Facilities” issued by the relevant Ready Mixed Concrete Association.
- .2 Samples

1.4 Quality Control

- .1 Submit in accordance with Section 01 01 50 – General Instructions.
- .2 Minimum two weeks prior to starting concrete work, provide valid certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

- .3 For concrete with high volume of supplementary cementing materials (HVSCM concrete, as defined in CSA A23.1), perform trial mixes to ensure that the required properties are achieved.

1.5 Administrative Requirements

- .1 Batch Logs: keep record of each batch delivered to site.
- .2 Concrete Delivery Slips: Keep all concrete delivery slips (“driver’s tickets”) on site until building is completed. Record on delivery slip where concrete was placed, including time and date.

1.6 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Minimum 2 weeks prior to starting concrete work, submit all concrete mix designs, and indicate where each concrete mix is to be used.
- .3 Provide composite layout drawings showing all cast in place pipes and conduits.
- .4 Minimum submission requirements for each concrete mix design shall include the following:
 - .1 Minimum specified compressive strength at 28 days (or at the time specified on drawings).
 - .2 Maximum aggregate size.
 - .3 Aggregate type (if not normal density).
 - .4 Concrete density range, wet and dry (if not normal density).
 - .5 CSA exposure class.
 - .6 Cement type (if not type GU).
 - .7 Percentage and type of supplemental cementing materials.
 - .8 Maximum water/cementitious materials ratio.
 - .9 Assumed method of placement of concrete.
- .5 Concrete pours: provide accurate records of all concrete pours marked on a set of Structural Drawings.
- .6 On completion of the works, provide written report to Departmental Representative certifying that the concrete in place meets performance requirements established in **PART 2 - PRODUCTS**.

PART 2 - PRODUCTS

2.1 Design Criteria

- .1 To CSA A23.1/A23.2, Alternative 1 – Performance, and as described under Mixes and on Structural Drawings.

2.2 Performance Criteria

- .1 Concrete supplier to meet the concrete performance criteria established by Departmental Representative and to provide verification of compliance.

2.3 Materials

- .1 Portland cement: to CSA A3001.
- .2 Cementitious hydraulic slag: to CSA A3000.
- .3 Fly ash: to CSA A3001, Type CI.
- .4 Water: to CSA A23.1.
- .5 Aggregates: to CSA A23.1/A23.2. Do not use recycled concrete as aggregate.
- .6 Admixtures: not to contain chlorides.
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2. Minimum compressive strength: 40 MPa at 28 days.
- .8 Non premixed dry pack grout: composition of non metallic aggregate and Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 40 MPa at 28 days.

2.4 Concrete Mixes

- .1 Use ready-mix concrete. Proportion concrete in accordance with CSA A23.1, Alternative 1 - Performance Method for Specifying Concrete.
- .2 Set performance characteristics of concrete in plastic state in coordination with all trades involved.
- .3 Meet performance criteria of concrete in hardened state as shown on Structural Drawings and provide verification of compliance.
- .4 Do not use admixtures containing chlorides.
- .5 Supplementary cementing materials (SCM):
 - .1 Conform to CSA A23.1.
 - .2 Follow slag and fly ash manufacturers' directions for proportioning and mixing of concrete.
 - .3 Fly ash not to exceed 15% of total cementitious material.
 - .4 Do not use concrete with more than 40% of SCM when ambient temperature is forecast to be below +10°C at the time of concrete pour and during the seven days after the pour, except for footings, walls and columns.
 - .5 Reduce W/C ratio to 0.45 where using more than 40% of SCM in concrete for slabs and other horizontal finished surfaces, in order to reduce bleed water and to increase rate or strength gain.

PART 3 - EXECUTION

3.1 Preparation

- .1 Provide advanced notice as indicated on drawings to allow Departmental Representative field review of reinforcing prior to placing of concrete/closing of wall forms.
- .2 Obtain Departmental Representative written approval before placing concrete.
- .3 Remove water and disturbed soil from excavations before placing concrete.
- .4 Before placing slab-on-grade, confirm that subgrade and backfill meet specifications and are free of frost and surface water.
- .5 Provide vapour barrier under slabs placed on the ground including slabs-on-grade and framed slabs as described by the Architectural specifications.
 - .1 Lap minimum 150 mm at joints and seal.
 - .2 Seal all punctures before placing concrete.
 - .3 Use patching material at least 150 mm larger than puncture and seal.
- .6 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

3.2 Installation/Application

- .1 Set sleeves, conduits, and other inserts and openings as indicated or specified elsewhere.
- .2 Refer to Typical Details and Drawing Notes for placing guidelines, maximum size and minimum spacing of sleeves, embedded pipes and conduits.
- .3 Check locations and sizes of sleeves and openings shown on Structural Drawings with Architectural, Mechanical and Electrical Drawings. Notify the Departmental Representative of any discrepancies.
- .4 Obtain Departmental Representative approval for any required sleeves and openings which are not shown on Structural Drawings or reviewed sleeving drawings.

3.3 Placing Concrete

- .1 Place concrete in accordance with CSA A23.1.
- .2 Delivery and place concrete with minimum re-handling.
- .3 Cast slabs with a top surface that is level or sloping as required by the Drawings.
- .4 Concrete exposed to view:
 - .1 Exposed surfaces to be dense, even, uniform in colour, texture and distribution of exposed aggregate.
 - .2 Defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints or excessive bug holes may be cause for rejection at the discretion of the Architect.
- .5 Maintain accurate records of all poured concrete including extent, date and location of each pour, concrete mix used, ambient air temperature, test samples taken and falsework removal date and mark on a set of Structural Drawings.

3.4 Finishing Concrete

- .1 Finish concrete to CSA A23.1/A23.2.

- .2 Finishing Flatwork:
 - .1 Protect concrete during finishing process. Use evaporation reducer during severe drying conditions.
 - .2 Provide final finish in accordance with proposed use and as follows:
 - .1 Steel trowel exposed interior concrete floors at least twice. Provide final spin troweling when non-slip finish is required.
 - .3 Surface Tolerances (flatness and levelness):
 - .1 Unless otherwise noted, conform to finish tolerance Class A.
 - .2 Measure surface tolerances using the F-Number method in accordance with ASTM E1155M within 72h of each concrete pour.

3.5 Concrete Curing and Protection

- .1 At a minimum cure and protect concrete in accordance with CSA A23.1
- .2 For concrete containing supplementary cementing materials, curing and protection times may need to be extended beyond those outlined by CSA A23.1 to achieve the required structural properties.
- .3 Cure slab surfaces immediately after finishing is completed. Unless otherwise noted or required, use a curing compound compatible with applied finishes.
- .4 Do not load concrete until sufficient strength is developed.

3.6 Slabs on Grade

- .1 Cracks in Slabs-on-Grade:
 - .1 Extensive cracking of slabs-on-grade or cracks in excess of 3 mm (1/8") in width may be cause for rejection of slab or portion of slab at the Architect's discretion.
 - .2 Protect edges of cracks in slabs-on-grade from breakage.

3.7 Grouting Under Base Plates and Bearing Plates

- .1 Grout under base plates and bearing plates using procedures in accordance with manufacturer's recommendations.
- .2 Provide 100% contact over grouted area.
- .3 Grout column base plates and beam bearing plates as soon as steelwork is completed.
- .4 Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.

3.8 Existing Structure

- .1 Take precautions to protect the existing structure from damage.
- .2 Retain an independent testing company to locate existing reinforcement and conduit in the areas of proposed openings and to mark locations on the surfaces of slabs and walls on which the cores and cuts are to be started using a non destructive method.

- .3 Mark locations and sizes of cores and openings and locations of reinforcement and conduit using indelible markers as follows:
 - .1 Red for top bars
 - .2 Green for bottom bars
 - .3 Black for cores, openings and conduit.

3.9 Inspection and Testing:

- .1 An independent Inspection and Testing Agency (certified under CSA A283 with category to suit testing provided) will be appointed to carry out inspection and testing of concrete and concrete materials per CSA A23.1/A23.2. and check conformance with applicable Standards and Contract documents including slab surface tolerances
- .2 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required.
- .3 The Agency will review all submittals pertaining to concrete mix designs and certification of plant, equipment and materials.
- .4 Compressive Strength Testing:
 - .1 One test is required for each 100 cubic meters of placed concrete, but not less than one test for each concrete mix placed each day. At least 3 tests are required for each class of concrete used.
 - .2 A group of three cylinders for each test will be provided, Location of concrete placement will be recorded for each cylinder set. One specimens will be tested at 7 and one at 28 days. The third specimen will be tested at 56 days if the required strength at 28 days is not achieved.
 - .3 One additional cylinder will be provided for each concrete mix during cold weather concreting. The specimens will be cured on site adjacent to and under the same conditions as the work they represent, and will be tested prior to form removal.
 - .4 If standard on site cured cylinders are used to determine concrete strength prior to removal of formwork, they will be kept adjacent to and under the same conditions as the work they represent.
- .5 Grout Testing
 - .1 One standard test per ASTM C1107 will be made each day when concrete grout is installed under base plates.
 - .2 A group of 6 cubes for each test will be provided. 3 cubes will be tested after 7 days, and 3 after 28 days.
- .6 Inspection and testing by the Agency will not augment or replace the Contractor's quality control nor relieve him of his contractual responsibility.

END OF SECTION 03 30 00

PART 1 - GENERAL

1.1 Related Requirements

- .1 Section 09 90 00: Painting.

1.2 References

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 Canadian Standards Association (CSA International):
 - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16, Limit States Design of Steel Structures.
 - .3 CSA S136, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W55, Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .7 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .3 ASTM International Inc.:
 - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) coating on Iron and Steel Products.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
 - .3 ASTM A1085/A1085M, Standard Specification for Cold Formed Welded Carbon Steel Hollow Structural Sections (HSS)
 - .4 ASTM A992, Standard Specifications for Structural Steel Shapes.
 - .5 ASTM F1554, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):
 - .1 CISC Handbook of Steel Construction.
 - .2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
 - .3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:

- .1 SSPC-SP 1, Solvent Cleaning.
- .2 NACE No.4 / SSPC-SP 7, Brush Off Blast Cleaning.
- .3 NACE No.2 / SSPC-SP 10, Near White Blast Cleaning.
- .4 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.
- .5 SSPC Paint Specification No. 20 – Zinc Rich Coating, Type I – Inorganic and Type II - Organic.

1.3 Quality Assurance

- .1 In accordance with Section 01 01 50 – General Instructions.
- .2 Qualifications
 - .1 Structural steel fabricator to be a member of the Canadian Institute of Steel Construction and to have at least five year experience with structural steel for buildings.
 - .2 Structural steel fabricator and erector to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components, and to have CWB approved procedure for welding rebar (Grade 400W) to structural steel.
 - .3 Welders to be CWB approved, working under supervision of a CWB approved firm.
 - .4 Engage a Professional Engineer licensed in the place where the project is located to be responsible for design, detailing and installation of all connections related to structural steel work.

1.4 Quality Control

- .1 Submit in accordance with Section 01 01 50 – General Instructions.
- .2 Source Quality Control Submittals:
 - .1 Provide all submittals 4 weeks prior to starting fabrication of structural steel.
 - .2 Mill test reports:
 - .1 Mill test reports to include ladle analysis and physical test results, and to show chemical and physical properties and other details of steel to be incorporated in project.
 - .2 The reports to be correlated to the materials or products to which they pertain
 - .3 In addition to mill testing, each batch of structural steel (including bolts) manufactured outside United States, Canada, Great Britain and EU countries must also be tested in Canada by an ISO 17025 certified testing laboratory. In addition to compliance with all the relevant CSA and ASTM requirements, the testing must show that the maximum boron content in structural steel does not exceed 0.0008%.
- .3 Tolerances
 - .1 Conform to the fabrication and erection tolerances of CAN/CSA S16.

1.5 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Shop Drawings:
 - .1 Provide drawings stamped and signed by the Professional Engineer responsible for steel connections.
 - .2 If additional information is required from Departmental Representative , allow a minimum of five working days for Departmental Representative to review and respond to the request for information.
 - .3 It is advisable to submit erection diagrams for review before preparing shop details. Copies of plans and section details developed by Departmental Representative will not be accepted as erection diagrams.
- .3 Fabrication drawings:
 - .1 Submit fabrication drawings showing designed assemblies, member sizes, components and connections. Show on drawings:
 - .1 Material specifications.
 - .2 Surface preparation.
 - .3 Shop painting / galvanizing.
 - .4 Section splices.
 - .5 Types of shop and field connections.
 - .6 Net weld lengths.
 - .7 Vent holes required for galvanizing process.
 - .8 Architectural clearance lines and finishes where connections could encroach other works.
 - .2 Substitution of alternative sections will only be allowed provided the new members have equal or greater capacity and stiffness and their dimensions are approved by Departmental Representative .
- .4 When requested, submit sketches and design calculations stamped and signed by the Professional Engineer responsible for connection design.
- .5 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for structural steel connections certifying that the work has been completed in accordance with all contract documents.

PART 2 - PRODUCTS

2.1 Design and Detailing Requirements

- .1 Design details and connections in accordance with requirements of CSA S16 and CSA S136 to resist forces and to allow for movements indicated. Consider load effects due to fabrication, erection and handling.

- .2 Follow conceptual connection details if shown on structural drawings. Do not change without Departmental Representative written approval. If welds are defined on drawings, the sizes shown are minimum requirements which might need to be increased to suit connection design.
- .3 Increase specified section thickness at no extra cost if required for fabrication (bending) or galvanizing. Alternatively, build up curved sections from plates.
- .4 Assume that bolt threads are intercepted by shear plane, unless special measures are indicated on shop drawings to exclude threads from shear plane.
- .5 Beams:
 - .1 Select beam end connections from CISC "Handbook of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Typical beam to spandrel beam and beam to column connections to be two sided or end plate connections.
 - .3 Select or design beam end connections for factored shear indicated on plans.
 - .4 When shears are not indicated, select or design non composite beam end connections to resist reaction due to maximum uniformly distributed load capacity of the beam in bending.
 - .5 Where no axial force is shown for beam to column connection, design to resist horizontal tension / compression equivalent to 2% of the factored axial force in column, in addition to all other loads.
 - .6 Seated beam connections to have top clip angles.
- .6 Moment connections:
 - .1 Provide moment connections at splices to maintain continuity of cranked beams. Provide header plates or stiffener plates to resist unbalanced flange forces at splices.
 - .2 Where moment connections are called for but values are not indicated, design for moment capacity of the smaller member in the connection.
- .7 Holes:
 - .1 Provide vent holes in HSS sections where required for galvanizing process. Locate so that any water inside HSS will drain away when HSS is in its final position. Maximum size – 16 mm (5/8") diameter. Fill holes with vent hole plugs after galvanizing.
- .8 Do not oversize anchor rod holes for site tolerances. Use hole sizes suggested in the CISC Handbook of Steel Construction.
- .9 Connect new steel members to existing concrete as directed on drawings. Do not field weld at connections with adhesive anchors.
- .10 Provide closure plates for all exposed and for all exterior tubular members.

2.2 Materials

- .1 Structural steel:
 - .1 Rolled shapes: to CSA G40.21 or ASTM A992, refer to drawings.

- .2 Hollow structural sections: to ASTM A1085 or CSA G40.21, refer to drawings.
- .3 Structural pipe: to ASTM A53.
- .4 Angles: to CSA G40.21, refer to drawings.
- .2 Anchor rods: CSA G40.21, or ASTM 1554, refer to drawings.
- .3 Bolts, nuts and washers: to ASTM F3125, grade A325.
- .4 Weldable reinforcing steel: to CSA G30.18, deformed bars.
- .5 Welding materials: to CSA W48 and CSA W59, certified by Canadian Welding Bureau. For members in seismic force resisting system, refer to additional brittleness requirements in CSA S16.
- .6 Shop paint: to CISC/CPMA 1-73a.
- .7 Shop paint primer: to CISC/CPMA 2-75, solvent reducible alkyd, red oxide, compatible with specified topcoat.
- .8 Zinc-rich coating: to SSPC Paint Specification No.20, compatible with top coat (where specified).
- .9 Hot dip galvanizing: to ASTM A123/A123M, minimum zinc coating of 600 g/m².
- .10 Galvanizing vent hole plug: Grade 6061 Aluminum circular plug.

2.3 Fabrication

- .1 Fabricate structural steel in accordance with CSA S16 and with reviewed shop drawings.
- .2 Continuously seal hollow members exposed to weather by intermittent welds and plastic filler unless continuous welds are indicated on drawings.
- .3 HSS members which require galvanizing to either be per CSA G40.21, grade 350W, Class H, or to be stress relieved prior to galvanizing.
- .4 Complete welded shop connections prior to galvanizing.
- .5 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left unpainted, place marking at locations not visible from exterior.
- .6 Match marking: shop mark bearing assemblies and splices for fit and match.

2.4 Shop Painting

- .1 Clean all members to SSPC-SP 1 – Solvent Cleaning, Remove loose mill scale, rust, oil, dirt and foreign matter using any suitable method.
- .2 In addition for members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.
- .3 In addition for members receiving zinc-rich coating: Clean steel to SSPC-SP 10 Near White Blast Cleaning.
- .4 Apply one coat of shop paint CISC/CPMA 1-73a to steelwork in the shop with the exception of:

- .1 Members to receive spray fireproofing.
- .2 Members to receive a finish coat of paint on site for which a CISC/CPMA 2-75 shop primer is required.
- .3 Members to receive zinc-rich coating.
- .4 Galvanized members.
- .5 Surfaces and edges to be field welded for a distance of 50 mm (2") from joints.
- .5 Apply one coat of compatible primer paint (CISC/CPMA 2-75) in the shop to steelwork to receive a finish coat of paint on site.
- .6 If more than one type of paint is specified, each paint to be visually identifiable after application.
- .7 Apply galvanizing in the shop to all structural steel located beyond the vapour barrier, including:
 - .1 Exposed exterior steel members.
 - .2 Exposed anchor rods.
 - .3 Other steel noted on drawings.
- .8 If galvanized steel is to be painted, use only non passivated galvanizing process (without chromate coating).
- .9 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5°C.
- .10 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.
- .11 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 General

- .1 Structural steel work: in accordance with CSA S16.
- .2 Welding: in accordance with CSA W59.

3.2 Connection to Existing Work

- .1 Verify dimensions and condition of existing works prior to start of fabrication. Report discrepancies, modify connection details if required and submit to Departmental Representative for review. Determine any potential interference with existing services and report problem areas to Departmental Representative for direction before commencing work.
- .2 Take precautions to protect existing works from damage. Provide temporary shoring as required. Repair damage to adjacent materials caused by structural steel installation.

3.3 Modification / Removal of Existing Steel Work

- .1 A set of Structural Drawings of the existing building may be viewed at the offices of the Architect or Departmental Representative .

- .2 Dismantle and cut existing structural steel as required. Provide temporary shoring and bracing required for these operations. Retain a Professional Engineer to design the temporary shoring and to review this work on site.
- .3 Clean existing structural steel, which is affected by the work and is to remain in place, down to bare metal, prior to its inspection so that its condition may be ascertained. Notify Departmental Representative when members are ready for inspection.
- .4 Remove from site existing steel which is dismantled but not designated for re-use.

3.4 Erection

- .1 Erect structural steel in accordance with CSA S16 and reviewed erection drawings.
- .2 Do not field cut or alter any members without Departmental Representative approval.
- .3 Make adequate provision for all loads acting on the structure during erection. Provide erection bracing to keep the structure stable, plumb and in true alignment during construction. Bracing members or connections shown on Structural Drawings are those required for the completed structure, and may not be sufficient for erection purposes. Do not remove erection bracings without written approval from the Engineer who designed it.
- .4 Steel framing to be plumb at temperature of 20°C. If erection is carried out at temperatures greatly differing from 20°C, make adequate provisions; some members may need to be erected out of plumb in order to become plumb when the temperature stabilizes at 20°C.
- .5 Do not make permanent connections until structure has been properly aligned.
- .6 Install bolts which are not pre-tensioned to be snug tight.
- .7 Apply dry lubricant to threads of all galvanized bolts prior to installation.
- .8 Report ill-fitting connections to Departmental Representative before taking corrective measures.
- .9 When welding after galvanizing is in place, grind away galvanizing at areas to be welded.
- .10 Remove slag from all completed welds so that they may be visually inspected.
- .11 Seal members by continuous welds where indicated.
- .12 Remove field connection aids from all surfaces which will be exposed to view and where interfering with clearances required by other trades.

3.5 Field Painting

- .1 Paint in accordance with Section 09 90 00 - Painting
- .2 Touch up damaged surfaces with the same paint as the shop coat.
- .3 Repair any galvanized or zinc rich painted surfaces which have been damaged or field welded in accordance with SSPC Technology Guide No.14.
- .4 Clean and prepare surfaces of bolts, which will receive a finished coat of paint in the same manner as the connected steelwork.

3.6 Inspection and testing:

- .1 An Inspection and Testing Agency (certified to CSA W178.1 & 2) will be appointed to carry inspection and testing of all structural steel.
- .2 Do not commence fabrication until details of inspection have been worked out with the Agency.
- .3 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required.
- .4 The Inspection Agency will submit reports to Departmental Representative, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.
- .5 Work will be inspected in shop and when erected. Store fabricated members in shop so that they are accessible for inspection.
- .6 Provide Inspection and Testing Agency with a copy of reviewed shop drawings.
- .7 Welding inspection:
 - .1 Welding inspection will be conducted in shop and in field.
 - .2 The Inspector will check welders' CWB certification.
 - .3 The Inspector will review welding procedures for conformance with CWB requirements, manufacturers' requirements and standard practice.
 - .4 Arrange for the Inspector to be present during welding of 10% of moment connections and 10% of butt welds in direct tension.
 - .5 The inspector will visually check all welds at plate girders, all butt welds (including cranks and splices), all welds in moment connections, all welds at crane columns and crane girders, all welds of roof anchors to the base structure, 50% of welds in hanger connections and 20% of all other welds for:
 - .1 Size, length and profile
 - .2 Joint preparation, including cleaning and removal of any paint.
 - .3 Fit up and alignment.
 - .4 Penetration and fusion.
 - .5 Slag removal.
 - .6 Distortion.
 - .7 Porosity.
 - .8 Cracks.
 - .6 Non destructive testing will be conducted on the following connections:
 - .1 All shop and field welded splices.
 - .2 A representative 10% of all other welded connections.
 - .7 Test results will be evaluated in accordance with CSA W59.

.8 Sample testing: When requested, test coupons will be taken and tested in accordance with CSA G40.20 to establish identification. Cut samples from member locations selected by Departmental Representative and provide to the Inspection and Testing Agency. Make good the locations if requested, at no extra cost, by adding new plates and welds acceptable to Departmental Representative. The Agency will have the samples tested for mechanical properties and for chemical composition and will classify the steel as to specification.

.8 Field inspection:

.1 Arrange for the Inspector to start field inspection as soon as each section of the Work is completed, plumbed, bolts tightened and field welding finished.

.2 The Inspector will sample erection procedures for general conformity with Contract requirements.

.3 The Inspector will check general fit-up and tolerances and report any apparent distortions and misalignments.

.4 Minimum 10% of elements will be checked by instruments for plumbness, alignment and elevation.

.5 Field inspection will include:

.1 Checking individual frame members for twisting, sweep and local damage.

.2 Checking levelness of leveling plates.

.3 Inspection of grouting under base plates and bearing plates.

.4 Inspection of bolting and post installed anchors as described below.

.5 Inspection of approved field cutting and reinforcing around openings.

.6 Inspection of field painting.

.7 Inspection of field touch-up.

.6 Bolting inspection:

.1 The Inspector will visually check all bolts in bearing connections. Where erection drawings indicate bolts with threads excluded from the shear plane, he will remove nuts from 1% of all bearing bolts and check that thread is excluded from the shear planes.

.7 Post installed anchor inspection:

.1 The Inspector will sample check drilled concrete and masonry anchors.

.2 The Inspector will provide full time inspection during installation of post installed adhesive anchors subject to sustained tension loads.

END OF SECTION 05 12 23

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 01 50 – General Instructions.

1.2 REFERENCE STANDARDS

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings
- .2 ASTM International (ASTM)
 - .1 ASTM A 123/A 123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A 653/A 653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A 792/A 792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .3 CSA Group (CSA)
 - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 - .2 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .3 CSA W59, Welded Steel Construction (Metal Arc Welding) [Metric].
 - .4 CAN/CSA S136 Package, North American Specification for the Design of Cold Formed Steel Structural Members.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 51, Lightweight Steel Framing Design Manual.
 - .2 CSSBI Fact Sheet #3, Care and Maintenance of Prefinished Sheet Steel Building Products.
 - .3 CSSBI Technical Bulletin Vol. 7, No. 2, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
 - .4 CSSBI S5, Guide Specification for Wind Bearing Steel Studs.
- .5 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 55 – General Instructions.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for structural metal studs 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 British Columbia, Canada.
 - .2 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
 - .3 Indicate locations, dimensions, openings and requirements of related work.
 - .4 Indicate welds by welding symbols as defined in CSA W59.

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Manufacturer Reports: Submit manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect structural metal studs from nicks, scratches, and blemishes.
 - .3 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
 - .4 Handle and protect galvanized materials from damage to zinc coating.
 - .5 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Steel: to CAN/CSA S136, fabricated from ASTM A653/A653M, Grade 230 steel.
- .2 Zinc coated steel sheet: quality to ASTM A653/A653M, with Z275 designation coating.

- .3 Aluminum-zinc alloy coated steel sheet: quality to ASTM A792/A792M, with AZM180 designation coating.
- .4 Welding materials: to CSAW59 and certified by Canadian Welding Bureau.
- .5 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm, length 19 mm
- .6 Anchors: concrete expansion anchors or other suitable seismically rated drilled type fasteners.
- .7 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 380 g/m²zinc coating.
- .8 Touch up primer: zinc rich, to MPI #18.

2.2 STEEL STUD DESIGNATIONS

- .1 Colour code: to CSSBI Technical Bulletin Vol.7, No. 2.

2.3 METAL FRAMING

- .1 Steel studs: to CAN/CSA S136, fabricated from metallic coated steel, depth as indicated.
 - .1 Minimum steel thickness of 1.09 mm.
- .2 Stud tracks: fabricated from same material and finish as steel studs, depth to suit.
 - .1 Bottom track: single piece.
 - .2 Top track: single piece.
- .3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.09 mm minimum thickness.
- .4 Angle clips: fabricated from same material and finish as studs, 38 x 38 mm x depth of steel stud, 1.37 mm minimum thickness.
- .5 Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

- .1 Mill reports for material properties reviewed by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts acceptable for structural metal stud 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 remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Weld in accordance with CSA W59.
- .2 Certification of companies: to CSA W47.1 for fusion welding CSA W55.3 for resistance welding.
- .3 Do structural metal stud framing work to CSSBI S5.

3.3 ERECTION

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at 400 mm on centre maximum, unless lesser spacing prescribed on shop drawings.
- .3 Erect studs plumb, aligned and securely attached with [2] screws minimum.
- .4 Seat studs into bottom tracks single piece top track.
- .5 Install 50 mm minimum telescoping track at top of walls where required to accommodate vertical deflection.
 - .1 Nest top track into deflection channel minimum of 20 mm and maximum of 25 mm.
 - .2 Do not fasten tracks together.
 - .3 Stagger joints.
- .6 Install studs at maximum 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .7 Brace steel studs with horizontal internal bridging at 1200 mm maximum.
 - .1 Fasten bridging to steel clips fastened to steel studs with screws.
- .8 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
- .9 Touch up welds with coat of zinc rich primer.
- .10 Erection Tolerances
 - .1 Plumb: maximum 1/500th of member length.
 - .2 Camber: maximum 1/1000th of member length.
 - .3 Spacing: maximum +/- 3 mm from design spacing.
 - .4 Gap between end of stud and track web: maximum 4 mm.
- .11 Cutouts

- .1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

- .2 Limit distance from centerline of last unreinforced cutout to end of member maximum 300 mm.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer's verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - QUALITY ASSURANCE.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review Work as follows.
 - .1 Once during progress of Work at 30% complete.
 - .2 Upon completion of Work, after cleaning carried out.
 - .4 Works to be inspected visually, with the aid of Contractor as required.

3.5 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 Related Work

- | | | |
|----|------------------|---------------------------|
| .1 | Section 01 01 50 | General Instruction |
| .2 | Section 06 24 00 | Laminated Plastic |
| .3 | Section 09 90 00 | Painting |
| .4 | Section 10 05 00 | Miscellaneous Specialties |

1.2 Reference Standards

- .1 Do millwork to “Economy” grades to Millwork Standards of the Architectural Woodwork Manufacturer’s Association of Canada, latest edition.

1.3 Samples

- .1 Submit duplicate 300 mm long samples of each type of trim in accordance with Section 01 01 50.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50.
- .2 Clearly indicate details of construction, profiles, jointing, fastening and other related details.

1.5 Coordination & Verification

- .1 Verify all dimensions & existing conditions on job site prior to all shop fabrication and work on site. Where major discrepancies occur, alert Departmental Representative immediately.
- .2 Coordinate work of this section with that of wall, electrical and mechanical sections where millwork interfaces with drywall partitions, plumbing, electrical outlets, etc.
- .3 It shall be the responsibility of this section to verify the dimensions and installation details for all Departmental Representative supplied equipment and furnishings requiring cut-outs, adaptations and interfacing with millwork items.
- .4 Coordinate work of this Section with Section 10 05 00 for supply and fabrication of window rolling shutter to be incorporated into finish carpentry and millwork.

1.6 Inspection

- .1 Architectural woodwork shall be manufactured and/or installed to AWMAC Quality Standards (Economy Grade). Shop drawings shall be submitted for review or approval before any work is commenced.
- .2 Any work which does not meet AWMAC Quality Standards as specified, shall be replaced by this Section at no additional cost to the Department Representative and to the satisfaction of the Departmental Representative and the inspector.

1.7 Guarantee

- .1 This Section shall furnish the Departmental Representative with a two (2) year Finish Carpentry supplier / Installer Guarantee or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork supplied will be in accordance with the Standards incorporated in the

AWMAC Quality Standards manual, latest edition.

- .2 The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Section, which appear during a two (2) year period following the substantial completion of the Project.

1.8 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 Waste Management and Disposal and the Waste Reduction Workplan and the Waste Management Plan to the maximum extent economically possible.

PART 2 PRODUCTS

2.1 Materials

- .1 Softwood lumber: to C.S.A. 0141-1970 and National Lumber Grades Authority requirements, with maximum moisture content of 6% for interior work, lumber selected for paint finish, fir species, to A.W.M.A.C., economy grade.
- .2 Solid lumber for transparent finish: eastern maple species, to AWMAC economy grade.
- .3 Canadian softwood plywood: to C.S.A. 0151-M1978, solid two sides, select.
- .4 Douglas Fir plywood: to C.S.A. 0121-M1978, good one side, sanded grade.
- .5 Nails and staples: to C.S.A. B111-1974, galvanized for exterior work, interior highly humid areas and for treated lumber; plain finish elsewhere.
- .6 Fiberboard: Standard of Acceptance: 'Ranger Premium MDF Board', 'Medite'. Medium Density (MDF) to ANSI/A208.2 and tested in accordance with ASTM D1037.
- .7 Hardboard: To CGSB11-GP-3M, tempered type, 3mm thick equal to 'Masonite'.

2.2 Cabinetwork Requirements

- .1 No adjustable shelving. All shelving shall be fixed mounted with security fasteners.
- .2 All horizontal shelving shall be 19mm plywood with paint finish.
- .3 Countertop shall have 13mm lip as detailed on drawings.
- .4 Cord grommets: round zinc-die-cast, black colour.

PART 3 EXECUTION

3.1 Cabinetwork

- .1 Fabricate hardwood for transparent finished millwork to A.W.M.A.C. economy grade.
- .2 Set nails and screws, apply stained plain wood filled to indentations, sand smooth and leave ready to receive finish. All exposed fasteners shall be security fasteners.
- .3 Install and adjust cabinet shelves and associate accessories. Recess shelf standards unless noted otherwise.
- .4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures. Make allowances for all wiring required within cabinet units, and conceal where possible. Refer to Mechanical and Electrical Drawings.
- .5 All shelving shall be plywood (no MDF shelving), birch veneer where painted.

- .6 Fit shelves with hardwood edging.
- .7 Provide solid matching wood strip on plywood edges, exposed in final assembly. Strips same width as plywood.
- .8 Details are shown on drawings for appearance purposes only and are not intended to supersede these specifications for fabrication methods or grades of material. Submit details with shop drawings.
- .9 Unless otherwise indicated, interiors of cabinets, all surfaces of concealed shelving and insides of drawers (except front panels) shall be shop-painted as scheduled.

3.2 Interior Trim

- .1 Standing and running trim for painting shall be A.W.M.A.C. economy grade construction.
- .2 Trim shall be as detailed.

3.3 Installation

- .1 Set and secure cabinetwork and finish carpentry items in place rigid, plumb and square.
- .2 Use purpose designed fixture attachments for wall mounted components.
- .3 Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units, counter tops, and shelving.
- .4 When necessary to cut and fit on site, make material with ample allowance for cutting. Provide trim for scribing and site cutting.
- .5 Permanently fix cabinet and counter bases to floor using appropriate angles and anchorages.
- .6 Counter-sink all semi-concealed anchorage devices used to wall mount components and conceal with solid plugs of species to match surrounding wood. Place flush with surrounding surfaces.
- .7 Carefully scribe cabinetwork which is against other building materials, leaving gaps of 0.8mm maximum. Do not use additional overlay trim for this purpose.
- .8 Install and adjust all cabinet hardware to ensure smooth and correct operation.
- .9 Site-install all computer wire grommets into millwork as directed by Departmental Representative and indicated on drawings.

3.4 Transparent-Finished Veneer and Trim

- .1 Where detailed, trim shall be of hardwood species and grain-cut as scheduled, all to A.W.M.A.C. economy grade.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

- .1 Section 01 01 50 General Instructions
- .2 Section 06 20 00 Finish Carpentry and Millwork

1.2 Samples

- .1 Submit duplicate samples of joints, edging, cut-outs and postformed profiles in accordance with Section 01 01 50.

1.3 Maintenance Data

- .1 Provide maintenance data for plastic laminate work for incorporation into maintenance manual specified in Section 01 01 50.

1.4 Product Handling

- .1 Cover finished laminated plastic surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.
- .2 Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22 degrees C.

1.5 Waste Management

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 - Waste Management and Disposal, the Waste Reduction Workplan, and the Waste Management Plan to the maximum extent economically possible.

PART 2 PRODUCTS

2.1 Materials

- .1 Laminated plastic for flatwork: to CAN3-A172, Type general purpose, 1.5mm thick based upon three solid colour or patterned material as selected by the Departmental Representative. Refer to Room Finish schedule, millwork elevations and Finishes Legend on the drawings.
- .2 Plywood core: to CSA 0151-1978, solid two (2) sides, 19mm thick unless otherwise noted on the drawings.
- .3 Laminated plastic adhesive: recorcinol resin to CSA 0112.7 as recommended by laminated plastic manufacturer's technical literature.
- .4 Draw bolts and splines: as recommended by fabricator.

2.2 Shop Fabrication

- .1 Comply with CAN3-A172, Appendix 'A'.
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.

- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Use low VOC adhesives. Laminated plastic finish is only applicable to countertops at point-of-sales and countertop & backsplash with sink shown on drawings. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2438 mm. Keep joints 200 mm from sink cut-outs.
- .5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

PART 3 EXECUTION

3.1 Installation

- .1 Install work, plumb, true and square, neatly scribed adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm o.c. 75 mm from edge. Make flush hairline joints.
- .4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.
- .6 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

- .1 Section 08 51 13 Aluminum Windows

PART 2 PRODUCTS

2.1 Sheet Metal Materials

- .1 To profiles as detailed from hot dipped galvanized steel with coating designation Z275 (G90) and meeting the requirements of ASTM A525M (latest version). Gauge to match cladding. Finish to match cladding.

2.2 Accessories

- .1 Isolation coating: to CAN/CGSB-1.108-M89.
- .2 Plastic cement: to CAN/CGSB-37.5-M89.
- .3 Underlay for metal flashing: asphalt laminated kraft paper to CAN/CGSB-51.32-M77.
- .4 Sealants: in accordance with Section 07900, paragraph 2.1.4, 3.3 normal temperature range, wet conditions, movement range 25%, colour as selected by Departmental Representative. Only sealants listed on CGSB Qualified Products List are acceptable for use on this project.
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm, Thickness same as sheet metal being secured.
- .6 Fasteners: Use security fasteners.
- .7 Washers: of same material as sheet metal 1.6 mm thick with rubber packings.

2.3 Fabrication

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable RCABC flashing details specifications and as indicated.
- .2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints. Form pieces wider than 300 mm with max. 1500 mm lengths.
- .3 Hem exposed edges on underside 12 mm. Miter and seal corner 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 o.c. in contact with concrete mortar.

2.4 Reglets and Misc. Flashings

- .1 Form recessed and surface mounted reglets and metal misc. flashing of galvanized sheet metal as detailed and in accordance with CRCA 'FL' series details. Provide slotted fixing holes and steel/plastic washer fasteners.

2.5 Self-Adhesive Through-wall Flashing Membrane

- .1 SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, having following physical properties:
 - .1 Thickness 40 mil
 - .2 Tensile Strength per ASTM D-412 250 psi for membrane
 - .3 Elongation per ASTM D-412 200%
 - .4 Permeance per ASTM E-96 <0.1 Perms
 - .5 Puncture Resistance per ASTM E154 40lbf
 - .6 Minimum Application Temperature 5°C
 - .7 Colour Blue

PART 3 EXECUTION

3.1 Installation

- .1 Install sheet metal work in accordance with CRCA specifications and Aluminum Sheet Metal Work in Building Construction – latest edition as detailed.
- .2 Use concealed fastening except where approved before installation.
- .3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
- .4 Lock end joints and caulk with sealant.
- .5 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .6 Insert metal flashing into reglets
- .7 Turn top edge of flashing into recessed reglet or mortar joint minimum 25 mm wedge flashing securely into join.
- .8 Caulk flashing at reglet, cap flashing with sealant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions
- .2 Section 06 20 00 – Finish Carpentry and Millwork
- .3 Section 07 62 00 – Sheet Metal Flashing and Trim
- .4 Section 08 51 13 – Aluminum Windows

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .2 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 - Shop Drawings, Product Data and Samples.
- .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 01 50 - Shop Drawings, Product Data and Samples.
- .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 01 50 – Shop Drawings, Product Data and Samples.

1.5 QUALITY ASSURANCE/MOCK-UP

- .1 Construct mock-up in accordance with Section 01 01 50 - Quality Control.
- .2 Construct mock-up to show location, size, shape and depth of joint s complete with back- up material, primer, caulking and sealant.
- .3 Mock-up will be used:

- .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 01 50 - 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.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 - Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material 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 Regional and Municipal regulations.
- .6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .9 Fold up metal banding, flatten, and place in designated area for recycling.

1.8 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 4.4 degrees C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9 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.

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.
- .4 Colours as selected by the Departmental Representative from manufacturer's complete range of available colours.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Urethanes One Part.
 - .1 CAN/CGSB-19.13.
 - .2 Applicable: Exterior locations in non-secure areas at joints between dissimilar construction.
- .2 Silicones One Part.
 - .1 To CAN/CGSB-19.13.
 - .2 Applicable: Exterior locations in non-secure areas for metal to metal contact.
- .3 Mildew resistant:
 - .1 Applicable: Interior non-secure areas including: junction of washroom fixtures
 - .2 to walls and floors; junction of vanities to walls; around washroom accessories in tile surfaces; joint between vanity counters and backsplash; joints between wall tiles at internal corners.
- .4 Security Sealants – Interior (Where Required)
 - .1 Two-part, non-sag, chemically curing epoxy adhesive/sealant, specifically designed for use in interior security areas.

- .2 Acceptable Product: Pecora Dynapoxy EP-1200.
- .3 Applicable: Interior joints as detailed.
- .5 Security Sealants – Exterior (Where Required)
 - .1 Two-part, non-sag, chemically curing epoxy sealant, specifically designed for use in exterior security areas.
 - .2 Acceptable Product: Euclid Chemical Euco #452-P epoxy system.
 - .3 Applicable: Exterior joints as detailed.
- .6 Acoustical Sealants – Interior
 - .1 Color- white
 - .2 Chemical base – acrylic
 - .3 Curing time – 3mm/3 days
 - .4 Application temperature range – 50C to 400C.
 - .5 STC classification (ASTM E90) – STC 56
 - .6 Surface burning characteristics)ASTM E84-08) – Flame Spread:10 and Smoke Development: 5
 - .7 Acceptable product: Hilti CP 572
- .7 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
 - .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 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 Related Work

- | | | |
|----|------------------|------------------------------|
| .1 | Section 09 22 00 | Non-structural Metal Framing |
| .2 | Section 09 29 00 | Gypsum Board |
| .3 | Section 09 90 00 | Painting |

1.2 Reference Standards

- .1 A924/A924M-99 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 A653/A653M-02A Standard Specification for Steel Sheet, zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the hot-Dip Process.
- .3 A1011/A1011M-03 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon Structural, High Strength low-Alloy and high Strength Low-Alloy with improved Formability.
- .4 A1008/A1008M-03 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, high-Strength Low-Alloy and high-Strength Low-Alloy with Improved Formability.
- .5 C665-01e1 Standard Specification for mineral-fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .6 CAN/CSA G40.21-M1998 = Structural Quality Steels.
- .7 CAN/CGSB-1.18-99 – Ready Mixed Organic Zinc-Rich Coating.
- .8 CAN/ULC-S705.1-2001 – Thermal Insulation Spray Applied Rigid Polyurethane foam, Medium Density, material Specification.
- .9 CSDFMA – Specifications for Commercial Steel Doors and Frames Canadian Steel Door and Frame Manufacturers’ Association 1990.
- .10 ANSI (American National Standards Institute) / BHMA (Builder Hardware Manufacturer Association).
 1. ANSI/BHMA A156.1, Butts and Hinges.
 2. ANSI/BHMA A156.2, Preassembled Locks and Latches.
 3. ANSI/BHMA A156.4, Door Controls (Closers).
 4. ANSI/BHMA A156.5, Auxiliary Locks and Associated Products.
 5. ANSI/BHMA A156.6, Architectural Door Trim.
 6. ANSI/BHMA A156.13, Mortise Locks and Latches.
 7. ANSI/BHMA A156.16, Auxiliary Hardware.
 8. ANSI/BHMA A156.18, Materials and Finishes.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50.
- .2 Clearly indicate each type of door and frame, material core thickness, mortises, reinforcements, anchorages, glazing, location of exposed fasteners and hardware arrangements.
- .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.

PART 2 PRODUCTS

2.1 Materials

- .1 Sheet Steel (WGSC): tension leveled steel to STMA924M) galvanized to ASTMA653M, commercial steel (CS), type B, coating designation ZF120 (paintable Galvaneal).
- .2 Hot rolled Carbon Steel Sheet (HRCS): commercial quality to ASTM A1011, for concealed reinforcement for materials, 2.7 mm minimum thickness.
- .3 Cold rolled carbon steel sheet (CRCS) commercial quality to ASTM A1008, shop prime coated.
- .4 Bituminous paint: to CAN/CGSB-1/108.

2.2 Components

- .1 Frames: base thickness steel as follows:
 - .1 Interior: 1.6 mm steel having a strike bucket which will accept a 25 mm throw deadbolt. Wedge in the area of the strike bucket to prevent spreading.
- .2 Doors: base thickness steel as follows:
 - .1 Interior: Hollow-core, metal, 45 mm thick with 1.2 mm CRS.
- .3 Frame floor anchors and channel spreaders: minimum 1.6 mm thick base steel.
- .4 Guard boxes: minimum 0.8 mm thick base steel.
- .5 Steel frame anchors:
 - .1 Thickness and design listed by ULC for labeled door and frame assemblies if applicable.
 - .2 Stud walls: Twist in stud anchor with base anchor for commercial doors.
- .6 Hinge, lock, strike, flush bolt and surface applied hardware reinforcing: 3.5 mm minimum base metal thickness. Prepare doors and frames to accommodate hardware specified in this section.
- .7 Hinge, lock, strike, flush bolt and surface applied hardware reinforcing: 3.5 mm minimum base metal thickness.
- .8 Door bumpers: black neoprene single stud.
- .9 Reinforcing channel: to CAN/CSA G40.21-M, Type 300 W.
- .10 Primer: to CGSB 1-GP-181M, zinc rich.
- .11 Top caps: galvanized steel for all exterior doors, 0.9 mm base metal thickness.

2.3 Door Type

- .1 (HCM) Doors: flush steel with full honeycomb core of 25 mm size bonded resin – impregnated kraft reinforcement, with reinforcement for hardware.

2.4 Fabrication

- .1 Fabricate doors and frames as detailed: in accordance with Canadian Steel Door and Frame Manufacturer’s Association (CSDFMA) “Canadian Manufacturing for Steel Doors and Frames”, 1990; for hollow steel construction; ULC requirements and reviewed shop drawings except where specified otherwise. Fabricate frames for glazing, setup and welded in similar manner as for door frames.
- .2 Mortise, reinforce, drill and tap doors and frames and reinforcements to receive hardware using templates provided by finish hardware supplier.

2.5 Frame

- .1 Cut miters and joints accurately and weld continuously on inside of frame profile.
- .2 Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .3 Protect strike and hinge reinforcements in grout filled frames in masonry walls using guard boxes welded to frames.
- .4 Weld in two channel spreaders per frame, to ensure proper frame alignment.
- .5 Provide Z type snap-in stud type anchors for fixing at floor.
- .6 Install 3 bumpers on strike jamb for each single door.
- .7 Provide steel channel type glazing stops at all glazed H.M. frame assemblies.

2.6 Door

- .1 Assemble components using spot or arc welding.
- .2 Continuously weld longitudinal door edges, fill and grind smooth to conceal edge seams, Mechanical locked open seams no acceptable.
- .3 Touch up doors with primer where galvanized finish damaged during fabrication.

2.7 Door Hardware

- .1 Hinges – 3 commercial grade five-knuckle hinges (Monthard BB1079 4”x4 ½” or Equal) with NRP (non-removable pin).
- .2 Mortise lockset to ANSI/BHMA A156.13, Series 1000 mortise lock, Grade 1 operational and security finish 626. Acceptable product – Stanley/Best Access 45H Series with forged lever handles #15, rectangular escutcheons type J, normal strike with strike box and key cylinders & keys from BEST ACCESS SYSTEMS, 7-pin removable core system to match keyway for Mission Medium Institution. Provide all new locksets with removable core construction cylinders or provide temporary locksets. Key all construction cores alike. Provide two keys to operate construction cores. Deadlock E0681 for hardware group #3.
- .3 Door closers and accessories - To Grade 1-ANSI A156.4 UL 10C., 100 hour salt spray. Arms and brackets to suit application. Acceptable product: LCN 4210 Series, 689 finish, CUSH at 85° swing.

- .4 Thresholds - 150 mm wide x full width of door opening, extruded aluminum mill finish smooth flat saddle type.
- .5 Silicone pressure sensitive door gasketing for adhesive application to head and jambs of door frame, colour – black. Acceptable product: DraftSeal DSS66D series
- .6 Security Hardware Keys - Arrange with the security hardware supplier/installer to have the keys for the security hardware delivered directly to CSC security officer who shall provide a receipt to the Contractor for security hardware keys. Provide a copy of the receipt to the Departmental Representative.
- .7 Safety glass for door lite – two layers of 6mm float glass held by minimally a 0.78mm (30mil) interlayer of polyvinyl butyral security film.
- .8 Kick Plate, 900mm height x full door width, 18 Ga. diamond pattern stainless steel kick plates for both inside and outside door faces, and for both door leaves.
- .9 Flush Bolts, heavy duty stainless steel body, cover plates and rods at top and bottom of each leaf.

PART 3 EXECUTION

3.1 Frame Installation

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreaders at third points of door opening to maintain frame width. Remove temporary spreaders after frames are built-in.
- .4 Make allowance for deflection to ensure structural loads are not transmitted to frames.

3.2 Door Installation

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .2 Adjust operable parts for correct function.

3.3 Door Hardware Installation

- .1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .2 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer is unacceptable.

END OF SECTION

PART 1 GENERAL

1.1 Scope of Work

- .1 Engineered design, shop drawings, fabrication and installation of all factory assembled extruded aluminum thermally broken exterior single hung windows complete with glazing, extruded deflection head channels, associated flashings, closures, sill covers, adaptors, coupling trim, caulking, weatherstripping, and all required anchorages, attachments and shims.

1.2 Related Work

- .1 Section 01 01 50 – General Instructions

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50.
- .2 Clearly indicate all pertinent dimensioning, general construction, component connections and locations, anchorage methods and locations, hardware locations, installation details.

1.4 Design Performance

- .1 Accommodate expansion and contraction within service temperature range of -35°C to 35°C.
- .2 Limit deflection of mullion to L/175 of clear span when tested to ASTM E330 under design wind load.
- .3 Design of exterior glazing in accordance with 2015 National Building Code of Canada (NBCC) taking in account wind and interior pressures with maximum deflection of any member not to exceed L/175 under positive or negative live loads. Annual probability factor shall be 1 in 10 for references velocity pressure.
- .4 Glazing to CAN/CGSB 12.20-M89 structural design of glass for buildings.
- .5 Design and install all glazing systems to resist seismic forces in accordance with requirements of NBCC, 2015.
- .6 All classification rating to CAN/CSA-A440-98.
- .7 Air infiltration shall not exceed $0.0003\text{M}^3/\text{S}\cdot\text{M}^2$ when tested in accordance with ASTM E283 at a pressure differential of 75 Pa.
- .8 Water tightness for fixed lites shall have no infiltration when tested in accordance with ASTM E331 with a pressure differential of 720 Pa.
- .9 Water tightness for Opening Vents shall have no infiltration when tested in accordance with ASTM E331 with a pressure differential of 500 Pa.

1.5 Maintenance Data

- .1 Provide data for maintenance and cleaning in accordance with instructions under Section 01 01 50.

1.6 Protection

- .1 Components and frames shall be adequately wrapped to prevent damage during shipping and construction operations.

1.7 Coordination

- .1 Coordinate work of this Section with that of Sections 02 41 99 and 06 20 00 where aluminum windows interface with existing exterior insulated wall panel and new finish carpentry.
- .2 Ensure that all adaptors, coupling members and required fitments are provided at above listed interfacing as detailed.

PART 2 PRODUCTS

2.1 Materials

- .1 All materials shall be to CAN/CSA-A440-98 CAN3-S157. Extrusions shall be 6063-T5 or T6 alloy and temper. Formed aluminum components shall be sheet of alloy and temper suitable for their application and finish.
- .2 Fasteners shall be 300/400 Series Stainless Steel or cadmium plated and of sufficient size and quantity to perform their intended function.
- .3 Glazing tapes shall be macro-polyisobutylene, highly adhesive and elastic with continuous built-in shim.
- .4 Weathering and glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.
- .5 Aluminum shall have isolation coating where required using Alkali-resistant Bituminous paint using dialectic separators where required.
- .6 Flashing shall be pre-formed to shapes and profiles shown or as required to insure a waterproof and air tight assembly. Material from aluminum alloy, architectural clear anodized where exposed, mill finish elsewhere.
- .7 Sill flashings shall be back and end damned and caulked into place, minimum 1.6 mm (16 guage).

2.2 Finish

- .1 Clear Anodized: Exposed aluminum sections shall be given an anodic oxide treatment in accordance with Aluminum Association Specification AA-M12C22A31, Columbia #201 to match other aluminum in building.

2.3 Fabrication

- .1 Construct units from extrusions of size and shape shown on shop drawings. All joints shall be drawn together and secured by means of screws driven through section walls into integral screw channels of adjoining extrusions. All joints shall be accurately machined, assembled and sealed to provide neat weathertight joints. Ventilator sash shall be tubular extrusions with two lines of extruded elastomeric weatherings retained in extruded splines in the window frames. Glass stops shall be square lock-in screwless type. Shielded drainage and pressure equalization vents shall be provided where required.
- .2 The window shall be exterior glazed and shall incorporate “top load” glass stop glazing.
- .3 Sash units shall be single hung unit, bottom lite is operable as shown and scheduled.
- .4 Window profile shall be 51 x 83 mm. Thermal break shall be pour and de-bridge type.
- .5 Vented units shall have stainless steel friction arms, aluminum hinges and cam handles.

2.4 Glazing

- .1 Sealed double glazing, insulated unit, as scheduled on drawings.

PART 3 EXECUTION

3.1 Windows

- .1 Install aluminum windows as indicated on drawings and in accordance with manufacturer's recommendations to achieve weathertight installations. Ensure assemblies are plumb, level and free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- .2 Use sufficient corrosion resistant anchorage devices to securely and rigidly fasten windows to building, without causing detrimental effects to shape or performance.
- .3 Set window sills level and uniform. Accurately and rigidly fit together all joints. Ensure joints are flush, hairline and weatherproof.
- .4 Caulking between window sections and materials installed by others: By this contractor, as specified in Section 07 90 00.
- .5 This contractor shall do all necessary sealing within the window frames to ensure a weatherproof installation.
- .6 Aluminum shall be isolated from concrete, mortar, plaster and dissimilar metals with bituminous paint or isolation tape.

3.2 Protection & Cleaning

- .1 Aluminum windows shall be adequately wrapped and protected to prevent damage during construction.
- .2 At completion of the project, remove protection and clean and polish all surfaces

END OF SECTION

PART 1 GENERAL

1.1 Work Included

- .1 Interior steel studs, metal furring channels, including floor and associated accessories, including design and engineering.
- .2 Installation of hollow metal door frames in steel stud partitions.

1.2 Related Work

- .1 Section 08 11 00 Steel Door, Frame and Hardware
- .2 Section 09 29 00 Gypsum Board

1.3 Standard Specifications

- .1 Unless otherwise shown or specified, materials and workmanship shall meet the standards detailed in the Specification Standards Manual of the British Columbia Wall and Ceiling Industry.
- .2 Where standards are outlined herein, it will not preclude the use of other standards included in the Specification Standards Manual where such standards are approved in writing by the Departmental Representative.

1.4 Design of Steel Studs Systems

- .1 Steel stud systems and connections shall be designed in strict accordance with CAN/CSA S136-01.
- .2 The stud wall system shall be designed to support lateral & gravity loadings as prescribed in the NBCC 2015.

1.5 Shop Drawings

- .1 Submit shop details and erection drawings showing stud gauges, sizes, fastening, configuration, etc.

PART 2 PRODUCTS

2.1 Interior Steel Studs

- .1 As specified in BCWC Section 9.7, Part 2, Items 1 & 2 to ASTM C645-76.
- .2 Galvanized 3 5/8" steel studs, 20 gauge minimum.
- .3 Use min. 20 gauge galvanized steel studs (doubled) at door jambs.
- .4 Head and bottom track as per ASTM C645-76

2.2 Furring Channels

- .1 As specified in BCWC Section 9.7, Part 2, Item 3.
- .2 Min. 25 ga. galvanized steel hat shaped channels with knurled face 22 mm thick.

2.3 Metal Security Sheet Metal

- .1 For placement over wall metal studs and ceiling assembly space, where scheduled, for security, shall be 16 gauge galvanized sheet metal. Use security fastener @ 200mm O.C. at perimeter, “Tamper Resist TORX Plus screws (5 lobe design)” manufactured by Camcar, Textron of Rockford, Illinois.

PART 3 EXECUTION

3.1 Installation Interior Steel Studs

- .1 Install steel and stud partitions in accordance with BCWC Section 9.7, Part 3, Item 2. Studs 300 mm o.c. maximum.
- .2 Use doubled 20 Ga. thick studs each side of door frames.
- .3 Erect new hollow metal door frames in steel stud partitions.
- .4 Use double walls where required to accommodate piping, ducts, exist. wall thicknesses, etc.

3.2 Installation Vertical & Horizontal Furring

- .1 Install vertical and horizontal furring in accordance with BCWC Section 9.7, Part 3, Item 4 spaced 400 mm o.c. maximum if applicable.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

- | | | |
|----|------------------|--------------------------------|
| .1 | Section 09 22 00 | Non-structural metal framing |
| .2 | Section 08 11 00 | Steel Door, Frame and Hardware |
| .3 | Section 09 90 00 | Painting |

1.2 Reference Standards

- .1 ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products.
- .2 ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .3 ASTM C 630 Standard Specification for Water-Resistant Gypsum Backing Board.
- .4 ASTM C 840 Standard Specification for Application and Finishing of Gypsum Board.
- .5 ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .6 ASTM C 1396 Standard Specification for Gypsum Board.
- .7 ASTM C 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- .8 ASTM C 84 Standard Test Methods for Surface Burning Characteristics of Building Materials.
- .9 Unless otherwise shown or specified, materials and workmanship shall meet the standards detailed in the Specification Standards Manual of the British Columbia Wall and Ceiling Industry and printed matter issued by the product manufacturers.
- .10 Where standards are outlined herein it will not preclude the use of other standards included in the Specification Standards Manual where such standards are approved in writing by the Departmental Representative.
- .11 Reference in these project specifications to Section numbers, Parts, and Item numbers means those within Section 9.6 of the Specification Standards Manual.

1.3 Quality Assurance

- .1 Provide gypsum board materials that comply with the following limits for surface burning characteristics when tested as per ASTM E 84:
 1. Flame spread: 25, maximum.
 2. Smoke developed: 150, maximum.

1.4 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 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 Standard Gypsum Board

- .1 Plain: to CSA A82.27-M1977 13 mm thick or to match with existing, 1219 mm wide x maximum practical length, ends square cut, edges tapered.

2.2 Metal Furring & Suspension Systems

- .1 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

2.3 Adhesives

- .1 Laminating compound: to CSA A82.31.

2.4 Accessories

- .1 Casing Beads: 0.5 mm base thickness commercial grade sheet steel with G90 zinc finish to ASTM A525-80A, perforated flanges; one piece length per location.
- .2 Acoustic Sealant: to CGSB 19-GP-21M. Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Panel for Joint Sealants.
- .3 Joint Compound: to CSA A.82-31-M1980, asbestos free.
- .4 Corner Beads: 32 x 32 mm, 6063-T5 aluminum alloy.

2.5 Fastening and Finishing

- .1 Nails, screws, tape, joint compound, and taping compound as specified in Section 9.5, Part 2, Item 2 of the Specification Standards Manual and the board manufacturer's printed instructions.
- .2 Corner beads, casing beads as specified in Section 9.6, Part 2, Item 3 of the Specification Standards Manual and the board manufacturer's printed instructions.

2.6 Fastening

- .1 Nails, screws, and staples: to ASTM C380.

2.7 Security Plywood

- .1 C.S.A. 0151-M1978, solid two sides, select. 13mm thick.

2.8 Rubber Base

- .1 Lay out base to keep number of joints at minimum.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

2.9 Fiber Cement Wall Base

- .1 CertainTeed 200mm 4/4 fiber cement trim with factory pre-finish. Installation per manufacturer instructions.

PART 3 EXECUTION

3.1 Gypsum Wallboard Application

- .1 Apply drywall in accordance with ASTM C 840, Section 9.6, Part 3, Item 6 of the Specification Standards Manual and printed instructions issued by the board manufacturer.
- .2 Gypsum wallboard shall be attached to metal studs, furring by screw application.

3.2 Corner Beads & Casing Beads

- .1 Install corner beads and casing beads in accordance with Section 9.6, Part 3, Item 11 of the Specification Standards Manual.

3.3 Finishing and Joint Treatment

- .1 Finish field joints, internal angles, screw heads, beads and trim in accordance with Section 9.6, Part 3, Item 4.1 of the Specification Standards Manual for a Level 5 finish.

3.5 Patching and Pointing

- .1 Point and patch drywall and leave work complete and ready for painting.

3.6 Accessories

- .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 o.c. using contact adhesive for full length.
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

3.7 Clean-up

- .1 Clean-up rubbish daily and take care to avoid defacing adjoining work.

END OF SECTION

PART 1 GENERAL

1.1 Work Included

- .1 All work and materials shall conform to the standards to the Master Painters Institute (MPI) Architectural Painting Specification Manual, latest edition, and as herein specified, indicated on drawings and schedules.

1.2 Qualifications

- .1 The paint products of the Paint Manufacturer shall be as listed in the MPI Architectural Painting Specification Manual (latest edition), under “Paint Product Recommendation” section, or approved equivalent.
- .2 This contractor shall have a minimum of five (5) years proven satisfactory experience, and shall maintain a qualified crew of painters throughout duration of the work who shall be qualified to fully satisfy the requirements of this specification. Only qualified journeymen (and apprentices) shall be engaged in painting and decorating work who have a provincial Tradesman Qualification certificate of proficiency.

1.3 Submittals

- .1 Paint colours shall match existing. Submit drawdown of the selected colours to Departmental Representative for approval before ordering paints.

1.4 Product Handling

- .1 Paint materials shall be delivered to the job site in sealed original labeled containers bearing manufacturer’s name, type of paint, brand name, designation and instruction for mixing and/or reducing.
- .2 The Contractor shall provide adequate storage facilities. Paint materials shall be stored at a minimum ambient temperature of 7°C in a well ventilated and heated single designated area.
- .3 Take all necessary precautionary measures to prevent fire hazards and spontaneous combustion.
- .4 Where toxic materials and both toxic and flammable solvents are used, appropriate precautions shall be taken and no smoking allowed as a regular procedure.

1.5 Environmental Conditions

- .1 Temperature, humidity and moisture content shall conform to the following:

Temperature:	No painting shall be performed when temperature on the surfaces, or the air in the vicinity of the painting work are below 5°C (41°F) for interior work.
Relative Humidity:	Shall not be higher than 85%.
Moisture of Surfaces:	Tests shall be done by electronic “Moisture Metre”.
Plaster and Wallboard:	Maximum moisture content 12%.
Masonry/Concrete:	Maximum moisture content 12% for solvent type paint. Masonry surfaces may be tested for alkalinity.
Wood:	Maximum moisture content 12%.

- .2 Proper lighting shall be the Contractor's responsibility.
- .3 All areas where painting and coating work is proceeding require adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 7°C (45°F) for 24 hours before and after paint application. Required heat and ventilation shall be provided by the Contractor.

1.6 Protection

- .1 Adequately protect other surfaces from paint and damage and make good any damage caused by failure to provide suitable protection, but this section will not be responsible for any damage caused by others.
- .2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray of dropping from fouling surfaces not being painted and in particular, surfaces within the storage and preparation area.
- .3 Cotton waste, cloths and material, which may constitute a fire hazard, shall be placed in closed metal containers and removed daily from the site.
- .4 Remove all surface hardware, electrical plates, fittings, fastenings, etc. prior to painting operation. These items shall be carefully stored, cleaned and replaced on completion of work in each area.

PART 2 PRODUCTS

2.1 Materials

- .1 Paint, varnish, stain, enamel, lacquer, and fillers used shall be of a type and brand herein specified and listed under "Paint Product Recommendations" as covered in the MPI Architectural Painting Specification Manual, latest edition, for specific purposes.
- .2 Paint materials such as linseed oil, shellac, turpentine, etc. and any of the above materials not specifically mentioned herein but required for first class work with the finish specified shall be of the highest quality product of an approved manufacturer. All coating material shall be compatible.
- .3 All materials shall be lead, hex. chromium, cadmium and mercury free and shall have low VOC content.
- .4 Preference should be given to ISO 2002 registered manufacturers.
- .5 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project. Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels. Use MPI listed materials having minimum rating where indoor air quality (odour) requirements exist.
- .6 All material shall be premium Architectural grade unless otherwise specified.

PART 3 EXECUTION

3.1 General

- .1 Method of paint application shall be generally by the accepted trade method. Painting coats specified are intended to cover surfaces satisfactorily when applied in strict accordance with recommendations.

- .2 Apply each coat at the proper consistency. Each coat of paint shall be slightly darker than preceding coat unless otherwise approved.
- .3 Sand lightly between coats to achieve the required finish. Each coat of finish should be dry and hard before a following coat is applied unless the manufacturer's directions state otherwise (4 hours for latex; 8 hours for alkyd).
- .4 Tint filler to match wood when clear finished are specified; work filler well into the grain and before it has set wipe the excess from the surface.
- .5 Application of paint shall be in strict accordance with MPI Architectural Painting Specification Manual requirements.
- .6 Complete hiding is required on all finishes, including deep tone colours.
- .7 Contractor shall employ sufficient tradesmen to carry out the job with no interruption, slow down or inconvenience to the project schedule and operations.

3.2 Condition of the Surfaces

- .1 Prior to commencement of work of this section, thoroughly examine all surfaces scheduled to be painted.
- .2 Report to Departmental Representative any condition adversely affecting this work.
- .3 No painting work shall proceed until all defects have been corrected and surfaces are acceptable for painting.
- .4 Commencement of work shall be held to imply acceptance of surfaces.
- .5 All preparation work shall be the responsibility of this section. (Refer to Surface Preparation).

3.3 Preparation of Surfaces

- .1 Prior to commencement of work of this section, thoroughly examine all surfaces scheduled to be painted. Report to Departmental Representative any conditions adversely affecting this work. Prepare all interior surfaces for repainting in accordance with MPI Manual requirements.
- .2 No painting work shall proceed until all defects have been corrected and surfaces are acceptable for painting. All preparation work shall be the responsibility of this Section.
- .3 Prepare all surfaces in accordance with the requirements in Chapter 3 of the MPI Architectural Painting Specification Manual (latest edition) and as herein specified.
- .4 Remove and securely store all miscellaneous surface fittings/fastenings (eg: electrical places and frame stops), removable rating/hazard/instruction labels, prior to painting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (eg: lacquer finishes).
- .5 All surfaces shall be sanded prior to the application of any coatings.
- .6 Allow full drying between coats, as per manufacturer's recommendations. Sand in between coats.
- .7 Remove all loose and peeling paint from walls and woodwork to a sound surface.
- .8 Loose and peeling paint not meeting ASTM Designation D3359-87 Test Method A-X cut scale 2A shall have the entire surface(s) removed to a sound surface.

- .9 Repair all water damaged surfaces and spot prime with a stain blocking primer.
- .10 Surface defects, such as nail/screw popping, paper tears, nicks and scratches, line gauges caused by chair back seat rests, tables, etc., shall be filled, sanded and spot primed with an approved primer and shall be considered normal surface preparation.
- .11 Units severely contaminated with grease, smoke and tar – hand wash with detergent and rinse thoroughly prior to any surface preparation.
- .12 All surfaces: applications shall be by brush/roller.
- .13 Allow full drying between coats, as per manufacturer’s recommendations. Sand in between coats.
- .14 Surface defects such as old paint runs on walls and wood works must be sanded smooth prior to the applications of any coating(s).
- .15 Tape fill, sand and spot prime all structural cracks.
- .16 Ensure that a transition primer is applied over alkyd surfaces where waterborne systems have been specified.

3.4 Electrical Equipment - General

- .1 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas. Colour and texture shall match adjacent surfaces, except as noted otherwise.
- .2 Keep sprinkler heads free of paint.

3.5 Field Quality Control

- .1 In strict accordance with the MPI Architectural Painting Specifications Manual requirements.

3.6 Painting Schedule

- .1 The following titles, grades and code numbers refer to those listed in the Master Painters Institute (MPI) Architectural Painting Specifications Manual, latest edition.
- .2 Exterior Systems: (Refer to Chapter 2, MPI Manual)
 - .1 Structural Steel & Metal Fabrications (non-galvanized) (premium grade)
EXT 5.1G (sheen level 5) Pigmented polyurethane over zinc-rich primer and high build epoxy.
 - .2 Galvanized Metal (premium grade)
EXT 5.3B alkyd finish (sheen level 5)
Use this finish on exterior galvanized steel, including but not necessarily limited to railings, structural connections, hollow metal doors and frames, roof top ducts, vents, and piping, and other exterior galvanized metal, as indicated and as specified under structural and 08 11 00.
- .3 Interior Systems: (Refer to Chapter 3, MPI Manual)
 - .1 Galvanized Metal (premium grade)
INT 5.3M High performance architectural latex (Sheen level G5 Semi-Gloss)
 - .2 Galvanized Metal (premium grade)

INT 5.3C alkyd (level 5 sheen)

.3 Drywall (premium grade)

INT 9.2B latex finish (level 3 sheen for walls)

.4 Dressed Lumber for Painting (premium grade)

INT 6.3B alkyd finish (level 5 sheen)

.5 Sealer for existing concrete slab (Sikalastic Resoflex over Sika MT primer, colour RAL 7046 Telegrey)

Apply the specified products per manufacturer instructions.

3.7 Electrical Services

- .1 Paint exposed metalwork, including exposed and insulated piping, sprinkler piping, ductwork, conduit, hangers, etc. in connection with mechanical and electrical trades within finished areas of the buildings, including Mechanical and Electrical Equipment Rooms. Paint as follows:
 - .1 One (1) coat red oxide primer (galvanized primer where applicable) two (2) coats enamel (semi-gloss) in accordance with INT 5.1K or INT 5.3M.
 - .2 Paint covered and insulated pipes three (3) coats. One (1) coat PVA sealer; two (2) coats enamel (semi-gloss).
 - .3 Colour to match room in which piping is exposed, unless otherwise directed or scheduled.

3.8 Adjust and Clean

- .1 On completion of the work, remove all paint where spilled, splashed or splattered.
- .2 During the progress of the work, keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 At the conclusion of the work leave the premises neat and clean to the satisfaction of the Departmental Representative.

END OF SECTION

PART 1 GENERAL

1.1 Scope of Work

- .1 Rolling counter shutter.
- .2 Corner Guards

1.2 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 06 20 00 Finish Carpentry and Millwork

1.3 Submission

- .1 Submit shop drawings and catalogue illustrations in accordance with Section 01 01 50.
- .2 Indicate size and description of components, base materials, surface finish inside and out, hardware, attachment devices, description of rough-in-frames, building-in details of anchors, connection/attachment requirements for interfacing materials and systems.

1.4 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – 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 Rolling Counter Shutter

- .1 Of size shown on drawings to consist of aluminum rolling curtain assembly for manual push-up operation, metal frame, hardware and fixing.
- .2 The unrated rolling shutter assembly shall consist of interlocking, flat faced slats extruded of 6063 aluminum alloy not less than .050” thick, fitted with endlocks to hold curtain in alignment. Bottom of curtain shall be fitted with an extruded bottom bar provided with a lift handle and a slide lock bolt at either end of window; and a continuous vinyl bumper to seal against the counter top. Curtain shall be coiled around a metal barrel which rotates on self-lubricating bearings and containing helical, oil-tempered counterbalance spring. Barrel shall be face-mounted as part of the complete assembly on inside (secure) side of wall. An aluminum hood and fascia shall be provided to enclose mechanism and end brackets. Units shall be lockable from secure side of wall. Guides shall be face-mounted on secure side of wall.
- .3 Finish: All exposed aluminum components shall be clear anodized.
- .4 Acceptable Products: Amstel, Dynaflair, Cookson, Kinnear, Cornell.

2.2 Corner Guards

- .1 Where indicated: adhesive mounted, 1.6mm (16 gauge) thick, Type 304 stainless steel alloy with #4 satin finish (vertical draw), formed corner guards, 75mm x 75mm x 1200mm with 3.2mm corner radius, starting above plywood base.

PART 3 EXECUTION

3.1 Examination and Preparation

- .1 Verification of conditions: examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.
- .2 Surface preparation: prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- .3 Protection: take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.2 Installation (General)

- .1 Install all materials in strict accordance with manufacturer's written instructions.

3.3 Installation of Rolling Counter Shutter

- .1 Shutter assembly and associated framing shall be installed and adjusted by experienced personnel employed by bonded installers in accordance with the manufacturer's instructions and approved shop drawings. All items in this Section shall be set in their correct location and shall be set level, square, plumb and at proper elevations, and in alignment with other work.
- .2 Secure anchors and joints with provision for expansion and deflection of structure, concealed fixing.
- .3 Coordinate fabrication and installation of finish carpentry of other interfacing sections.
- .4 Adjust door and shutter assemblies to operate smoothly with minimum clearance and close contact with frames.

3.4 Cleaning

- .1 Immediately upon completion of installation, clean materials in accordance with manufacturer's recommended cleaning method.
- .2 Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.5 Protection

- .1 Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions.
- .2 Section 21 13 13 – Wet Pipe Sprinklers Systems.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.
- .3 Shop drawings to show:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of Anchorage
 - .4 Supports
 - .5 Accessories
 - .6 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide in accordance with Section 01 01 50 – General Instructions.
 - .2 As-Built drawings:
 - .1 Provide in accordance with Section 01 01 50 – General Instructions
 - .2 Submit to Departmental Representative for approval and make corrections as directed.
 - .3 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
 - .3 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 01 50 – General Instructions.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33-Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 HANGERS AND SUPPORTS

- .1 All hangers and supports shall conform to the appropriate NFPA and local jurisdiction standards.

2.2 MISCELLANEOUS METALS RELATED TO FIRE PROTECTION SYSTEM

- .1 All miscellaneous metal related to the fire protection systems including all metal back up plates and supports for all ceiling or wall supported equipment is part of this section of the work.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Division 9 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 FIELD QUALITY CONTROL

- .1 Site Tests: conduct tests in accordance with Section 01 01 50 – General Instructions and Section 21 13 13_Wet Pipe Sprinkler System, and submit report to Departmental Representative.
 - .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 Schedule site visits, to review Work.

3.3 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 01 01 50 – General Instructions
- .2 Section 21 05 05 – Common Work Results for Fire Suppression

1.2 REFERENCES

- .1 Perform work in accordance with the following:
 - .1 ANSI/NFPA 13, Installation of Sprinkler Systems
 - .2 NFPA 25, Inspection, Testing, and Maintenance of Water-based Fire Protection Systems.
 - .3 National Building Code of Canada – current edition
 - .4 National Fire Code of Canada – current edition

1.3 SCOPE OF WORK

- .1 Contractor is responsible for complete installation of automatic sprinkler systems to meet all requirements of the referenced codes in accordance with the specifications and drawings.
- .2 Relocate, remove, and / or add:
 - .1 Sprinkler heads and piping for the Canteen Relocation project.
 - .2 Coordinate with Contractor with regards to the existing building elements to remain and the new building elements to be added.
 - .3 Allow for fire watch during sprinkler system renovation.
- .3 Contractor is responsible for completing full and complete as-builts to the requirements of NFPA 13 for “Working Plans.” As-builts shall be prepared using AutoCAD.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions and in accordance with ANSI/NFPA 13, working plans and design requirements. Shop drawings and hydraulic calculation shall be signed and sealed by a professional engineer licensed in the province of BC.
- .2 Submit shop drawings for the following:
 - .1 Piping and joining method.
 - .2 Sprinkler heads.
 - .3 Seismic bracing means and methods.

1.5 ENGINEERING DESIGN CRITERIA

- .1 Design system in accordance with ANSI/NFPA 13.

- .1 To suit occupancy.
- .2 Pipe size and layout:
 - .1 Hydraulic design
 - .2 Sprinkler head layout: to ANSI/NFPA 13. Contractor shall coordinate sprinkler head layouts with architectural, structural, mechanical and electrical systems in order to avoid obstruction of sprinkler head.

1.6 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.7 SEISMIC RESTRAINT

- .1 Provide seismic restraint in accordance with current National Building Code of Canada and BCBC.

Part 2 Products

2.1 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to NFPA 13. Minimum Sch.40 for threaded joints and minimum Sch.10 for roll groove joints.
- .2 Fittings and joints to NFPA 13:
 - .1 Ferrous: screwed, welded, flanged, roll grooved.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to 50mm (NPS 2): bronze, screwed or grooved ends. Ball or butterfly valves.
 - .3 65mm (NPS 2½) and over: cast iron flanged or roll grooved ends, indicating butterfly valve.
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services.

2.2 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Temperature ratings
 - .1 Ordinary temperature - rated sprinklers shall be used in all general areas.
 - .2 High temperature classification sprinklers shall be used in high temperature zones in accordance with NFPA.
 - .3 Intermediate classification sprinklers shall be used in intermediate temperature zones.

2.3 STANDARD UPRIGHT/ PENDANT SPRINKLER

- .1 Bronze finish vertical upright pendant standard sprinklers with frangible glass bulb.
- .2 All areas with exposed concrete or metal deck ceilings.

2.4 SIGNS

- .1 Signs for control drain and test valves: to NFPA 13.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide sprinkler shop drawings and hydraulic calculation which shall be signed and sealed by a professional engineer licensed in the province of BC.
- .2 Provide letter of assurances for the sprinkler system and seismic restraints in the renovated areas, signed and sealed by a professional engineer licensed in the province of BC.
- .3 Sprinkler system testing report to be submitted to the Departmental Representative.
- .4 Coordinate sprinkler head locations with electrical and HVAC plans. Relocate existing sprinkler heads and add new heads as required to suit new architectural layout.
- .5 Coordinate sprinkler branch line runs with structural steel, concrete beams, electrical and HVAC plans.
- .6 Fill voids around openings through floors and walls for fire protection piping with approved fire stopping and smoke seal.
- .7 Connect fire protection piping system to existing fire sprinkler main line and provide all necessary connection and joining materials.
- .8 After completion of sprinkler system, the sprinkler contractor shall furnish a written statement or certificate as per NFPA and to the effect that the work covered by the contract has been completed in accordance with approved tender documents. Provide copies of all test certificates.
- .9 Support sprinkler system components in accordance with NFPA 13 requirements for earthquake (seismic) restraints. Seismic zone to be based on Agassiz, BC.
- .10 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13, NFPA 25, and manufacturer's written installation instructions.
- .11 Brace piping in accordance with NFPA 13 and seismic shop drawings.
- .12 Use roll grooved fittings where possible in order to maximize system flexibility.

- .13 Arrange sprinkler piping such that it is completely drainable. Install auxiliary drains in all trapped sections of piping. Extend drain lines to the floor level within the reach of a floor drain with a 15 meter hose.
- .14 Provide all acceptance materials and requirements outlined in NFPA 13, including copies of Contractor's Material and Test Certificate, reports of all tests not included in the NFPA 13 forms, and NFPA 25 in Operation and Maintenance Manuals.

3.2 **Testing**

- .1 Testing to be witnessed by Authority Having Jurisdiction.
- .2 Hydraulically test the system at 200 psi (1380 KPa) for two hours.
- .3 Rework and retest if there is any drop in gauge pressure or visual leakage. Gauge shall be located at the low elevation point of the system.
- .7 Provide "Contractor's Material and Test Certificate" forms, and reports of all tests not included in the forms.

3.3 **Coordination**

- 1. Coordinate work with Fire Alarm System
- 2. Maintain sprinkler clearance from obstructions such as lights, beams, columns, and partitions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 01 50 – General Instructions.
- .2 Section 01 91 00 – Commissioning.

1.2 REFERENCES

- .1 National Building Code of Canada 2015
- .2 National Plumbing Code of Canada 2015
- .3 Authority Having Jurisdiction
- .4 ULC and FM Standards for applicable products

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all plumbing equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves, where applicable.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for all plumbing equipment 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 where applicable.
 - .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 where applicable.
- .5 Approvals:
 - .1 Submit two hard 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. PDF draft copy may be submitted for review if agreed upon 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 one set of reproducible mechanical drawings. Provide sets of prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-built (as-constructed) drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing, 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 using as-built drawings.
 - .5 Submit completed reproducible as-built drawings (hardcopy, CAD and PDF) with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 General Instructions.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
 - .1 TORX with pin (to remove fasteners).

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect products from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 SECURITY FASTENERS

- .1 Fasteners used in areas accessible by inmates shall be TORX with pin, stainless steel screws, which require a special tool to remove the fasteners. Use fasteners compatible with material through which they pass.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that existing conditions are acceptable for connection to new materials to be installed within this contract.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION FOR PLUMBING EQUIPMENT

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all plumbing equipment.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct operational tests and submit report as described in Section 01 01 50 General Instructions.

3.5 COMMISSIONING

- .1 Test and verify operation of each fixture, valve, and electrically controlled device in accordance with Section 01 91 00 Commissioning.

3.6 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing. Random equipment will be tested.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Perform in accordance with Section 01 01 50 General Instructions.

3.7 CLEANING

- .1 Clean in accordance with Section 01 01 50 General Instructions.
 - .1 Progress Cleaning: Leave Work area clean at end of each day.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 01 50 General Instructions.

3.8 WASTE MANAGEMENT

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 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 SECTION INCLUDES

- .1 Bases, pads, hangers and supports for piping.

1.2 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions.

1.3 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-2016, Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A125-96(2013)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 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 MSS SP58 and ASME B31.1.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers, to withstand seismic events as specified Section 23 05 49 - Seismic Restraint.

1.5 SUBMITTALS

- .1 Submittals: in accordance with the Submittal Procedure requirements in Section 01 01 50 General Instructions.
- .2 Submit all information and data in both printed paper format and PDF electronic format.
- .3 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.

- .2 Connections to equipment and structure.
- .3 Structural assemblies.
- .4 Quality Control Check Sheets
- .5 Closeout Submittals: Provide all applicable close-out submittals per Section 01 01 50 General Instructions.

1.6 QUALITY CONTROL

- .1 General:
 - .1 Contractor to be responsible for quality control of the products and installation in this section.
 - .2 Quality Control Program Submittals:
 - .1 Quality Control Check Sheet
 - .2 Check sheets to include the following information:
 - .1 Pipe or ductwork system
 - .2 Equipment number, make and model, including weights
 - .3 Pipe support type and spacing
 - .4 Pipe support finish (corrosion protection, painted)
 - .5 Details of pipe attachment to structure
 - .6 Hanger details at pipe insulation (where applicable and specified)
 - .7 Comments on seismic installation

Part 2 Products

2.1 GENERAL

- .1 Provide hangers and supports to secure equipment in place, prevent vibration, protect appropriate against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.
- .2 Provide insulation protection saddles on all insulated piping.
- .3 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP58.
- .4 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.
- .5 Support from (top of) structural members. Where structural bearings do not exist or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.
- .6 Do not suspend from metal deck.

2.2 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.3 WALL SUPPORTS

- .1 Horizontal and Vertical pipe adjacent to wall.
 - .1 Exposed pipe wall support for lateral movement restraint.
 - .2 Galvanized or other non-corrosive finish.
 - .3 Channel type support
 - .4 Angle iron wall brackets (galvanized or other non corrosive finish) with specified hangers.

2.4 FLOOR SUPPORTS

- .1 Horizontal pipe.
 - .1 Do not support piping from the floor unless specifically indicated.
- .2 Vertical pipe.
 - .1 Mid-point of risers between floor slabs - adjustable fabricated steel supports.

2.5 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel

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 plumbing fixtures 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 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25% of total load.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation of thermal insulation for plumbing piping.

1.2 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions.
- .2 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C449/C449M-07(2013), Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C547-15, Standard Specification for Mineral Fiber Pipe Insulation.
 - .4 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
- .2 National Building Code of Canada
 - .1 NBCC-2015
- .3 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R2015).
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S115-11(R2016), Standard Method of Fire Tests of Firestop Systems
 - .3 CAN/ULC-S702-14, Standard for Mineral Fibre Thermal Insulation for Buildings

1.4 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" - will mean "not concealed" as defined herein.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 01 50 General Instructions.
- .2 Submit following shop drawing information:
 - .1 Pipe insulation: manufacturer's catalogue literature
 - .2 Installation requirements
 - .3 Schedule of all piping systems and proposed insulation types, thicknesses and finishes.

1.6 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with Section 01 01 50 General Instructions.
- .2 Installation instructions to include procedures used, and installation standards achieved.

1.7 QUALIFICATIONS

- .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

1.9 WASTE MANAGEMENT AND DISPOSAL

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

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 CAN/ULC-S702 or ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.

2.1 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.

2.2 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Air drying on mineral wool, to ASTM C449/C449M.

2.3 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.4 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.5 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.6 JACKETS

- .1 Not applicable.

2.7 FIRE STOPPING AND SMOKE SEAL MATERIALS

- .1 References:
 - .1 CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.
 - .2 ASTM E814 Standard Method of Fire Tests and Through-Penetration Firestops.
 - .3 1997 Certifications Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).
 - .4 Underwriters Laboratories of Canada. Listing of Equipment and Materials Vol. 3 Fire Resistance Ratings -Revision 4/95.
- .2 Work Included:
 - .1 Furnish all labour, material, equipment and services necessary to supply and install firestopping and smoke seals around piping penetrations through fire rated wall and floor assemblies, as indicated and as specified.
- .3 Quality Assurance:
 - .1 The work of this section shall be carried out only by an approved specialist firm, employing skilled tradesmen experienced in firestopping and smoke seal application and approved, licensed and supervised by the manufacturer of fire stopping materials.
 - .2 All work to be of the highest quality according to best trade practice and in strict accordance with manufacturer's printed specifications.
- .4 Submittals:
 - .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Submit manufacturers' product data for materials and prefabricated devices. Include assembly/location design system number references with copies of test information. Construction details should accurately reflect actual job conditions.
 - .3 For building assemblies which do not correspond to any previously tested and rated assemblies, submit proposals based on related designs using accepted fireproofing design criteria.
- .5 Materials:
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-

S115 and not to exceed opening sizes for which they are intended.

- .2 Service penetration assemblies and design numbers: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19. 1997 Certification Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).
- .3 Service penetration firestop components: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC or equivalent approved tests by Warnock Hersey.
- .4 Fire resistance rating of installed fire stopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of piping systems to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer’s instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.1 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: (A-1).
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code (1501-H).
- .3 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Insulation thickness (mm)					
			Up to 1	1¼ -2	2½-4	5-6	6½-8	>8
Pipe sizes (NPS)			Up to 1	1¼ -2	2½-4	5-6	6½-8	>8

Domestic Water	All	A-1	25	25	25	25	38	38
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.4 Finishes:

- .1 Exposed indoors: PVC jacket.
- .2 Exposed in mechanical rooms: PVC jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Outdoors: Water-proof aluminum jacket.

3.2 INSULATION PACKING OF PIPE SLEEVES

- .1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation - Thermal Ceramics to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

3.3 CLEANING

- .1 Clean in accordance with Section 01 01 50 General Instructions.
 - .1 Progress Cleaning: Leave work area clean at end of each day.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.
- .2 Waste Management in accordance with Section 01 01 50 General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 01 50 – General Instructions.
- .2 Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15-13, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-12, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-13, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .2 ASTM International Inc.
 - .1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - .2 ASTM B88M-16, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05 (R2016), Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 National Building Code of Canada
 - .1 NBCC-2015
- .6 National Plumbing Code
 - .1 NPC-2015
- .7 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).
 - .1 NSF/ANSI 61-16, Drinking Water System Components.

1.3 QUALITY ASSURANCE

- .1 All potable water system components shall conform to NSF/ANSI Standard 61.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 General Instructions.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 General Instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packaging Waste Management: remove in accordance with Section 01 01 50 General Instructions.
- .2 Place materials defined as hazardous or toxic in designated containers.

Part 2 Products

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type K: to ASTM B88M.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 and smaller: wrought copper to ANSI/ASME B16.22; with stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

- .1 Rubber gaskets, latex-free, 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 PROTECTIVE CONDUIT

- .1 Not applicable.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with NPC, and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .4 Buried tubing:
 - .1 Not applicable.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with isolation valves.
- .2 Balance recirculation system using existing valves. Mark settings and record on as-built drawings on completion.

3.4 PRESSURE TESTS

- .1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system is fully functional.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system to approval of Departmental Representative.

3.8 START-UP

- .1 Timing: start up after:
 - .1 Disinfection procedures 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.
- .4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

- .1 Scheduling:
 - .1 Verify system performance after leakage tests and disinfection are completed.
- .2 Procedures:

- .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 Verify performance of temperature controls.
 - .3 Verify compliance with safety and health requirements.
 - .4 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .5 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
- .1 Not applicable.

3.10 CLEANING

- .1 Clean in accordance with Section 01 01 50 General Instructions.
 - .1 Progress Cleaning: Leave work area clean at end of each day.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.

3.11 WASTE MANAGEMENT

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 01 50 – General Instructions.
- .2 Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM B32-08 (2014), Standard Specification for Solder Metal.
 - .2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70-12 (R2016), Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3-12, Plumbing Fittings.
- .3 National Building Code of Canada
 - .1 NBCC-2015
- .4 National Plumbing Code
 - .1 NPC-2015

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 General Instructions.
- .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 01 50 General Instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove in accordance with Section 01 01 50 General Instructions.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

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

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.
 - .2 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.
- .2 Above ground sanitary and vent: to CAN/CSA-B70.
 - .1 Joints:
 - .1 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

3.3 TESTING

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

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Not applicable.

- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (sanitary, vent) c/w directional arrows.

3.5 CLEANING

- .1 Clean in accordance with Section 01 01 50 General Instructions.
 - .1 Progress Cleaning: Leave work area clean at end of each day.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.

3.6 WASTE MANAGEMENT

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 01 50 – General Instructions.
- .2 Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A126-04(2014), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700-15, Standard for Cold Water Meters-Displacement Type, Met Alloy Main Case.
 - .2 ANSI/AWWA C701-15, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702-15, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series-11 (R2016), Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08 (R2013), Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10 (R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).
 - .1 NSF/ANSI 61-16, Drinking Water System Components.

1.3 QUALITY ASSURANCE

- .1 All potable water system components shall conform to NSF/ANSI Standard 61.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting prior to beginning on-site installation, with Departmental Representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 General Instructions.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for all plumbing fixtures and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Indicate on drawings materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, accessories.
- .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.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing fixtures and accessories for incorporation into manual.
 - .1 Description of plumbing fixtures and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location 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.
- .4 Packaging Waste Management: remove packaging materials as specified in accordance with Section 01 01 50 General Instructions.

Part 2 Products

2.1 Manufactured Units

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass shall be chrome plated finish. Water supply piping exposed in finished areas shall be chrome plated brass pipe and fittings.
- .4 Number, locations: architectural drawings to govern.

- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

2.2 KITCHEN SINKS & FAUCETS

- .1 SNK-1: Two Handles Faucet
 - .1 Two Handle Faucet: chrome plated, 203 mm [8"] centerset, ECAST construction lead free [equal or less than 0.25%] cast brass body, 1/4 turn ceramic disc valve cartridges, vandal resistant 5.7 LPM [1.5 GPM] pressure compensating Softflo aerator outlet, 203 mm [8"] projection L type swing spout, 60 mm [2-3/8"] metal vandal proof lever handles with blue and red index buttons.
 - .2 Temperature control and mixing valves shall not be accessible to inmates and shall be provided with temperature-adjusting knob and dial thermometer to measure discharge temperature.
 - .3 Thermostatic Water Mixing Valve (CSA-B125.3 & ASSE 1017/1070): for group faucets to ASSE 1069 at 1.9LPM [0.5GPM] and ASSE 1070 at 1.9LPM [0.5 GPM] Lead free brass to NSF61 with corrosion resistant internal components, integral screens and checks, Allen wrench set point adjustment and lock nuts, ½ NPT connections, inlet ball valves. Nickel plated bronze body, temperature adjusting spindle, 10 mm [3/8"] inlets and outlet FNPT connections, integral checks, offer temperature range between 35 °C [95 °F] and 46 °C [114.8 °F]. Food service area; The water supply to the fixture hot water connection, to limit the temperature. Field set to 60°C [140°F] with booster to 82°C [180°F] where required by health regulations. Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.
 - .4 Single bowl, ledgeback sink 20 gauge, 18-8 stainless steel. Product has a bright mirror finished rim and satin finished bowl. Sink is fully undercoated. Basket strainer waste fitting (3 1/2", 89 mm) and installation kit are included.

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 specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 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 National Plumbing Code of Canada, local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.
- .3 Mounting Heights to match existing conditions.
- .4 Barrier-free fixtures to comply with most stringent of either NBCC or CAN/CSA B651.

3.4 START-UP

- .1 General:
 - .1 In accordance with manufacturer recommendations.
- .2 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
- .3 Provide continuous supervision during start-up.

3.5 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing fixtures per manufacturer requirements.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:

- .1 Pressure at fixtures: +/- 70 kPa.
- .2 Flow rate at fixtures: +/- 20%.
- .4 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .5 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.
- .6 Access doors:
 - .1 Verify size and location relative to items to be accessed.
 - .2 Verify key locks.

3.6 CLOSEOUT ACTIVITIES

- .1 Submit close out documentation per section 01 01 50 General Instructions.
- .2 Training: provide systems demonstrations and training.

3.7 CLEANING

- .1 Clean in accordance with Section 01 01 50 General Instructions.
 - .1 Progress Cleaning: Leave work area clean at end of each day.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment.
- .2 Waste Management in accordance with Section 01 01 50 General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 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 05 00 – Common Work Results for Plumbing.
- .2 Section 22 42 00 – Plumbing Fixtures.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A 126-04 (2009) – Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
 - .2 ASTM B 62-09 – Standard Specification for Composition Bronze or Ounce Metal Castings
- .2 American Water Works Association (AWWA):
 - .1 AWWA C700-09 – Cold Water Meters – Displacement Type, Bronze Main Case
 - .2 AWWA C701-12 – Cold Water Meters – Turbine Type for Customer Service
 - .3 AWWA C702-10 – Cold Water Meters – Compound Type
- .3 Canadian Standards Association (CSA International):
 - .1 CSA-B64 Series-11 – Backflow Preventers and Vacuum Breakers
 - .2 CSA-B79-08 – Commercial and Residential drains and cleanouts
 - .3 CSA B125-01 – Plumbing Fittings
 - .4 CSA-B356-10 – Water Pressure Reducing Valves for Domestic Water Supply Systems
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .5 Plumbing and Drainage Institute (PDI):
 - .1 PDI-G101 – Latest Edition – Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
 - .2 PDI-WH201 – Latest Edition – Water Hammer Arresters Standard

1.3 SUBMITTALS

- .1 Submittals in accordance with Division 1 – Submittal Procedures.

1.4 NSF 61

- .1 Comply with NSF 61.

Part 2 Products

- .1 Not Applicable

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

3.3 CLEANOUTS

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

3.4 WATER HAMMER ARRESTORS

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

3.5 START-UP

- .1 Timing: start-up only after:
 - .1 Pressure tests have been completed.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Read all Divisions of the building specification, Tendering Requirements, Contract Forms, and Conditions of Contract, and Division 1 which contain items affecting Mechanical Work.
- .2 If similarity or discrepancies are found between contents of Divisions 21, 22, 23, and Division 1 or other documents stated above, the one with most stringent content shall be applicable.
- .3 The Mechanical Work shall consist of the supply and installation of complete and operable systems and shall include all necessary labour, plant, materials, and incidentals for the work involved.
- .4 The drawings and specifications are intended to describe complete working systems including all necessary labour and materials. Where items required to complete working system are not specified or shown on drawings, contractor shall include costs at no additional expense to Owner.
- .5 Immediately inform the Departmental Representative, in writing, of all discrepancies, errors, omissions, contradictions and ambiguities during tender stage. The necessary Addendum or bulletin will be issued to all Bidders. Include a complete cross-checking of Drawing and Specifications for sizes and quantities to correspond correctly. Data mentioned in the Specifications and not shown on Drawings, and vice-versa, must be interpreted as part of the Work. Bring obvious discrepancies or omissions to the attention of the Departmental Representative during the Tender Period. Where discrepancies still exist within the documents, contractors shall allow for the more demanding installation or more stringent requirement.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Colour coding chart.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit four copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .2 Prepare and insert into each operation and maintenance manual a CD containing electronic copy of approved O&M manual including approved AS BUILT drawings.
- .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Transfer information weekly to reproducible, revising reproducible to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.

- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings in CADD with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 01 50 – General Instructions.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 – Health and Safety Requirements.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 01 50 – General Instructions as follows:
 - .1 One set of spare filters for the HRV unit.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 01 50 – General Instructions.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycle in accordance Section 01 01 50 – General Instructions.

Part 2 Product

2.1 Access Doors

- .1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:
 - .1 Valves;
 - .2 Filters;

- .2 Mark removable ceiling tiles used for access with colour coded dots.
- .3 Provide ULC-listed fire rated access doors installed in rated wall and ceilings.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Division 9 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 01 50 – General Instructions.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 01 01 50 – General Instructions.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in Section 01 01 50 – General Instructions.

3.4 DEMONSTRATION

- .1 Contractor 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 HVAC Systems
- .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 Contractor will record these demonstrations on video tape for future reference. Submit the recording media to Owner.

3.5 PROTECTION

- .1 Protect equipment, pipes 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 23 07 15 - Thermal Insulation for Piping
- .2 22 11 16 - Domestic Water Piping
- .3 23 21 13.02 – Hydronic Systems Steel
- .4 This section applies to all related work under Div. 22 and Div. 23.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181 Ready-Mixed Organic Zinc-Rich Coating.
- .2 National Fire Code of Canada (NFCC 2015)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 – General Instructions.
- .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 01 50 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return of pallets crates padding and packaging materials in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 MATERIAL

- .1 Paint: zinc-rich to CAN/CGSB-1.181-99.
 - .1 Primers Paints Coating: in accordance with manufacturer's recommendations for surface conditions.

- .2 Primer: maximum VOC limit to Standard GS-11.
- .3 Paints: maximum VOC limit to Standard GS-11.
- .2 Fire Stopping: in accordance with Section 01 01 50 – General Instructions.

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 PIPE TYPE APPLICATIONS

- .1 All above ground piping shall be SCH 40 black steel.

3.3 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.

3.4 CLEARANCES

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

3.5 DRAINS

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

3.6 AIR VENTS

- .1 Install air vents to at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.7 DIELECTRIC COUPLINGS

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

3.8 PIPEWORK INSTALLATION

- .1 Install pipework to applicable standard.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material. 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 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

- .13 Provide for thermal expansion as indicated.
- .14 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. Use gate or ball valves at branch take-offs for isolating purposes except where specified.
 - .6 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .15 Check Valves:
 - .1 Install silent check valves on discharge of pumps and as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.9 SLEEVES

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

3.10 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.

3.11 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.12 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 01 50 – General Instructions.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.13 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Hydrostatic test heating water piping, to 1400 kPa or 1.5 times the working pressure of final system pressure, whichever higher, which shall hold without pressure drop for a period of not less than 2 hours. Make correction for variations in ambient temperature between start and finish of this test.
- .3 Test drains for tightness and grade as required by the local plumbing inspector.
- .4 Hydrostatically test domestic water piping to a pressure of 1.5 times operating pressure or at least 120 psi (860 kPa) and maintain test pressure without loss for a minimum of 4 hours.
- .5 Test natural gas piping in accordance with local requirements.

- .6 Tests shall last at least 4 hours and if leaks develop, these shall be corrected and test repeated in an approved manner and to satisfaction of Inspection Authorities.
- .7 Arrange for a potable water purity test. Submit a laboratory report at substantial completion.
- .8 Test all backflow preventers and include report in Data Books.
- .9 Submit written confirmation of all testing.
- .10 Pipework: test as specified in relevant sections.
- .11 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .12 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .13 Conduct tests in presence of Departmental Representative.
- .14 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .15 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.14 CLEANING

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Electrical motors, drives and guards for mechanical equipment and systems.
 - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1- Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. 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 01 50 – General Instructions.
 - .2 Shop Drawings: submit shop drawings in accordance with Section 01 01 50 – General Instructions.
- .3 Quality Control: in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals

- .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial /Territorial regulations.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance Division 1 requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 GENERAL

- .1 Motors: high efficiency, in accordance with local power company standards, local by-laws and to ASHRAE 90.1.

2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W (1/2 HP) : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 60 Hz, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 60Hz, 575 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 01 50 – General Instructions.

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 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 01 50 – General Instructions.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 01 01 50 – General Instructions.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in Section 01 01 50 – General Instructions.

3.4 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 SUMMARY

- .1 Related Sections
 - .1 Section 01 01 50 – General Instructions.
- .2 Section Includes
 - .1 Pads, hangers and supports for mechanical piping and equipment.
- .3 This section applies to all related work under Division 22 and Division 23.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-07 - Power Piping, ASME B31.3-06 - Process Piping
- .2 ASTM International
 - .1 ASTM A125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.

- .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified Section 01 01 50 – General Instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 01 50 – General Instructions.

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 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers to withstand seismic events.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 13 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed and FM approved to MSS SP69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut FM approved.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate FM approved to MSS SP69.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies
 - .2 Steel brackets
 - .3 Sway braces for seismic restraint systems
- .6 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .7 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel galvanized.

- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields.
- .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP69 FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed FM approved.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.9 PLATFORMS AND CATWALKS

- .1 None are required for HVAC equipment

2.10 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size per manufacturers' instructions; chamfer pad edges.

2.11 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel. 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 AC, CU, HRV and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete where applicable with 4 minimum concrete inserts, one at each corner.

- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: to Provincial 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 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	5.0 m	
8	5.0 m	
10	5.0 m	
12	5.0 m	

- .6 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 01 50 – General Instructions.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 01 01 50 – General Instructions.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in Section 01 01 50 – General Instructions.

3.8 CLEANING

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Vibration isolation materials and components, seismic control measures and their installation including AC, CU, HRV, and piping system.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13- Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC)

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. 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 01 50 – General Instructions.
 - .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.
 - .1 Provide separate shop drawings for each isolated system complete with performance and product data.
 - .2 Provide detailed drawings of seismic control measures for equipment and piping.
- .3 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 01 50 – General Instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycle in accordance with Section 01 01 50 – General Instructions.

1.6 WORK INCLUDED

- .1 Provide vibration isolation on all motor driven equipment with motors of 0.37 kW (0.5 HP) and greater power output (as indicated on the motor nameplate) and on piping, as specified herein. For equipment less than 0.37 kW, provide neoprene grommets at the support points. Electrical grommets are not acceptable.
- .2 Provide seismic restraints for all isolated and non-isolated equipment and piping systems.
- .3 Ensure isolators and restraining devices which are factory supplied with equipment meet the requirements of this section. Provide signed and sealed Letter of Assurance as required by this section.
- .4 Ensure equipment manufacturers provide attachment points capable of withstanding specified seismic forces.

1.7 DESIGN CRITERIA

- .1 Ensure that the minimum distance between adjacent corner isolators is at least equal to the height of the centre of gravity of the equipment. Include height of centre of gravity on shop drawings. Otherwise, design for increased forces on the supports, and submit design calculations with shop drawings for approval.
- .2 Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified. Use dynamic stiffness for elastomers and do not exceed 60 durometer.
- .3 Design isolators and seismic restraints to meet the structural requirements of the Building Code.
- .4 Where integral isolation/snubbing devices do not meet the seismic requirements provide secondary all directional snubbing devices.
- .5 Design attachments to both the equipment and the structure to meet the specified forces involved. Have the attachment details to the structure approved by a Professional Engineer registered in British Columbia.
- .6 Provide seismic restraints for pipes 65 mm diameter and larger except where the pipe hanger rod length, from attachment to structure to attachment of support hardware (i.e. top of clevis hanger) is less than 305 mm.

- .7 Provide seismic restraints for all isolated piping and equipment, regardless of size.

1.8 QUALIFICATIONS

- .1 Have all isolation/seismic restraint products tested and certified by an independent testing laboratory, or certified by a registered professional engineer, to demonstrate that the products meet the requirements of this section. If particular tests are carried out to represent an isolator type, the tests shall be valid for the full load range of the isolator. Submit such tests or certification on request.

1.9 DESIGN PROFESSIONAL AND LETTERS OF ASSURANCE

- .1 Have the complete and functional seismic restraint system designed and certified by a British Columbia registered professional engineer.
- .2 Submit Letters of Assurance for the design Work of this Section, signed and sealed by the design professional engineer.
- .3 Have the design professional engineer undertake such field reviews as he or she determines to be necessary to confirm that the construction generally conforms with the design intent.
- .4 Submit letters of Assurance of Field Review and Compliance for the design Work of this Section, signed and sealed by the design professional engineer, upon completion of the Work of this Section.
- .5 Ensure that Letters of Assurance conform to the standard requirements of the Authority Having Jurisdiction.

1.10 SUBMITTALS

- .1 Obtain all relevant equipment information and provide calculations, shop and placement drawings for all vibration isolation elements and steel bases for review before materials are ordered. Provide attachment to both the equipment and the structure meeting the specified forces involved. Have attachment details to the structure approved by a BC registered Professional Engineer.
- .2 Submit samples of materials required to complete the work of this section for inspection and review if requested.
- .3 Have the vibration isolation vendor provide a full inspection report of isolation/restraint products provided and installed, listing all deficiencies.

Part 2 Products

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.

- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor 100% relative humidity installations.
- .4 Colour code springs.

2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
- .6 Performance: as indicated.

2.6 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.
- .6 Performance: as indicated.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.9 ISOLATORS

- .1 Supply all of the vibration isolation equipment from one approved supplier with the exception of isolators which are factory installed and are standard equipment with the machinery. In the latter case have the manufacturer supply certified calculations of the internal restraints as well as certified calculations for anchorage to the structure.
- .2 Provide isolators of the following types
 - .1 Pad Isolators
 - .1 Neoprene pad isolators, as defined by CAN/CSA-S6. Select pads for a 15% static deflection. Hold down equipment mounted on neoprene pad isolators using anchor bolts, nuts, washers, and hemi-grommets.
 - .2 Neoprene Floor Isolators
 - .1 Neoprene-in-shear isolators designed to meet specified seismic requirements. Select isolators for a 5 mm minimum static deflection, and bolt to structure. In the case of rubber isolators, provide protection in the design of the isolator to avoid contact of the rubber element with oil in the mechanical room.
 - .3 Spring Floor Isolators
 - .1 Spring mounts, with a minimum 25 mm deflection, complete with levelling devices, and minimum 6 mm thick ribbed neoprene sound pads with 1.3 mm minimum deflection. Design isolator to meet specified seismic requirements and bolt down using neoprene grommets.
 - .4 Hanger Isolators
 - .1 Spring hangers within minimum 25 mm deflection, complete with 6 mm thick sound pads sized for 0.5 mm minimum deflection, or neoprene

hangers. A neoprene element alone, without a hanger box, is acceptable provided no short-circuiting occurs and equipment rotates above 1170 rpm.

- .3 Select isolators at the supplier's optimum recommended loading, and do not load beyond the limit specified in the manufacturer's literature.
- .4 Design springs with stiffeners ratio of $k_x/k_y = 1.0$ to 1.5 with a working deflection between 0.3 and 0.6 of solid deflection.
- .5 Provide hot-dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located out-of-doors or in areas where moisture may cause corrosion.

2.10 FLEXIBLE PIPE CONNECTORS

- .1 Install Neoprene or EPDM flexible connectors between vibrating equipment and piping over 65 mm, except those pumps handling domestic water.

2.11 SEISMIC ROD CLAMP

- .1 Use seismic rod clamps where the length of the threaded support rod for equipment/pipe/ductwork is over 50 times the rod diameter.
- .2 Use 25 mm x 25 mm x 6.4 mm angle for threaded rod size 9.5 to 15.9 mm diameter.
- .3 Use 38 mm x 38 mm x 6.4 mm angle for threaded rod size 19 to 32 mm diameter.
- .4 Provide rod clamps complete with locking bolt.

2.12 SEISMIC SOLID BRACE FOR NON-ISOLATED EQUIPMENT/PIPING/DUCTWORK

- .1 Provide two solid braces at 90° to each other at attachment point, for non-isolated hung equipment, piping, and ductwork.
- .2 Use braces complete with formed steel solid brace anchors with two bolts holds for the solid brace and swivel hinge on a support bracket on each end of the brace.

2.13 MECHANICAL EQUIPMENT ANCHORS

- .1 Anchors shall be provided by vibration isolation/seismic restraint supplier. The responsibility for the seismic restraint of resiliently mounted equipment, from attachment to structure to point of attachment to equipment, is that of the vibration isolation/seismic restraint supplier.

2.14 EPOXY PUTTY

- .1 Steel reinforced epoxy putty with an ultimate compressive strength of 82,700 kPa.

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 manufacturer's instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless 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 ISOLATORS

- .1 Execute the work in accordance with the specifications, and where applicable, in accordance with the manufacturer's instructions and only use workmen experienced in this type of work.
- .2 For all equipment mounted on vibration isolators, provide a minimum clearance of 50 mm to other structures, piping, equipment, and similar items.
- .3 Isolate all floor or pier mounted equipment on spring floor isolators, unless otherwise specified.
- .4 Isolate pumps and axial fans rotating at more than 1170 RPM on neoprene floor isolators. Use the lowest RPM scheduled for two speed equipment in determining isolator deflection.
- .5 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing seismically rated drilled inserts.
- .6 For equipment mounted on a slab on grade, mount on neoprene floor isolators, unless otherwise specified.

- .7 For all electrical connections to isolated equipment, provide a 90° bend of flexible conduit for 25 mm conduit and smaller or 90° Crouse-Hind EC couplings for larger conduit. Use connections long enough so that the conduit will remain intact if the equipment moves laterally 300 mm from the installed position, and flexible enough to transmit less vibration to the structure than is transmitted through the springs.
- .8 Where piping connected to noise generating equipment is routed from the mechanical room through walls and plumbing chases, position piping to avoid contact with the concrete structure, future framing, drywall and other finishes which may radiate noise.

3.4 EQUIPMENT INSTALLATION

- .1 Bolt all equipment to the supporting structure. Do not bridge isolation elements.

3.5 NON-ISOLATED HANGING SYSTEM

- .1 Follow the Seismic Restraint manual Guidelines for Mechanical systems published by SMACNA in the selection of the appropriate diameter of threaded rod for the associated load at each attachment point. Use the next largest size of rod if any doubt exists.
- .2 Wherever possible keep piping, ducting and equipment within 300 mm of the structure (i.e. top of pipe/duct or equipment to the attachment point at underside of structure). Intermediate points may exceed this 300 mm rule but a consecutive 300 mm attachment must occur with 9 m for ducting and 12 m for piping. No further seismic restraint is required if these parameters are met and all threaded rods at restraint points exceed 6.3 mm diameter.
- .3 Piping/ducting may be attached to walls and require no further restraint as long as it is attached within 300 mm of that wall.
- .4 Use pipe riser clamps wherever possible on piping without thermal expansion, instead of clevis hangers.
- .5 Anchor pipes without thermal expansion penetrating structural walls to the wall at the point of penetration.
- .6 Anchor ducts penetrating walls to the wall at the point of penetration.
- .7 Place piping closer to the structural ceiling than ductwork, except where maintenance prone valves or other devices are installed in the piping.
- .8 Set the minimum distance from drill holes to the edge of the concrete or adjacent drill holes as recommended by the manufacturer of the drill inserts.
- .9 Place seismic bracing or cables for ductwork within 600 mm, in both directions from every turn or jog, then:
 - .1 space the transverse bracing at 9 m intervals;
 - .2 space the longitudinal bracing at 18 m intervals.
- .10 Place seismic bracing or cables for pipes within 600 mm, in both directions from every turn or jog, then:
 - .1 space the transverse bracing at 12 m intervals;
 - .2 space the longitudinal bracing at 24 m intervals.

- .11 Include anchored wall penetrations when calculating the 9/18 and 12/24 bracing spacings to determine the number of transverse and axial restraints required.
- .12 Install the required restraints equidistantly between corner and penetration anchor points.

3.6 ANCHORING RIGIDITY

- .1 Maximum air gap between anchor bolt and restraint housing anchor hole shall not exceed 3 mm.
- .2 If the air gap exceeded 3 mm, the clearance must be reduced by hemi-grommets (where the bolt is concentric with the hole) or epoxy putty.
- .3 Follow manufacturer's instructions to hand knead the 0.5 fast epoxy putty and fill the entire gap between the bolt hole and the anchor bolt.

3.7 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Upon completion of installation.
 - .3 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Provide Departmental Representative with notice 24 h in advance of commencement of tests.
 - .3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .4 Submit complete report of test results including sound curves.

3.8 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 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
 - .2 This section applies to all related work under Division 22 and Division 23.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
 - .2 Product data to include paint colour chips, other products specified in this section.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 01 50 – General Instructions.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.
 - .2 Dispose of unused paint coating material at official hazardous material collections site approved by Departmental Representative.

- .3 Do not dispose of unused paint 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 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.

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 plastic-coated cloth 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
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Sprinklers	Red	SPRINKLERS

2.6 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.

2.7 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.

2.8 LANGUAGE

- .1 Identification in English.
- .2 Use one nameplate and label.

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 Division 9 - Painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

- .2 Provide ULC and CSA registration plates as required by respective agency.

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 At beginning and end points of each run and at each piece of equipment in run.
- .7 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.
- .8 Identification easily and accurately readable from usual operating areas and from access points.

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 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 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 30 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1 2016.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2015.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 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.

1.8 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.

1.9 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.

- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Strainers in place, baskets clean.
 - .3 Isolating and balancing valves installed, open.
 - .4 Calibrated balancing valves installed, at factory settings.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Hydronic systems: plus or minus 5 %.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB standards of AABC SMACNA and ASHRAE.
- .2 Do TAB of systems, equipment, components, controls including but not limited to the following:
 - .1 HVAC Systems
- .3 Qualifications: personnel performing TAB current member in good standing of AABC qualified to standards of AABC.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop, temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:

- .1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.
- .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate.

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air and water systems specified this section.
 - .2 Quality assurance: as for air and water systems specified this section.
- .2 Measurement of noise and vibration from equipment specified in Division 23.
- .3 Smoke management
 - .1 Test for proper operation of all fire dampers, installed as a component part of air system specified in Division 23.

1.21 POST-OCCUPANCY TAB

- .1 Participate twice in system checks during warranty period 3 months after acceptance and 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 01 01 50 General Instructions
- .2 23 31 13.0 Metal Ducts – Low Pressure to 500PA (2”W.G.)
- .3 23 33 00 Air Duct Accessories
- .4 23 37 20 Louvres, Intakes and Vents

1.2 REFERENCES

- .1 Definitions:
 - .1 For purposes of this section:
 - .1 "CONCEALED" – insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" – means "not concealed" as previously defined.
 - .3 Insulation systems – insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.3 Reference Standards:

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-2010 – Latest Edition, Standard 90.1-2010 (I-P Edition) -- Energy Standard for Buildings Except Low-Rise Residential Buildings
- .2 ASTM International Inc.
 - .1 ASTM B209M-10 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
 - .2 ASTM C335/C335M-10E1 – Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-11 – Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 - .4 ASTM C449-07 (2013) – Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement
 - .5 ASTM C553-11 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - .6 ASTM C612-10 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation
 - .7 ASTM C795-08 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

- .8 ASTM C921-10 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- .9 ASTM D412-06AE2 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
- .10 ASTM D1424-09 – Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
- .11 ASTM E84-12 – Latest Edition, Test Method for Surface Burning Characteristics of Building Materials
- .12 ASTM E96M-12 – Standard Test Methods for Water Vapor Transmission of Materials
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52MA – Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation
- .4 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-2011 – Latest Edition – Commercial Adhesives
- .5 National Fire Protection Association
 - .1 NFPA-90A - Latest Edition, Installation of Air Condition and Ventilating Systems
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards 2013.
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S102-10 – Latest Edition, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S701-11 – Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering

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.
- .5 Rigid Insulation:
 - .1 Ducting and Fittings: Rigid insulation with vapour barrier to be composed of fibrous glass or mineral wool fibres formed into rigid board having a factory applied vapour barrier, and suitable for application on exposed or concealed rectangular ducts and plenums.
 - .1 Specification Compliance:
 - .1 CGSB 51-GP-10a
 - .2 ASTM C612-70, Class 1
 - .3 ASTM C411-05 to meet NBC or CUA (NFPA 90A), latest edition.
 - .2 Vapour Barrier:
 - .1 Vapour barrier shall be composed of aluminum foil minimum 24 gauge thick (0.7 mil), reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper. Vapour barrier shall meet or exceed the following:
 - .1 Water Vapour Permeability: 0.3 perms max.
 - .2 Moisture Absorption: Less than 0.2% by volume.
 - .2 Fire Hazard Classification: not to exceed:
 - .1 Flame Spread: 25
 - .2 Fuel Contributed: 50
 - .3 Smoke Developed: 50
 - .3 Specification Compliance:
 - .1 ASTM-C411-05 to meet NBC or CUA 90A (NFPA-90A), latest edition.
 - .2 Thickness of rigid insulation with vapour barrier to be as indicated in schedule.
 - .2 Vapour Barrier:
 - .1 Vapour barrier shall be composed of aluminum foil minimum 24 gauge thick (0.7 mil), reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper. Vapour barrier shall meet or exceed the following:
 - .1 Water Vapour Permeability: 0.3 perms max.
 - .2 Moisture Absorption: Less than 0.2% by volume.
 - .2 Fire Hazard Classification: not to exceed:
 - .1 Flame Spread: 25
 - .2 Fuel Contributed: 50
 - .3 Smoke Developed: 50
 - .3 Specification Compliance:
 - .1 ASTM-C411-05 to meet NBC or CUA 90A (NFPA-90A), latest edition.
 - .2 Thickness of rigid insulation with vapour barrier to be as indicated in schedule.
 - .3 Application: Thicknesses as indicated in insulation schedule.
 - .1 Fresh air intakes from louvres to mixing box and/or filter sections of air handling units.
 - .2 All rectangular exhaust air ductwork for a minimum distance of 3000mm from the terminal at the roof or exterior wall or to motorized damper or as noted on the drawings.
 - .3 All rectangular supply air ducts from air handling units (in mechanical rooms) \.

- .6 Flexible Insulation:
 - .1 Ducting and Fittings:
 - .1 Flexible insulation with factory applied vapour barrier to be composed of fibrous glass formed into a flexible blanket and be suitable for application on exterior of round and rectangular ducts. Flexible insulation shall be used on rectangle ducts in concealed locations only.
 - .2 Specification Compliance:
 - .1 CGSB 51-GP-11b (Type 1)
 - .2 Class 6 ASTM C411-05, to meet CUA-90A (NFPA 90A).
 - .2 Vapour Barrier:
 - .1 The vapour barrier shall be composed of aluminum foil min 24 gauge (0.7 mil) thick, reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper.
 - .2 Specification Compliance:
 - .1 ASTM-C411 to meet NBC 1974 or CUA-90A.
 - .3 Applications: Thicknesses as indicated in insulation schedule.
 - .1 Insulate circular exhaust air ducts for a minimum distance of 3000mm from the roof terminal or exterior wall opening, or to motorized dampers or as noted on drawing.
 - .2 Unheated fresh air ducts.
 - .3 Supply air ductwork, as noted on drawings.
 - .4 Finishes:
 - .5 All concealed ductwork will be left with factory applied vapour barrier facing as specified above, with no further finish required.
 - .6 Cover all exposed ductwork with a thermocanvas jacket as specified under "Jackets".
 - .7 The bottom of duct insulation shall be pinned per TIAC standards.
 - .8 Insulation shall not be installed until spaces are weather tight and no risk of water.

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
- .3 Aluminum:
 - .1 To ASTM B 209 with moisture barrier as scheduled in PART 3 of this section.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Smooth, Stucco embossed or Corrugated.
 - .4 Jacket banding and mechanical seals: 12 or 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 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, reinforced, 50 or 75 mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Tie wire: 1.5 mm stainless steel.
- .9 Banding: 12 or 19 mm wide, 0.5 mm thick stainless steel.
- .10 Facing: 25 mm stainless or galvanized steel hexagonal wire mesh stitched on one face or both faces of insulation or one face of insulation with expanded metal lath on other face.
- .11 Fasteners: 2 or 4 mm diameter pins with 35 mm diameter or square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Ensure surfaces are clean, dry, free from foreign material.
- .2 No insulation shall be installed until the area to be insulated is weather tight and there is no risk of water.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1/C-2	yes	25
Round cold and dual temperature supply air ducts	C-2	yes	25
Rectangular warm air ducts	C-1/C-2	no	25
Round warm air ducts	C-2	no	25
Supply and return ducts exposed in space being served	C-1/ C-2	yes	25
Outside air ducts to mixing plenum	C-1	yes	50
Exhaust duct 3000mm back from wall or roof penetration	C-1/C-2	yes	50
Acoustically lined ducts	none		50

- Interior ductwork does not require exterior insulation if acoustic insulation is provided.
- Exterior outdoor ductwork requires exterior insulation even if acoustic interior insulation is provided.

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
 - .1 Use TIAC 2013 code C-1 insulation, scored to suit diameter of duct.
 - .1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed	CRF/1	CRD/1
Outdoor, exposed to precipitation	CRF/3	CRD/3
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.
 - .2 This section applies to all related work under Division 23.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus) Canadian Environmental Assessment Act (CEAA), 2012, c. 37.
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. 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 01 50 – General Instructions.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 01 50 – General Instructions.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

- .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.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards
 - .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 01 50 – General Instructions.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 01 50 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

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 CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.

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, 19mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: by Departmental Representative.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Outdoor: UV rated material at least 0.5 mm thick.
- .2 ABS Plastic:
 - .1 One-piece moulded type and sheet with pre-formed shapes as required.
 - .2 Colours: by Departmental Representative.
 - .3 Minimum service temperatures: -40 degrees C.
 - .4 Maximum service temperature: 82 degrees C.
 - .5 Moisture vapour transmission: 0.012 perm.
 - .6 Thickness: 0.75 mm.
 - .7 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Locations:
 - .1 For outdoor use ONLY.
- .3 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.
- .4 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: stucco embossed.

- .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.
- .5 Stainless steel:
- .1 Type: 316.
 - .2 Thickness: 0.25 mm.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

2.9 WEATHERPROOF MEMBRANE FOR INSULATION INSTALLED OUTDOORS

- .1 Prefabricated, self-adhering, sheet-type waterproofing membrane: FlexClad-400 or approved alternative.
 - .1 Description:
 - .1 Top Layer: Stucco-embossed, UV-resistant aluminum weathering surface.
 - .2 Middle Layer: Double layer of high-density polyethylene reinforcement.
 - .3 Bottom Layer: Uniform layer of rubberized Caulking.
 - .2 Heat Aging, No visible blistering or deterioration.
 - .3 Tear Resistance, ASTM D 1424, Average: 660 grams.
 - .4 Elongation, ASTM D 412, Minimum: 450 percent.
 - .5 Low Temperature Flexibility, 1,000,000 cycles at -10°F, 1,200 cycles at -20°F: No cracking.
 - .6 Water Vapor Transmission, ASTM E 96: 0.009 perms.
 - .7 Flame Spread Index, ASTM E 84: 0.
 - .8 Smoke Density Index, ASTM E 84: 5.
 - .9 Wind-Driven Rain, SFBC TAS-110-95, 100 mph: No leakage or failure.
 - .10 UV Stability: Excellent.
- .2 Application: All insulated pipework exposed to outdoors.

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 manufacturer's instructions and this specification. Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .4 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at expansion joints, valve, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: aluminum SS PVC ABS.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. TIAC Code: A-1.
 - .1 Securements: bands Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .2 TIAC Code: A-3.
 - .1 Securements: bands at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.

- .3 TIAC Code: A-6.
 - .1 Insulation securements
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code
- .4 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .5 TIAC Code: A-2.
 - .1 Insulation securements:
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .6 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to <1	1<1 ½	1 ½ <4	4 to<8	8 & over
Refrigerant Hot Gas Liquid Suction & Chilled Water & Brine	4-16	A-6	25	25	25	25	25	25
Refrigerant Hot Gas Liquid Suction & Chilled Water & Brine	below 4	A-6	25	25	25	38	38	38
Cooling Coil Condensate Drain		C-2	25	25	25	25	25	25

- .7 Finishes:
 - .1 Exposed indoors: PVC jacket to match existing..
 - .2 Exposed in mechanical rooms: PVC jacket to match existing.
 - .3 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .4 Outdoors: water-proof aluminum jacket.
 - .5 Finish attachments: SS bands at 150 mm on centre. Seals: closed.
 - .6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 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 REFERENCES:

- .1 Section 01 01 50 – General Instructions
- .2 Section 01 91 00 – Commissioning
- .3 Section 26 05 00 – Common Work

1.2 GENERAL COMMISSIONING CONCEPT AND COMMISSIONING PLAN

- .1 Commissioning Agent being hired by Contractor.
- .2 The Commissioning as applied to buildings is the process of bringing a building into use concluding all activities directed to that end, and including equipment as well as staffing involved in the subject facility.
- .3 Verification, as related to the Mechanical, Electrical and Specialty systems installed in the building, represents the process of proving the performance of the equipment as defined in the technical specifications.
- .4 Contractor shall manage and oversee the commissioning process.
- .5 The Commissioning Plan (provided by the Commissioning Agent):
 - .1 Identifies the role of each participant in the Commissioning Process and maps out both overall and phase-specific strategies for the project.
 - .2 Describes the procedures for verification of each system.
- .6 The Commissioning Process covers the full life cycle of the project from the initial planning activities through to the point where that facility is in full operation and in full compliance with predefined user, operator, design and contract requirements.
- .7 The Commissioning Process includes the following five major components:
 - .1 Thorough documentation and monitoring of all facets of construction.
 - .2 Extensive tests of all subsystems, their components and controls.
 - .3 Testing of whole systems that include a multiple of subsystems.
 - .4 Specific and detailed training on all major equipment for operational personnel.
 - .5 Ongoing monitoring and checking during the warranty period.

1.3 OBJECTIVES

- .1 Support quality management through monitoring and checking of the installation.

- .2 Verify systems performance through inspection and performance testing of the completed installation.
- .3 Move the completed facility from the "static completion" state to the optimal "dynamic" operating state.
- .4 Optimize operating and maintenance through delivery of comprehensive quality training and instruction to the Owner's operating personnel.
- .5 System debugging and optimization.
- .6 Completion of training and instruction for the operating and maintenance personnel.
- .7 Assure provision of accurate and useful historical records, such as "as-built drawings", test certificates etc. Such records provide important data for operating and maintaining the systems as well as for future system testing, maintenance or renovations.
- .8 Completion of testing and verification through seasonal review.
- .9 Specifically, the Commissioning Process shall deliver to the owner:
 - .1 A complete set of documentation on the design intent and maintenance requirements of each system involved in the commissioning process.
 - .2 A system that functions in accordance with the design intent.
 - .3 Operators who fully understand the design intent and the operation and maintenance requirements of the equipment.

1.4 CONTRACTOR'S RESPONSIBILITIES

- .1 Start-up Phase
 - .1 Ensures that start-up program is implemented in accordance with the facility start-up requirements within the contract documents.
 - .2 Following start-up, which may be observed by the Owner/Departmental Representative, and must therefore be pre-scheduled, begins Performance Testing under conditions which simulate varying load and all operating modes, including emergency modes of operation.
 - .3 Following contractor's thorough testing, schedules, and performs verification-related tasks in the presence of the Commissioning Agent.
- .2 Post-Construction Phase
 - .1 Post construction commissioning is the continued adjustment, optimization and modification of the systems to meet specified requirements. It includes updating documentation to reflect minor set point adjustments, system maintenance and calibration, major system modifications and provision of ongoing training of operation and maintenance personnel.

- .2 The objective of post construction phase commissioning is to maintain the performance of the systems throughout the useful life of the facility in accordance with the current design intent.
- .3 Complete all commissioning procedures, activities, and performance verification, which were delayed or not executed during the construction phase.
- .4 Executes system checks with the Owner/Departmental Representative:
 - .1 Once during the first month of building operation.
 - .2 Once during the third month of building operation.
 - .3 Once between the fourth and tenth months in a season opposite to the first or third month visit.
- .5 Completes rectification of all deficiencies revealed by the above checks.
- .6 Revises all as-builts and operating and maintenance documents to reflect all changes, modifications, revisions and adjustments upon completion of commissioning.

1.5 Standard of acceptance

- .1 Commissioning Agent services shall be performed by a separate independent company.
- .2 Standard of acceptance:
 - .1 K.D. Engineering.
 - .2 Western Mechanical.
 - .3 Design Intent

Part 2 Products

2.1 COMMISSIONING INVOLVEMENT

- .1 The Commissioning Agent shall direct, witness and verify equipment performance testing. Accordingly, the Contractor and/or his suppliers and/or his Independent Third Party Commissioning Agents shall perform the following:
 - .1 Check and ensure the installation of the systems and equipment to ensure that the installation is complete, is in a proper and safe state, has been pre-tested to ensure all complete and proper operation, and is ready for verification.
 - .2 Run and test the systems and equipment through their design parameters to verify their capabilities in performance, sequencing, safety protection and alarms annunciation.

2.2 SYSTEMS TO BE COMMISSIONED

- .1 Mechanical systems shall include, but are not limited to, the following (Refer to Division 1 – General Commissioning (Cx) requirements):
 - .1 Air distribution systems.
 - .2 Direct expansion (DX) cooling / heating systems.

.3 Control systems.

2.3 TESTING EQUIPMENT

.1 The Contractor shall provide all instrumentation and test equipment necessary to conduct the tests specified during the commissioning process.

2.4 DOCUMENTATION

.1 Contractor shall record all test results and procedures on approved record forms, and submit the forms together with copies of test certificates to Departmental Representative and Commissioning Agent for review and approval.

.2 When the results are verified, the Commissioning Agent shall incorporate those records in his Systems Operations Manual. He shall also make entry of those test results into appropriate sections of the Operating and Maintenance Manual for reference.

Part 3 Execution

3.1 COMMISSIONING PROCESS

.1 Perform and complete all works as specified in the Mechanical specifications. In general, it shall include complete activation of all systems; calibration; testing; verification of performance of all components, equipment and systems; verification of performance of all systems through all specified modes of control and sequences of operation, recording of test results for submission; demonstration, instruction and training of Owner's operating and maintenance personnel; and follow-up during the first year of operation for fine tuning and monitoring purposes.

.2 Advise the Owner/Departmental Representative at least 3 days in advance of any test.

.3 Complete the testing form provided for each test, and submit copies to the Departmental Representative.

3.2 TESTING OF MECHANICAL SYSTEMS – ADDITIONAL REQUIREMENTS

.1 Plumbing and Drainage System Testing

.1 The plumbing and drainage system shall be tested in accordance with the Plumbing Code under the National Building Code.

.2 The Contractor shall notify the Building Inspector and/or Departmental Representative when systems are available for testing. The Contractor shall document all tests performed and shall arrange for the Building Inspector and/or Departmental Representative to witness tests completed.

.3 Also perform hydrostatic pressure test for domestic hot and cold water systems.

.2 Water Treatment/Flushing of New Piping

- .1 The Specialist shall complete the Manufacturers' testing forms and submit a report to the Departmental Representative and Commissioning Agent.
 - .2 The Specialist shall assist the Contractor in cleaning all new piping systems. The Specialist shall take samples and repeat the cleaning process if the specification requirements are not met.
 - .3 The specialist shall provide:
 - .1 Initial water analysis and treatment recommendations
 - .2 Start-up assistance
 - .3 All necessary laboratory services and technical assistance required
 - .4 During circulation of cleaning solutions, periodically examine and clean filters and screens and measure and monitor changes in pressure drop across equipment.
 - .5 The specialist shall revisit the site after one month of operation of each system and re-test the systems, and provide a report to the Departmental Representative and Commissioning Agent.
 - .6 Where multiple cut-ins are required into an existing system, the Specialist shall repeat the above steps, and report after the completion of each cut-in.
- .3 Fire Protection
- .1 The Contractor shall hydrostatically test the systems as per the specification and NFPA requirements to meet all certifications. The test shall be witnessed by the Departmental Representative and/or the Commissioning Agent. Provide a copy of the report in NFPA 13 and 14 reporting format for all such tests to the Commissioning Agent.
 - .2 The Contractor shall obtain approval certificates from the Authorities having Jurisdiction and submit copies of the certificates to the Commissioning Agent for review.
- .4 Piping Systems (Hydronic Circulation)
- .1 Before testing, ensure that all installed valves and equipment are accessible for servicing and replacement, as per manufacturer's recommendations.
 - .2 Test all piping systems in accordance with all applicable Plumbing Codes.
 - .3 All other systems not covered by Codes noted above shall be tested and proven tight over a period of four (4) hours by a hydrostatic test. Remove fixtures, appliances, devices, vents and gauges and temporarily plug connections, as required. Provide temporary bypass when required.
 - .4 Repair any leaks or defects and repeat the tests to the satisfaction of the Departmental Representative.
 - .5 Complete the testing forms and forward copies of the test reports to the Departmental Representative and Commissioning Agent.
 - .6 After testing, TAB contractor shall measure the water flow at each existing reheat coil via the existing circuit setters. Submit report to the Departmental Representative and Commissioning Agent for review.
 - .7 The Contractor shall co-ordinate with the TAB Contractor and provides assistance during the balancing process. Review the complete installation with the balancing

contractor, and provide a report stating that all systems can be balanced by the balancing contractor as per the design. Any concerns or discrepancies must be highlighted to the Departmental Representative and Commissioning Agent prior to installation. Notify the Departmental Representative and Commissioning Agent in writing that this coordination has taken place before installation begins. Additional costs related to the lack of proper type or location of balancing devices will be borne by the Contractor.

3.3 COMMISSIONING MEETINGS AND REPORTING

- .1 The Contractor shall include all responsibilities noted in the commissioning specifications, including all tests, within his construction schedule.
- .2 The commissioning meetings, as required by the Commissioning Agent, shall follow the regular construction meetings. The testing schedules and results of all tests shall be reviewed.
- .3 All testing forms and reports associated with the mechanical systems shall be directed to the Commissioning Agent with copies to the Departmental Representative.
- .4 The forms and reports to be issued shall include:
 - .1 Reviewed shop drawings
 - .2 Equipment verification/data forms
 - .3 Testing forms
 - .4 Reports resulting from tests
 - .5 Testing schedule

3.4 OPERATING AND MAINTENANCE MANUAL

- .1 The Contractor shall prepare and submit the Operating and Maintenance Manual as detailed in the specification Section 01 01 50 – General Instructions.
- .2 The Contractor shall re-submit the manual should the Departmental Representative find deficiencies. Training shall not begin until the manual has been accepted by the Departmental Representative.
- .3 One (1) copy of the manual shall be forwarded to the Commissioning Agent in good quality, vinyl covered binders at the time of submission to the Departmental Representative. Four (4) final hard copies and 3 digital final copies of the manuals (after incorporating the Departmental Representative/Commissioning Agent comments) shall be submitted to the Commissioning Agent in 75mm (3") D-ring white vinyl covered binders with transparent sleeve.
- .4 Each mechanical manual shall be organized as follows, but not limited to the following:
 - .1 Project Directory
 - .2 Plumbing

- .3 Fire Protection
- .4 Heating and cooling
- .5 Ventilation
- .6 Controls System
- .5 The project directory shall contain the names, addresses, fax numbers and telephone numbers of Contractors, Sub-Contractors, Manufacturers and Manufacturers representatives.
- .6 Sections 3.4.4.2 to 3.4.4.6 noted above shall be divided into the following sub-sections.
 - .1 Shop drawings (reduced to 8½" x 11")
 - .2 As-built drawings (reduced to 8½" x 11")
 - .3 As-built riser diagrams (reduced to 8½" x 11")
 - .4 Systems description
 - .5 Operating procedures
 - .6 Maintenance procedures
 - .7 Trouble shooting guide;
 - .8 Valve chart (where applicable)
 - .9 Filter size chart (where applicable)
 - .10 Equipment lists
 - .11 Testing and verification forms
 - .12 Certification forms
- .7 Systems description shall be a detailed description of each major component, describing the intent, function, operational modes, and any information that may be pertinent to day-to-day operation.
- .8 The operating procedures, maintenance procedures, spare parts list, and troubleshooting guide shall be as recommended by the Manufacturer.
- .9 The equipment list shall include make, model, serial number, electrical characteristics, RPM, pump impeller sizes, fan belt and sheave sizes.

3.5 OWNER DEMONSTRATION AND OPERATOR TRAINING

- .1 Systems' demonstration shall be conducted by the Contractor. The demonstration shall cover all operation and maintenance requirements and a physical demonstration of equipment installation and operation.
- .2 Owner demonstration shall include a walk-through of the building by the Contractor. During the walk-through, the Contractor shall:
 - .1 Identify equipment
 - .2 Identify starters associated with equipment
 - .3 Identify valves and balancing dampers

- .4 Identify access doors
- .5 Review general maintenance of equipment
- .6 Review drain points in pipe work systems
- .7 Identify maintenance items
- .3 The Contractor and equipment Manufacturer shall provide operator training for each mechanical system and item of equipment.
- .4 Training and instruction shall be provided by qualified Technicians and shall be conducted in a classroom setting and at the equipment or system.
- .5 Training and instruction will begin after the Operating and Maintenance manual has been approved and delivered to the Departmental Representative.
- .6 Each session shall be structural to cover.
 - .1 The operating and maintenance manual
 - .2 System description
 - .3 Operating procedures
 - .4 Maintenance procedures
 - .5 Trouble shooting procedures
 - .6 The Manufacturer's or Service Representative's name, address and telephone number
 - .7 Provide course documentation for up to six (6) people.
 - .8 Training and instruction shall be provided for the following systems wherever applicable:
 - .1 Life Safety & Fire Protection Systems
 - .2 Heating and Cooling Systems
 - .3 Building Automation & Controls Systems.
 - .4 Mechanical Systems
 - .5 Ventilation Systems
 - .9 Time Allocation
 - .1 The time allocation for various Owner training sessions is not predetermined. The agenda for training sessions will be outlined and agreed upon with the mechanical contractor and commissioning agent through the commissioning program to ensure the Owner receives adequate training.

3.6 TESTING FORMS

- .1 The Contractor and Manufacturer shall provide testing and commissioning forms for review and acceptance.
- .2 Mechanical testing and verification forms shall include, but are not limited to, the following:

- .1 Equipment test form
- .2 Piping pressure test form
- .3 Test identification form
- .4 Chemical treatment data sheet
- .5 Fan data sheet

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 23 05 05 Installation of Pipework.
 - .2 23 07 15 Thermal Insulation for Piping.
 - .3 23 73 12 Halocarbon Management

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.22-01 (R2010), Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .2 ASME B16.24-11, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .3 ASME B16.26-11, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ASME B31.5-10, Refrigeration Piping and Heat Transfer Components.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B 280-08, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52S1-09/Supplement No.1 to B52-05, Mechanical refrigeration code.
- .4 Environment Canada (EC)
 - .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

Part 2 Products

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B 280, type K.
 - .2 Annealed copper: to ASTM B 280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa and temperature 121°C.
- .2 Brazed:
 - .1 Fittings: wrought copper to ASME B16.22.
 - .2 Joints: silver solder, 15% Ag-80% Cu-5%P or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A 307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 Insulation

- .1 For refrigerant suction and hot gas lines throughout, ½” (12 mm) thickness for suction lines 35°F (1.7°C) and above and smaller than 2 ½” (65 mm) dia., ¾” (19 mm) thickness on all other lines.
- .2 Materials to comply with CAN/CGSB-51-40.
- .3 Attach using quick-setting contact adhesive along seams and joints, as recommended by the insulation manufacturer.
- .4 All joints to be covered with self-adhesive PVC tape as recommended by the insulation manufacturer.
- .5 Use waterproof aluminum jacket where exposed to sunlight to avoid UV deterioration.

2.6 LIQUID INDICATORS

- .1 Liquid indicators shall be double port type with copper brass body, and flared or solder ends.
- .2 Provide removable seal caps on each port to inspect refrigerant condition.

2.7 STRAINERS

- .1 Refrigerant strainers shall be angle replaceable cartridge type with brass shell.
- .2 Cartridge material and screen size shall be suitable for refrigerant and piping materials utilised in the system.

2.8 HOT GAS REGULATOR

- .1 Sweat end, screw adjustment, integral electric shut off valve, or a separate electric solenoid shut-off valve upstream of hot gas regulator.

2.9 FILTER-DRYERS

- .1 Combination filter-dryers shall be angle type, with brass shell and incorporate a combined straining and drying material.
- .2 Desiccant material shall be replaceable.

2.10 SOLENOID VALVES

- .1 Solenoid valves shall have copper or brass body with flared or screwed ends.
- .2 Coil assembly shall be replaceable.
- .3 Valves shall incorporate a manually operated stem to serve as a bypass in case of coil failure.

2.11 EXPANSION VALVES

- .1 Provide angle type or straight through expansion valves suitable for the refrigerant utilised in the system.
- .2 Valves shall have brass body, internal or external equaliser, adjustable superheat setting and be complete with capillary tube and remote sensing bulb.

2.12 CHARGING VALVES

- .1 Provide general purpose type refrigerant charging valves with brass body, flared or solder ends and with removable valve core.
- .2 Provide valve inlet with quick coupling connection for ease of charging.

2.13 FLEXIBLE CONNECTORS

- .1 Flexible connectors shall consist of close pitch corrugated bronze hose with single layer of exterior braiding to provide additional strength and prevent elongation of corrugated section.
- .2 Connectors shall be minimum 230 mm long and provided with bronze fittings to facilitate connection to equipment

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 GENERAL

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05 - Installation of Pipework.

3.3 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

- .1 General:
 - .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
 - .2 Size lines to manufacturers and industry standards and recommendations.
- .2 Hot gas lines:
 - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
 - .3 Provide inverted deep trap at top of risers.
 - .4 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified.
 - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.
- .3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 MOUNTING

- .1 Mount refrigerant pipe in galvanized sheet metal wire way with lid for mechanical and environmental protection.

3.7 LIQUID INDICATORS

- .1 Provide full size liquid indicators in main liquid line leaving condenser. If a receiver is used, install in liquid line leaving receiver.

3.8 STRAINERS

- .1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.
- .2 Provide shut-off valve at each side of strainer to facilitate maintenance.

3.9 REFRIGERANT DRYERS

- .1 Provide full flow permanent refrigerant drier in low temperature systems and systems utilising hermetic compressors.
- .2 Mount drier vertically in liquid line adjacent to receiver with three valve bypass assembly to permit isolation of drier for servicing.

3.10 FILTER-DRYERS

- .1 Filter-dryers may be used in systems instead of separate strainers and dryers.
- .2 Install with three valve bypass assembly to permit isolation for servicing.

3.11 SOLENOID VALVES

- .1 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.
- .2 Provide solenoid valves with manually operable items.

3.12 EXPANSION VALVES

- .1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.
- .2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.
- .3 Select valves for maximum load at design operating pressure and minimum 6°C of superheat.
- .4 Locate remote expansion valve sensing bulb immediately after evaporator outlet and suction line.

3.13 CHARGING VALVES

- .1 Provide refrigerant charging connections in liquid line between receiver shutoff valve and expansion valve.

3.14 FLEXIBLE CONNECTORS

- .1 In general install suction and hot gas piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.
- .2 Flexible connectors shall only be utilised at or near compressors where it is not physically possible to absorb vibration within piping configuration.

3.15 START-UP AND COMMISSIONING

- .1 Charge refrigerant, start-up and submit written report to Department Representative.
- .2 Commissioning:
 - .1 In accordance with section 01 91 00 – Commissioning, and section 23 08 00 Mechanical Commissioning.
- .3 Halocarbons Management:
 - .1 In accordance with section 23 05 00 Common Work Results - Mechanical.
 - .2 In accordance with section 23 73 12 – Halocarbon Management.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 07 84 00 Firestopping.
 - .2 23 05 00 Common Work Results for HVAC.
 - .3 23 05 29 Hangers and Supports for HVAC Piping and Equipment.
 - .4 23 33 53 Duct Liners.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A480 / A480M-12 – Latest Edition, General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
 - .2 ASTM A635/A635M-09b – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements
 - .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 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA-90A – Latest Edition, Installation of Air Condition and Ventilating Systems
 - .2 NFPA 90B – Latest Edition, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards – Metal and Flexible, 2005, 3rd Edition
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012, 2nd Edition
 - .3 IAQ Guideline for Occupied Buildings Under Construction 2007, 2nd Edition
- .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Use SMACNA Seal Class “C” for all ductwork up to 500 Pa (2” w.g.) maximum operating pressure.
- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.
 - .3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

- .1 Sealant: water-based, polymer type flame resistant duct sealant. Temperature range of minus 5 degrees C to plus 93 degrees C (minus 23 degrees F to plus 200 degrees F).

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular: standard radius or short radius with single thickness turning vanes.
 - .2 Round: five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 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.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Use radiused elbows unless indicated otherwise.
- .7 Obstruction deflectors: maintain full cross-sectional area.

- .1 Maximum included angles: as for transitions.

2.5 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE or SMACNA.
- .3 Joints: to ASHRAE or SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.6 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 00 Common Work Results for HVAC.
 - .1 Strap hangers: of same material as duct but one sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500 mm wide.
 - .2 Hanger configuration: to ASHRAE or SMACNA Standards.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE or SMACNA Standards.

<u>Duct Size (mm)</u>	<u>Angle Size (mm)</u>	<u>Rod Size (mm)</u>
Up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .2 For concrete: manufactured concrete inserts.
 - .3 For steel joist: manufactured joist clamp.
 - .4 For steel beams: manufactured beam clamps.

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE and SMACNA Standards.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Insulate strap hangers 100 mm beyond insulated duct.
- .4 Support risers in accordance with ASHRAE or SMACNA Standards.
- .5 Install breakaway joints in ductwork on sides of fire separation.
- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

- .7 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where applicable.
- .8 Coordinate ductwork installation with all other trades involved on this project. Optimize ceiling space in suspended ceilings and maintain maximum headroom under exposed ducts.
- .9 Seal all joints in low pressure and high pressure. Apply sealant to outside of joint to manufacturer's recommendations. Bed tape into sealant and recoat with a coat of sealant. This applies to all supply, return, outdoor air and exhaust ductwork.
- .10 Limit length of flex duct to 1500mm.
- .11 Test all supply air and exhaust air ducts as recommended by SMACNA.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA Standards.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE or SMACNA Standards.

<u>Duct Size (mm)</u>	<u>Spacing (mm)</u>
To 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 23 05 00 Common Work Results for HVAC
 - .2 23 05 93 Testing, Adjusting and Balancing for HVAC.
 - .3 23 31 13.01 Metal Ducts-Low Pressure to 500 Pa.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS)
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible, 95.

1.3 SUBMITTALS

- .1 Submittals in accordance Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 1.0 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

2.3 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 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans, and HRV.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 600 x 600 mm for person size entry.
 - .2 450 x 750 mm for servicing entry.
 - .3 300 x 300 mm for viewing.
 - .4 As indicated.
 - .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Devices requiring maintenance.

- .3 Required by code.
- .4 Reheat coils.
- .5 Heat pumps
- .6 Elsewhere as indicated.

3.3 WORK FOR OTHER SECTIONS

- .1 Install all motorized dampers, fire stats, thermostats, limit switches, sail switches, safety controls, and instrument wells required for control and alarm systems. Coordinate this work with Controls Coordinator.
- .2 Provide pitot tube closures for TAB work. TAB contractor to locate closures to be installed by sheet metal contractor. Also install closures adjacent to all BMS duct mounted sensors.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 23 05 00 Common Work Results for HVAC.
 - .2 23 31 13.01 Metal Ducts - Low Pressure to 500 Pa.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Fire Protection Association (NFPA):
 - .1 NFPA-90A - Latest Edition, Installation of Air Condition and Ventilating Systems
 - .2 NFPA 90B – Latest Edition, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
- .4 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA):
 - .1 SMACNA HVAC Duct Construction Standards – Metal and Flexible, 2005, 3rd Edition
 - .2 IAQ Guideline for Occupied Buildings Under Construction 2007, 2nd Edition
- .5 Underwriters' Laboratories Inc. (UL):
 - .1 UL 181 – Factory-Made Air Ducts and Connectors
- .6 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC S110-07 – Latest Edition, Standard Methods of Test for Air Ducts

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Friction loss.
 - .2 Leakage.
 - .3 Fire rating.

Part 2 Products

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC-S110.

- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

- .1 Spiral wound flexible aluminum, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
- .3 Maximum length: 1500 mm.
- .4 Application: connections to cell grilles as indicated.

2.3 METALLIC - INSULATED

- .1 Spiral wound flexible aluminum with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
- .3 Maximum length: 1500 mm
- .4 Application: connections to air terminals where indicated.

Part 3 Execution

3.1 DUCT INSTALLATION

- .1 Install in accordance with: CAN/ULC-S110, UL-181, NFPA 90A, NFPA 90B and SMACNA.
- .2 Use gear drive clamps for attaching flexible ducts to equipment and fittings.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .2 ASTM C916-85(2007), Standard Specification for Adhesives for Duct Thermal Insulation.
 - .3 ASTM C1071-12, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - .4 ASTM C1338-08, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - .5 ASTM G21-09, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- .3 North American Insulation Manufacturers Association (NAIMA)
 - .1 NAIMA AH116-2002, Fibrous Glass Duct Construction Standards.
- .4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - .1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible-2005.
 - .2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-2007.
- .5 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for duct liners and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Construction IAQ Management Plan:
 - .1 Submit Indoor Air Quality (IAQ) Plan for pre-occupancy and construction phases of building.
 - .2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 DUCT LINER

- .1 General:
 - .1 Mineral Fibre duct liner: air surface coated mat facing.
 - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with NFPA 90B, CAN/ULC-S102, NFPA 90A.
 - .3 Fungi resistance: to ASTM C1338 ASTM G21.
- .2 Flexible:
 - .1 Use on round or oval surfaces.
 - .2 25 mm thick, to ASTM C1071 Type 1, fibrous ductliner.
 - .3 Density: 24 kg/m³ minimum.
 - .4 Thermal resistance to be minimum per below when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
0.74 (m².degrees C)/W for 25 mm thickness;
1.11 (m².degrees C)/W for 38 mm thickness;
0.37 (m².degrees C)/W for 12 mm thickness;
1.41 (m².degrees C)/W to 50 mm thickness.
 - .5 Maximum velocity on coated air side: 25.4m/s.
 - .6 Minimum NRC of 0.65 at 25 mm thickness based on Type A mounting to ASTM C423.

2.2 ADHESIVE

- .1 Adhesive: to ASTM C916 NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.

.3 Water-based fire retardant type.

2.3 FASTENERS

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Nylon Metal Polymer retaining clips, 32 mm square.

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

2.5 SEALER

.1 Meet requirements of NFPA 90B NFPA 90A.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

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 duct liner 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 GENERAL

.1 Do work in accordance with SMACNA HVAC Duct Construction Standard as indicated NAIMA AH116 except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.3 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive to ASTM C916.

.1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.

- .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres impact driven mechanical fasteners to compress duct liner sufficiently to hold it firmly in place.
 - .1 Spacing of mechanical fasteners in accordance with NAIMA AH116 SMAC HVAC Duct Construction Standard.
- .2 In systems, where air velocities exceed 20.3 m/s, install galvanized sheet metal nosing to leading edges of duct liner.

3.4 JOINTS

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative.
- .3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 General Instructions.
 - .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 01 50 General Instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 23 05 00 Common Work Results HVAC
 - .2 23 05 93 TAB for HVAC
 - .3 23 31 13.01 Metal Ducts - Low Pressure to 500 Pa.

Part 2 Products

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified.
 - .3 Concealed fasteners.
- .3 Colour: as indicated.

2.2 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

- .1 Refer to Grilles and Diffuser schedule on drawings.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 Refer to Grilles and Diffuser schedule on drawings.

2.5 DIFFUSERS

- .1 General: flow straightening devices, blank-off quadrants and gaskets as indicated.
- .2 Refer to Grilles and Diffusers schedule on 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 manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Fit frames tightly to prevent leakage and smudging, and to completely cover openings.
- .4 Furnish mounting frames to suit construction finish schedule, with concealed fastenings.
- .5 Install grilles plumb with building lines, in alignment where several grilles occur in line, and centrally in ceiling tiles unless otherwise indicated.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 23 05 00 Common Work Results for HVAC.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - .2 ASTM E331-00 (R2009) – Latest Edition, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtains Walls by Uniform Static Air Pressure Difference
 - .3 ASTM E547-00 (R2009) – Latest Edition, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtains Walls by Cyclic Static Air Pressure Difference
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

PART 2 Products

2.1 FIXED LOUVERS - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Color: As specified by Departmental Representative.
- .3 Material: extruded aluminum alloy 6063 T5.
- .4 Blade: drainable pattern and maximum blade length of 1500 mm.
- .5 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .6 Mullions: at 1500 mm maximum centres.
- .7 Fastenings: stainless steel SAE 194 8F with SAE 194 SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .8 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U frame.
- .9 Finish: anodized.

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 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials, components and installation for heat reclaim devices.
- .2 Related Sections:
 - .1 Section 01 01 50 – General Instructions.
 - .2 All sections of Division 23, 25 and 26

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 84, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section - 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 -Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings to indicate project layout and dimensions; indicate:
 - .1 Equipment, piping, and connections, together with control assemblies, thermostatic controls, auxiliaries and hardware.
 - .2 Control equipment shipped loose, showing final location in assembly.
 - .3 Dimensions, internal and external construction details, recommended method of installation with mounting support details.
 - .4 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.
 - .5 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.
 - .6 Indicate maximum height difference between inside and outside units.
 - .7 Indicate minimum outside air temperature that the units can operate.
 - .8 Indicate equipment performance and ratings.

- .3 Quality assurance submittals: submit following in accordance with Section - 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.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section - Closeout Submittals.
- .5 Certificates:
 - .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
 - .2 Provide confirmation of testing.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section - 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 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section - Construction/Demolition Waste Management and Disposal.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section - Closeout Submittals.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:
 - .1 Bearings and seals.
 - .2 Addresses of suppliers.
 - .3 List of specialized tools necessary for adjusting, repairing or replacing.

Part 2 Products

2.1 GENERAL

- .1 Comply with ASHRAE 84.

2.2 AIR TO AIR FIXED PLATE EXCHANGER

- .1 Casing: 0.8 mm thick galvanized steel.
- .2 Insulation material: Self-extinguishing urethane foam.
- .3 Heat transfer element material: Partition spacing plate special treated paper.
- .4 Motors: totally enclosed capacity permanent split phase induction motor.
- .5 Filters: Non-woven fabrics filters.
- .6 Operating environment: OA temperature shall be 5F (-15C) to 104F (40C), 80% RH or less with general air conditioning room environment.
- .7 Cross contamination: < 1%.
- .8 Ventilation modes: ventilation and / or bypass.
- .9 Removable access panels.
- .10 Accessories: automatic motorized bypass, flange connectors, operational controller c/w defrost cycle.
- .11 Options: coordinate to provide external mounted motorized on/off damper for O/A intake ductwork, and backdraft damper for exhaust ductwork.

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 manufacturers recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.
- .3 Install access doors in accordance with Section - Air Duct Accessories for access to coils, dampers.

3.3 FIELD QUALITY CONTROL

- .1 Tests:
 - .1 Perform tests in accordance with Section - Common Work Results - Electrical.

3.4 CLEANING

- .1 Proceed in accordance with Section - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 Halocarbons

- .1 Comply with all of:
 - .1 Federal Halocarbon Regulations, 2003;
 - .2 *Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems* (the Environment Canada “Refrigeration Code of Practice”) Cat. No.: En14-207/2015E-PDF. April, 2015.
- .2 Work on Halocarbon Systems includes installation, servicing, leak testing, charging and/or decommissioning of a refrigeration system or an air-conditioning system or doing any other work on the system that may result in the release of a halocarbon.
- .3 All work on Halocarbon Systems shall be carried out only by a “Certified Person” as defined by the Federal Halocarbon Regulations 2003.
 - .1 Provide copies of all technicians’ certificates to the Departmental Representative.
- .4 Halocarbons listed under Item 1 through 10 of Schedule 1 of Federal Halocarbon Regulations, 2003 (SOR/2003-289) are not acceptable refrigerants for any new installations.
- .5 Document **all** work on Halocarbon Systems using CSCs halocarbon form “**Information Required for Refrigeration Systems at Federal Correctional Facilities**”. Obtain the latest form from Departmental Representative. Affix the completed form to equipment, and submit a copy of the form to Departmental Representative.
- .6 Comply with the following timelines:
 - .1 Upon delivery of halocarbon-containing equipment to site, submit the following information to Departmental Representative within 24 hours of service;
 - .1 Equipment Location
 - .2 Make
 - .3 Model #
 - .4 Serial #
 - .5 Type of halocarbon
 - .6 Halocarbon charging capacity of system (kg or lbs)
 - .7 Factory Halocarbon Charge (kg or lbs)
 - .8 Cooling capacity (kW, Btuh, or Tons)
 - .2 Leak-test factory-charged halocarbon-containing equipment containing over 10kg of refrigerant in accordance with the Refrigeration Code of Practice within one week of equipment delivery to site.
 - .3 Leak-test field-charged halocarbon-containing equipment in accordance with Section 4.4 of the Refrigeration Code of Practice at the time of field charging of system.
 - .4 For all work on Halocarbon Systems, submit forms to Departmental Representative within 48 hours of work.

- .5 For release of halocarbons >10 kg and <100 kg, submit forms to Departmental Representative within 24 hours of discovery of release.
- .6 For release or potential release of halocarbons > 100 kg, submit forms to Departmental Representative **immediately**.
- .7** Conduct annual leak tests of halocarbon-containing equipment with 19kW (5.4 tons) or greater cooling capacity in accordance with the *Federal Halocarbon Regulations, 2003* until such time as Interim Certificate of Completion is issued.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.
 - .1 23 05 05 Installation of Pipework.
 - .2 23 05 13 Common Motor Requirements for HVAC Equipment.
 - .3 23 08 02 Cleaning and Start-up of Mechanical Piping Systems.
 - .4 23 23 00 Refrigerant Piping.
 - .5 23 73 12 Halocarbon Management

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Air Conditioning and Refrigeration Institute (ARI).
 - .1 ANSI/ARI 210/240-08, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - .2 ARI 270-09, Sound Rating of Outdoor Unitary Equipment.
 - .3 ANSI/UL 1995-2005, Standard for Heating and Cooling Equipment.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B52-05 (R2009), Mechanical Refrigeration Code.
 - .2 CSA C22.1HB-12, Canadian Electrical Code Handbook.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association.
 - .1 NFPA 90A-2012, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Shop Drawings:
 - .1 Submit shop drawings to indicate project layout and dimensions; indicate:
 - .1 Equipment, piping, and connections, together with valves, control assemblies, thermostatic controls, auxiliaries and hardware.
 - .2 Control equipment shipped loose, showing final location in assembly.
 - .3 Dimensions, internal and external construction details, recommended method of installation with mounting support details.
 - .4 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.

- .5 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.
- .6 Type of refrigerant used. Refrigerant shall be R410A ozone friendly.
- .7 Indicate maximum height difference between inside and outside units.
- .8 Indicate minimum outside air temperature that the units can operate.
- .3 Instructions: submit manufacturer's installation instructions.
- .4 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 01 50 – General Instructions include data as follows:

Part 2 Products

2.1 GENERAL

- .1 Indoor Unit (Evaporator) (Fan Coil):
 - .1 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, internal piping, control circuit board and fan motor.
 - .2 The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch.
 - .3 Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory.
 - .4 Capacities: as indicated in mechanical equipment schedules.
 - .5 Include optional: low ambient operation below -12C WB.
- .2 Outdoor Unit (Condensing Unit):
 - .1 The outdoor unit is designed specifically for use with indoor units and is equipped with a circuit board that interfaces to the indoor units.
 - .2 The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit must be run tested at the factory.
 - .3 Capacities: as indicated in mechanical equipment schedules.

2.2 UNIT CABINET (EVAPORATOR)

- .1 Casing shall have a white finish. Multi-directional drain and refrigerant piping providing four (4) directions for refrigerant piping and two (2) directions for draining.
- .2 The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right). A motorized air sweep flow louvre shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution. The indoor unit fan shall consist of three (3) speeds - High, Medium and Low.
- .3 Return air shall be filtered by means of easily removed catechin and enzyme filters.
- .4 The evaporator coil shall be of non-ferrous construction with pre-coated aluminum strake fins on copper tubing. All tube joints shall be brazed with PhosCopper or silver alloy.

The coil shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

- .5 The electrical power of the unit, supplied from the outdoor unit shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

2.3 CONTROLLER (EVAPORATOR)

- .1 Unit shall have a wall mounted wired programmable controller to perform input functions necessary to operate the system.
 - .1 The controller shall consist of a microprocessor programmable controller c/w monthly/daily/hourly scheduling, Power On/Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
 - .2 Temperature changes shall be by 1°C increments with a range of 18°C to 30°C.
 - .3 The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and evaporator coil temperature, receiving and processing commands from the wireless controller, providing emergency operation and controlling the outdoor unit.
 - .4 The control voltage between the indoor unit and the outdoor unit shall be 208 volts AC.
 - .5 The system shall be capable of automatic restart when power is restored after power interruption.
 - .6 Control system shall control the continued operation of the air sweep louvers, as well as provide on/off and system/mode function switching.
 - .7 The controller shall be compatible with the HRV system and be able to provide programmable interface with the HRV's operational and safety control system.
 - .1 Sequence of operation:
 - .1 The split AC unit shall operate based on a pre-determined occupancy schedule.
 - .2 The indoor unit fan shall run continuously during occupied mode. The indoor unit shall heat/cool to maintain the room temperature setpoint.
 - .3 The indoor unit fan shall shutdown during unoccupied mode.
 - .4 The HRV unit shall run continuously to provide both supply ventilation air and exhaust air during occupied mode.
 - .5 The HRV unit shall shutdown and its duct mounted outdoor air intake isolation damper shall shut during unoccupied mode.
 - .6 The HRV integral safety controls shall provide bypass whenever heat reclaim is unfavorable; or when in defrost cycle; or when outdoor air temperature is beyond low limits.

2.4 CONDENSING UNIT (OUTSIDE UNIT)

- .1 The casing shall be zinc-coated steel with acrylic or polyester coating for corrosion protection. The base shall be of Aluminum-Zinc-Magnesium alloy coated steel, or galvanized steel base.
- .2 The unit shall be furnished with a direct drive propeller type fan. The fan motor shall have inherent protection, with permanently lubricated bearings. The fan motor shall be mounted for quiet operation and shall be provided with a raised guard to prevent contact with moving parts. The outdoor unit shall have horizontal discharge airflow.

- .3 The condenser coil shall be of non-ferrous construction with pre-coated aluminum strake fins on copper tubing. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of a linear expansion valve (LEV) metering orifice. The linear expansion valve shall be controlled by a microprocessor controlled step motor.
- .4 The compressor shall have variable compressor speed inverter technology (VCSI). The outdoor unit shall have an accumulator. The compressor shall be equipped with an internal thermal overload. The compressor shall be mounted to avoid the transmission of vibration.
- .5 The electrical power of the unit shall be 208 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. Pulse Amplitude Modulation shall be incorporated into electrical circuit. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 208 volts AC.
- .6 Capacities: as indicated in mechanical equipment schedules.

2.5 PRECHARGED REFRIGERANT PIPING

- .1 Where practical use pre-charged pre-insulated refrigerant piping for hot gas and liquid.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of sub trade previously installed under others sections of contract are acceptable for split air conditioning in accordance with manufacturer's written instructions.
 - 1. Visually Inspect sub trade 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 MANUFACTURERS INSTRUCTIONS

- .1 Comply with manufacturer's written instructions.
- .2 Mount outdoor units on concrete housekeeping pad.
- .3 Provide refrigeration piping and accessories as per manufacturer's recommendations. Refer to 23 73 12 for Halocarbon Management.
- .4 DDC interface is required.

3.3 INSTALLATION

- .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Install outdoor units on concrete housekeeping pad with vibration isolation providing 95% isolation efficiency.
 - .1 Co-ordinate installation with Section 07 62 00 for flashing.

- .3 Secure with hold-down bolts in accordance with manufacturer's recommendations.
- .4 Make piping connections.
- .5 Nothing to obstruct ready access to components or to prevent removal of components for servicing.
- .6 Size anchor bolts to withstand seismic acceleration and velocity louvers as specified in section 23 05 48 – Vibration and Seismic Controls for ductworks, piping and equipment.
- .7 The installation shall be completed in compliance with federal halocarbon regulation, 2003.
- .8 Installation refrigerant piping in accordance with section 23 23 00 – Refrigerant piping.

3.4 DRAIN PANS

- .1 Install so that no water can accumulate. Arrange easy access for cleaning.
- .2 Include internal or external trap for proper draining.

3.5 START-UP AND COMMISSIONING

- .1 Have manufacturer certify installation.
- .2 Submit written start-up and commissioning reports to Departmental Representative.
- .3 **START-UP AND COMMISSIONING**
 - .1 Commissioning: in accordance with section 01 91 00 – Commissioning and section 23 08 00 – Mechanical Commissioning.
- .4 Halocarbon management in accordance with section 23 73 12 – Halocarbon Management.

3.6 CLOSEOUT ACTIVITIES

- .1 Manufacturer to deliver verbal, and written instructions to operating personnel.
- .2 Closeout: Refer to Section 01 01 50 – General Instructions

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 – General Instructions.
 - .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 01 50 General Instruction.

3.8 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.
- .2 Related Sections:
 - .1 Section 01 01 50 – General Instructions.
 - .2 All sections of Division 23
- .3 The existing facility is equipped with a standalone electronic control system. All newly added hardware required for proper operation of existing and new equipment shall be fully compatible with the existing system. Contractor shall carry out an inventory and condition assessment of the existing control system prior to commencement of the contract. Responsibility for any subsequent failures of the existing system being modified by this contractor will rest solely with this contractor for the duration of the contract.
- .4 All new controllers shall be standalone electronic controlled and programmable.
- .5 Provide, install, calibrate, program and commission the control system to achieve the performance specified in the following clauses and to equipment manufacturer's installation and operating and maintenance manuals. Refer to Section - General Instructions for requirements including scheduling and phasing responsibilities by the contractors including sub-contractors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-Z234.1- 89(R1995), Canadian Metric Practice Guide.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .3 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SYSTEM DESCRIPTION

- .1 Refer to existing control system documents.
- .2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
 - .1 Building Controllers.
 - .2 Field control devices.
 - .3 Complete operating and maintenance manuals.
 - .4 Training of personnel.
 - .5 Acceptance tests, technical support during commissioning, full documentation.
 - .6 Wiring interface co-ordination of equipment supplied by others.
 - .7 Miscellaneous work as specified in these sections and as indicated.

- .8 Retain and coordinate with electrical sub-contractor to provide electrical work as covered in Division 26 as an integral part of the Division 25 sub-contract. Refer to Division 26 documents and coordinate scope with Division 26 sub-contractor.
- .9 Line voltage power required for controls from dedicated circuits determined on site by Controls Contractor.
- .10 All cables and wiring shall be in conduit system.
- .11 Balancing work as required to setup the control and HVAC systems to design performance.
- .12 Firestopping for new penetrations through existing fire rated assemblies. Refer to Section – Fire Stopping.
- .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.
 - .3 Location of controllers as reviewed by Departmental Representative prior to installation.
 - .4 Provide utility power to EMCS as required.
- .4 Language Operating Requirements:
 - .1 Provide English operator selectable access codes.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section– General Instructions.
- .2 Quality Control:
 - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
 - .2 Permits and fees: in accordance with general conditions of contract.
 - .3 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative.
 - .4 Existing devices intended for re-use: submit test report.

1.5 QUALITY ASSURANCE

- .1 Have local office nearest to the project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,
- .2 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section - Health and Safety Requirements.

1.6 EXISTING CONDITIONS - CONTROL COMPONENTS

- .1 Utilize existing control wiring and piping as applicable.
- .2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications, unless otherwise noted.

- .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 60 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair approval 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 should approve repair or replacing 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 being repaired or replaced.
 - .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.

1.7 IDENTIFICATION, CALIBRATION AND PROGRAMMING

- .1 Provide a written sequence of operation for each piece of equipment or system being controlled.
- .2 Program each controller immediately following installation. Setup and tune all control loops during the initial start-up of the systems.
- .3 At the time of the Owner's Demonstration and Instruction Period:
 - .1 Demonstrate and confirm that all systems are programmed and operating correctly.
- .4 Check sensor calibration and control system operation twice during the first year of operation including the first heating season and prior to the first cooling season. Include all parts and labour in service. Following each visit submit:
 - .1 A report indicating all work performed.
- .5 Provide one day of on-site instruction to the Owner's operating personnel during the first year of operation, scheduled as requested by the Owner.

Part 2 Products

2.1 EQUIPMENT

- .1 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.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation: to manufacturer's recommendations.

3.2 I/O WIRING

- .1 All input/output device wiring will use #18-2 solid core cable with individually jacked conductors and jacketed sheath over the pair.
- .2 Use plenum rated cable where required.
- .3 All I/O wiring passing near or within the enclosure of a VFD will be shielded, with the shield terminated at the device end.
- .4 All I/O wiring will be identified using Panduit adhesive wire-marker at the controller and end device ends. Description of point to include point mnemonic, point type and network location.
- .5 All I/O wiring within controller enclosure shall be neat and tidy and suitably bundled and strapped or contained in plastic wire duct or equivalent.
- .6 All wiring shall be in conduit system.

3.3 POWER WIRING

- .1 Where required, provide power wiring and transformers and grounding to each controller and transducer as per the manufacturer's specification.
- .2 Each building controller will have its own dedicated power supply. No other controller or input/output device will be powered from this supply.
- .3 Power wiring as per manufacturer's specification.
- .4 All wiring shall be in conduit system.

3.4 ENCLOSURE AND CONDUIT

- .1 Relays, transformers, and I/O devices and peripherals shall be installed in separate enclosures and not in the enclosures containing the controllers.
- .2 All wires shall be in conduit system.
- .3 Provide tamperproof screws to new and relocated equipment, controls enclosures and devices which are located in inmate accessible areas. Tamperproof screws shall be stainless TORX with pin.

- .4 Wiring is to be in EMT conduit with set screw metal fittings in all wall spaces and exposed locations as well as in pipe chases, service spaces, attics, and crawl spaces which are entered for service access.
- .5 All conduits shall be piped smoothly and neatly following building lines.
- .6 Exposed conduits located in areas where inmates have access shall comply with the following security measures:
 - .1 Use two-hole straps.
 - .2 Install straps within 100mm of device boxes.
 - .3 Install straps within 100mm of both sides of fittings.
 - .4 Install straps at a maximum spacing of 500mm.
 - .5 All fittings steel.
 - .6 Keep conduit close to the wall and avoid spaces behind the conduit
 - .7 Route conduit along top of walls where possible.
- .7 Liquid-tight flexible conduit to be used for roof mounted equipment wiring c/w liquid-tight fittings. Provide spun aluminum roof jack where control wiring penetrates roof unless penetration is within waterproof roof equipment curb.
- .8 All junction boxes will have covers properly and firmly affixed after installation completion.
- .9 Control panels located in occupied areas for relays or other similar field devices shall be accessible and located above corridor ceilings. For areas accessible by inmates, provide security type access panels.

3.5 CONTROL SYSTEM COMMISSIONING

- .1 Upon completion of the installation of the controls system and the calibration of all sensors, this Subcontractor shall carry out all required testing, debugging, and revision of operations to suit the intent of the Sequence of Operation and to the review of the Departmental Representative.

3.6 PAINTING

- .1 Painting: in accordance with Division 9 - Painting, supplemented and as follows:
 - .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
 - .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
 - .3 Clean and prime exposed hangers, racks, fastenings, and other support components.
 - .4 Paint unfinished equipment installed indoors.

3.7 CLEANING

- .1 Proceed in accordance with Section - General Instructions.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.1 GENERAL

- .1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenders/Bidders). This Section covers items common to Sections of Division 26, 27 and 28. This section supplements requirements of Division 01.
- .2 Reference to “Electrical Division” shall mean all related Electrical Sections and components including Division 26, 27 and 28.
- .3 The word “Provide” shall mean “Supply & Install” the product and services specified. “As Indicated” means that the item(s) specified are shown on the drawings.
- .4 Provide materials, equipment and devices of specified design, performance, intent and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedule, ensure timely performance, ensure co-ordination and establish orderly completion and the delivery of a fully commissioned installation.
- .5 The most stringent requirements of this section, other electrical sections and drawings shall govern.
- .6 All work shall be in accordance with the Contract Drawings and Specifications and their intents, complete with all necessary components, including those not normally shown or specified but required for a complete installation.

1.2 CODES AND STANDARDS

- .1 Do complete installation in accordance with Canadian Electrical Code, CSA C22.1-2018.
- .2 Comply with CSA Certification Standards and Electrical Bulletins in force at time of tender at time of tender submission.
- .3 Perform work in accordance with CSA Z462 - Workplace Electrical Safety and Worksafe BC.

1.3 DEFINITIONS

- .1 Electrical and Electronic terms: unless otherwise specified or indicated, terms used in these specifications and on drawings are those defined by IEEE SP1122.

1.4 PERMITS, FEES

- .1 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Obtain and pay for an electrical permit to cover all electrical, and Telecommunications work.
- .4 Submit a copy of electrical permit to the Departmental Representative prior to commencement of work on site.
- .5 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department at no cost.
- .6 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
- .7 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative.

1.5 SUMMARY OF ELECTRICAL WORK

Boundaries of work are shown on the architectural drawing A01, A02 and electrical Drawing E01.

Work under this contract includes but is not limited to;

- .1 Remove and relocate existing portable electrical and electronic equipment from existing Canteen to new Canteen (room#213C in Building M) as indicated on the plans and specifications.
- .2 Provide new power and data outlets c/w conduits, raceways and wiring in the spaces as indicated on drawings. Remove and relocate existing outlets and switches to suit the new layout.
- .3 Provide new LED lighting fixtures suspended from the ceiling and wall packs as indicated on the drawings c/w seismic supports.
- .4 Dispose of the existing and unused material removed from site, unless indicated otherwise.
- .5 Provide Cat.6 data cables for connection of Point of Sale (POS) units to the Institution's IT system as indicated. In coordination with IT department, terminate on the existing patch panel of the local IT cabinet. Departmental representative shall do final cross connections. Provide patch cords as required.

- .6 Provide Intercom wiring (use Aiphone special wiring suitable for the Aiphone intercom devices) c/w conduits and outlet boxes as required between the base and door stations. Departmental representative shall supply the intercom units and this contractor shall install, test and commission the intercom system.
- .7 Provide two new CCTV cameras with licenses and conduits, wiring and brackets as required. Install cameras as indicated, re-program, test and commission the system in accordance with relevant spec section 28 23 00.
- .8 Provide new PA speaker in the Canteen c/w volume control, conduits and wiring to connect to the existing PA system. Match existing speakers and volume control.
- .9 Upon completion of installation, perform test and commissioning and demonstrate the operation of the systems and equipment and provide training (minimum of 4 hours).

1.6 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples in accordance with Section 01 01 50 – General Instructions.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

1.7 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.
- .2 Additional maintenance material requirements are included under various other Sections.

1.8 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manual specified in Section 01 01 50 – General Instructions.
- .2 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion

- or feature of installation.
- .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
- .3 Wiring and schematic diagrams and performance curves.
- .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .5 Copy of reviewed shop drawings.

1.9 CARE, OPERATION AND START-UP

- .1 Instruct departmental representative and operating personnel in the operation, care and maintenance of equipment.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.10 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235-83 (R1996).
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.11 MATERIALS AND EQUIPMENT

- .1 Equipment and material to be new and CSA certified, and manufactured to standard quoted.
- .2 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Inspection Department.

1.12 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Lamicoïd 3 mm thick plastic engraving sheet, white face and black core, self adhesive unless specified otherwise.

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 Wording on nameplates and labels to be approved by departmental representative prior to manufacture.
- .3 Allow for average of twenty-five (25) letters per nameplate.
- .4 Identification to be English.
- .5 Nameplates for junction boxes to indicate system and/or voltage characteristics.
- .6 Nameplates for pull boxes to indicate system and type of cable.

1.13 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding for 347/600 V, and 120/208V wiring throughout.

1.14 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.15 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible after equipment is installed.

1.16 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Use decal signs, minimum 175 x 250 mm size.

1.17 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1 200 mm.
 - .2 Wall receptacles: 400 mm.
 - .3 Telephone outlets: 400 mm.

1.18 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.

1.19 CONDUIT AND CABLE INSTALLATION

- .1 Refer to drawings for type of conduit and cable to be used.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Run parallel or perpendicular to building lines.

1.20 CUTTING, CORING AND PATCHING

- .1 Make arrangements with General Contractor for all cutting, coring and patching in this work.
- .2 Conduct ground penetrating radar (GPR) scans prior to coring or cutting existing concrete slabs or walls.
- .3 Fill up all new conduit penetrations with approved compound.

1.21 FIRESTOPPING

- .1 Where cables or conduits pass through fire rated ceilings and fire rated walls, pack space full with a ULC approved firestopping system.

1.22 FIELD QUALITY CONTROL

- .1 Conduct and pay for testing, commissioning, demonstration and training of the following:
 - .1 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Check resistance to ground before energizing.

- .2 Circuits originating from branch distribution panels.
- .3 Lighting and associated controls.

- .2 Refer to each Section for additional testing requirements.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of contract.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that each system is taken out of service the shortest possible amount of time.
- .5 Submit test results to Departmental Representative for review.

1.23 POWER INTERRUPTIONS

- .1 Contractor shall work closely with Departmental Representative to arrange all interruptions of any portion of the existing electrical distribution systems.
- .2 All interruptions to existing electrical distribution systems and shutdown of existing Panel boards in the contract shall be carried out outside normal working hours, or on weekends. Normal working hours of the Institution are considered to be 0730 to 1600 hours, Monday through Friday, except holidays.
- .3 Contractor shall submit request for any power shutdown 7 working days prior to such power shutdown. Request shall indicate start time of interruption and duration of interruption. Indicate in request exactly what buildings and/or systems will be affected by the requested power shutdown.
- .4 No interruptions to power shall be carried out without the approval of the Departmental Representative.

1.24 CLEANING

- .1 Do final cleaning in accordance with Section 01 01 50 – General Instructions.

1.25 RECORD DRAWINGS

- .1 Refer to Section 01 01 50 – General Instructions.
- .2 Indicate conduit and cable runs, junction boxes and circuit numbers.

1.26 ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT

- .1 Refer to Section 01 01 50 – General Instructions.

END OF SECTION

1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Refer to Section 01 01 50 – General Instructions.

1.3 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger, minimum size 12 AWG.
- .2 Copper conductors with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Fastenings and Fittings.
- .2 Provide a green insulated bond conductor in all conduits sized in accordance with CSA C22.1-2012, Canadian Electrical Code, Part 1.

END OF SECTION

oi1 **General**

1.1 RELATED WORK

- .1 This Section covers items common to Sections of Division 26, 27 and 28. This Section supplements requirements of Division 01.

1.2 REGULATORY REQUIREMENTS

- .1 Restraints shall meet the requirements of the National Building Code, B.C. Building Code and the City of Abbotsford Building Code.
- .2 All electrical and communications equipment that is new or being relocated is to be seismically restrained.

1.3 SEISMIC RESTRAINT DESIGN AND INSPECTION

- .1 Arrange and pay for the services of a professional engineer registered in the province of B.C. “Seismic Engineer” shall provide all required engineering services related to seismic restraints of the electrical and communications equipment.
- .2 The Seismic Engineer shall provide assistance to the contractor during the course of the equipment install if necessary.
- .3 The Seismic Engineer shall inspect the completed seismic installation and shall submit a letter to the departmental representative stating that the complete seismic installation is installed in accordance with the seismic engineers drawings and it complies with all regulatory requirements.

1.4 SUBMITTALS

- .1 Submit shop drawings of all restraining devices, including details of attachments to the structure, either tested in an independent testing laboratory or approved by a B.C. registered professional Engineer.

1.5 SCOPE OF WORK

- .1 Provide restraint for electrical equipment, including lighting fixtures, communication and security cabinets, etc., to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake.
- .2 Provide all seismic restraint related hardware, including bolts and anchors, from point of attachment to equipment through to and including attachment to structure.
- .3 It is the entire responsibility of equipment manufactures to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

2 Products

2.1 GENERAL

- .1 Provide anchor bolts, straps and other mounting materials as specified by Seismic Engineer.

3 Execution

3.1 INSTALLATION

- .1 Carry out all seismic restraint works on electrical equipment as per the recommendations of the Seismic Engineer and in accordance with all regulatory requirements.
- .2 Co-ordinate the work with other trades as required.

END OF SECTION

1 General

1.1 REFERENCES

- .1 CSA C22.1-2018 Canadian Electrical Code, Part 1.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Refer to Section 01 01 50 – General Instructions.

1.4 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 Products

2.1 EQUIPMENT (GENERAL)

- .1 Clamps for grounding of conductor, size as required.
- .2 System and circuit, equipment, grounding conductors, bare stranded copper, untinned, soft annealed, size as indicated.
- .3 Insulated grounding conductors: green, type RW90.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous, communications, equipment, grounding systems including, conductors, connectors, accessories, as indicated, to conform to requirements of departmental representative, and local authority having jurisdiction over installation.

- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Provide a green insulated bond conductor in all conduits and ducts.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary 120/208V system.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to transformers, panels, telephone protection blocks, and communication cabinet.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of departmental representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing equipment.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 26 05 00 - Common Work Results - Electrical

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Refer to Section 01 01 50 – General Instructions.

1.4 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
- .3 Minimum size: 104 mm square.

2.2 TELEPHONE CABINETS

- .1 16 Gauge sheet steel, painted grey.
- .2 Dimensions as indicated.
- .3 Front Door; Continuous piano hinge, pad-lockable haspe.
- .4 19 mm Plywood mounting backboard inside painted grey.

3 Execution

3.1 JUNCTION AND PULL BOX INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.

- .2 All junction and pull boxes are not indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Ground pull boxes as indicated.

3.2 TELEPHONE CABINET INSTALLATION

- .1 Install telephone cabinet as indicated.
- .2 Install all equipment as indicated within cabinet.
- .3 Ground cabinet to communications ground bar using #6 insulated ground wire in EMT conduit.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Install size 2 identification lamicoids indicating system name on pull boxes and junction boxes.
- .3 Install size 6 identification lamicoid on Telephone Cabinet.

END OF SECTION

- 1 General**
- 1.1 REFERENCES**
 - .1 CSA C22.1-2018 Canadian Electrical Code, Part 1.
- 1.2 SHOP DRAWINGS AND PRODUCT DATA**
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
- 1.3 WASTE MANAGEMENT AND DISPOSAL**
 - .1 Refer to Section 01 01 50 – General Instructions.
- 1.4 ENVIRONMENTAL PROTECTION**
 - .1 Refer to Section 01 01 50 – General Instructions.
- 2 Products**
- 2.1 RECESSED OUTLET AND CONDUIT BOXES GENERAL**
 - .1 Size boxes in accordance with CSA C22.1.
 - .2 102 mm square or larger outlet boxes as required for special devices.
 - .3 102 mm square outlet boxes for lighting fixture outlets.
 - .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.
 - .5 Gang boxes where wiring devices are grouped.
 - .6 Blank cover plates for boxes without wiring devices.
- 2.2 SURFACE CONDUIT AND DEVICE BOXES**
 - .1 Cast aluminum, one or two gang FS or FD boxes with factory threaded hubs and mounting feet for all boxes mounted on finished wall or ceiling surfaces.
- 2.3 FITTINGS - GENERAL**
 - .1 Bushing and connectors with nylon insulated throats.
 - .2 Knock-out fillers to prevent entry of debris.

- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

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 and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

1 General**1.1 LOCATION OF CONDUIT**

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

1.2 CONDUIT SIZES

- .1 Note that conduit sizes referenced in the 2018, Canadian Electrical Code are used.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Refer to Section 01 01 50 - Waste Management.

1.4 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 Products**2.1 CONDUITS / RACEWAYS**

- .1 Underground ducts: rigid type DB2, size as indicated.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid steel conduit: to CSA C22.2 No. 45, galvanized steel, threaded.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, steel.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Channel type supports for two or more conduits at 1.5 m on centre.
- .3 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 EMT couplings and connectors shall be malleable steel, set screw type. Connectors shall have insulated throats. Cast fittings are not acceptable.

2.4 FISH CORD

- .1 Polypropylene.

3 Execution

3.1 INSTALLATION

- .1 Install concrete encased DB2 ducts for electrical and communications systems as indicated and in accordance with CAN/CSA A23.1.
- .2 All wiring to be in Electrical metallic tubing (EMT) type conduit unless otherwise indicated on drawings.
- .3 Install wiring in threaded Rigid Steel Conduit where indicated on drawings.
- .4 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .5 Conceal conduits above T-Bar Ceiling.
- .6 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 21 mm diameter.
- .9 Dry conduits out before installing wire.
- .10 Install fish cord in empty conduits.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on surface channels.
- .3 Do not pass conduits through structural members except as indicated.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.

END OF SECTION

1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Refer to Section 01 01 50 - Waste Management.

1.3 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 Products

2.1 SWITCHES

- .1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2, No.55 and CSA – C22.2, No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea molded housing.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
- .3 Toggle operated fully rated for fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2 LED DIMMER SWITCHES

- .1 Rating : 1200 VA, 120 V AC, single pole. CSA approved.
- .2 Operating Range: 0-10 V
- .3 Designed for dimmable LED driver/lamps.
- .4 Dimmer to be compatible and as recommended by manufacturer of Type `A` luminaire supplied and installed.
- .5 Manually operated with the following features:
 - .1 Slide control dimmer, and ON/OFF Switch.
 - .2 Building radio/TV interference filter.
 - .3 White color.

2.3 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15R and 5-20R, 125 V, 15 A, U ground, with following features:
 - .1 Urea molded 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 riveted grounding contacts.
 - .6 White color.
- .2 Other receptacles with ampacity and voltage as indicated.

2.3 COVER PLATES

- .1 Stainless steel cover plates for wiring devices.
- .2 Sheet steel coverplates with turned over edges for surface mounted boxes.

3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single pole 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 Cover Plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

-
- 1 General**
 - 1.1 RELATED WORK**
 - .1 Section 26 05 00 - Common Work Results – Electrical.
 - 1.2 SHOP DRAWINGS AND PRODUCT DATA**
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
 - 1.3 WASTE MANAGEMENT AND DISPOSAL**
 - .1 Refer to Section 01 01 50 – General Instructions.
 - 1.4 ENVIRONMENTAL PROTECTION**
 - .1 Refer to Section 01 01 50 – General Instructions.
 - 2 Products**
 - 2.1 BREAKERS GENERAL**
 - .1 Bolt-on moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
 - .2 Common-trip breakers with single handle for multi-pole applications.
 - .3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting.
 - .4 Circuit breaker interrupting capacity: 25 kA (symmetrical), or as indicated.
 - .5 All new circuit breakers to match the existing panel boards.
 - 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.
 - 3 Execution**
 - 3.1 INSTALLATION**
 - .1 Install circuit breakers as indicated.

.2 Provide lamicaid nameplates as indicated.

END OF SECTION

1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
- .2 Submit complete IES files and heat dissipation data prepared by recognized independent testing laboratory.
- .3 IES files to include VCP table and spacing criterion.
- .4 Details of luminaires listed in specifications, may include features considered exclusive to one manufacturer. It is not the intent of this specification to limit the submission of luminaires to one manufacturer and other manufacturers may submit bids on equal equipment.
- .5 All luminaires shall be delivered to the site completely assembled and in original cartons. Ensure the availability of a dry and protected storage space before delivery of fixtures.
- .6 Luminaires of the same or similar type shall be supplied by the same manufacturer.

1.2 SAMPLE LUMINAIRES

- .1 Submit sample luminaires (one sample for each luminaire type) for review during shop drawing stage when requested by the Departmental Representative.
- .2 Deliver samples to the Departmental Representative's office or to another location as directed. Collect the sample(s) at the conclusion of the review.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) – CAN/CSA – C22.2 No. 250.13-17 – Light Emitting Diode (LED) equipment for lighting applications.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 01 50.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance

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LUMINAIRES

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with Waste Management Plan.

- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Remove all debris and unused material from site.

1.3 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 PRODUCTS

2.1 GENERAL

- .1 Provide luminaires new and complete with all mounting accessories, junction boxes, back plates to cover exposed areas, trims, frames and lamps.
- .2 Refer to electrical drawings for existing luminaires and typical mounting details. Verify/confirm existing site conditions and mounting details of fixtures before ordering materials.
- .4 All luminaires, accessories and components shall be CSA approved.

2.2 LUMINAIRES

.1 Type 'A' LUMINAIRE

- .1 General Description:
 - .1 Suspended from ceiling c/w Light Emitting Diode (LED) lamps.
 - .2 Lumen Output: 4000 L.
 - .3 Color Temperature: 4000 K. CRI > 80.
 - .4 Mounting: Surface – Ceiling – suspended – row mount.
 - .5 Life expectancy: 50,000 hours at 25 Deg. C., L70. .
 - .6 Ambient Temperature: 0 to +40 Deg.C.
 - .7 Hardware: Polycarbonate lens.
 - .8 Paint colour: White
 - .9 Warranty: 5 Years
- .2 LED Driver:
 - .1 Electronic: 90% min power factor, max 20% THD
 - .2 Input Wattage: Equal or Less than 30W.
 - .3 Voltage: 120V.

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LUMINAIRES

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- .4 Life Expectancy: 50,000 hours at 25 Deg. C.
- .5 Warranty: 5 Years

- .3 Acceptable Product (or approved equal): PACO Lighting – PUCS-R-90-LED-120-40-MV-PC-AC-DIM c/w all accessories and aircraft cables.

- .4 Use one 90” long fixture in lieu of two 45” long fixtures shown on the Plans where practical and applicable.

.2 Type ‘B’ LUMINAIRE

- .1 General Description:
 - .1 Wall pack (full cut-off) with Light Emitting Diode (LED) lamp.
 - .2 Lumen Output: 4400 L.
 - .3 Color Temperature: 4000 K. CRI > 80.
 - .4 Life expectancy: 50,000 hours at 25 Deg. C., L70. .
 - .5 Ambient Temperature: -30 to +40 Deg.C.
 - .6 Lens: Impact resistant polycarbonate lens.
 - .7 Housing: Marine-grade die-cast aluminum driver housing
 - .8 Surge protection: to ANSI C62.41 (10KV/5KA)
 - .9 Optics: Type IV distribution
 - .10 Paint colour: Gray
 - .11 Hardware: Tamper proof
 - .12 Warranty: 5 Years

- .2 LED Driver:
 - .1 Electronic: 90% min power factor, max 20% THD
 - .2 Input Wattage: Equal or Less than 40W.
 - .3 Voltage: 120V.
 - .4 Life Expectancy: 50,000 hours at 25 Deg. C.
 - .5 Warranty: 5 Years.

- .3 Acceptable Product (or approved equal): Kenall Lighting – FN15-4-7-DB-36L-40K8-DV-9500 c/w all accessories.

3 EXECUTION

3.1 INSTALLATION

- .1 Install new luminaires suspended from the ceiling in the space with LED lamps.

- .2 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

- .3 Protect all luminaires from construction dust and debris.

- .4 Clean all lighting reflectors, lenses and other lighting surfaces at time of final cleaning.
- .5 Provide appropriate seismic restraint for all fixtures.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 26 05 00 – Common Work Results – Electrical.
- .2 Section 26 05 28 – Grounding Secondary.
- .3 Section 26 05 31 – Junction and Pull Boxes.
- .4 Section 26 05 32 – Outlet Boxes and Conduit Boxes.
- .5 Section 26 05 34 – Conduits, Fastenings and Fittings.

1.2 STANDARDS AND CODES

- .1 Comply with latest issues and all addendums of the following standards:
 - .1 ANSI / TIA, 568-D series standards – Commercial Building Telecommunications Standards.
 - .2 TIA – 607 - D – Commercial Building Ground and Bonding Requirements for Telecommunications.
 - .3 NECA/BICSI 568- 2006 – Standard for Installing Commercial Building Telecommunications Cabling.
 - .4 Canadian Electrical Code including all BC amendments and bulletins.
 - .5 National Building Code.

1.3 CONTRACTOR QUALIFICATIONS

- .1 The cabling contractor shall be a certified systems vendor of Category 6 components, and/or cabling, and use only technicians fully trained and qualified on installation and testing of the components installed.
- .2 All staff performing any type of work contained in this Section shall be certified in the installation, termination and testing of all aspects of Category 6 UTP cabling and components.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Refer to Section 01 01 50 – General Instructions.

1.6 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 01 50 – General Instructions.

2 Products

2.1 CATEGORY 6 UTP HORIZONTAL CABLE

- .1 Four (4) pair, unshielded, twisted, solid copper core, 100 ohm, 23 AWG, Category 6, FT4 rated.
- .2 Category 6 cable for both data and voice horizontal cabling. White color for voice cables and blue for data cables. Use Cat. 6 green cable for all security system cable runs unless otherwise indicated. Confirm color of the security cables with Department Representative.
- .3 Transmission requirements shall conform to or exceed all applicable sections of the TIA/EIA 568-C current specifications and addendums for Category 6 cable and components.
- .4 Electromagnetic radiation: cables shall comply with Class A limits of FCC Part 15, Subpart J for computing devices.
- .5 Nearby sources of radio and electrical interference such as radio transmitters, HVAC, arc welders, motors, intercom or radar installations shall be evaluated for any possible effects.

2.2 CATEGORY 6 PATCH CORDS

- .1 Modular Patch Cords:
 - .1 Mechanical: All UTP Patch Cords shall be fabricated with stranded conductors.
 - .2 Transmission: All UTP Patch cords shall meet the same transmission performance requirements as stated for Category 6 Horizontal UTP.
 - .3 Wired “straight through”.
- .2 4-pair, 23 AWG, 8P/8W, T569A (ISDN) wired, RJ45 plug at each end.
- .3 Provide the following required lengths and quantities:
 - .1 3.0 metres – 10 total
 - .2 1.0 metre – 10 total.

2.3 IDC CONNECTORS

- .1 Rail mounted, Insulation Displacement Type (IDC) termination connector strips.
- .2 Category 6 for all horizontal cabling to set run, wall outlets.
- .3 6 x 4-pair connection strips for all horizontal cables.
- .4 Connection strips to suit existing mounting rails in existing CER Room.

2.4 DATA PATCH PANELS

- .1 Existing “AMP” NORDX patch panel suitable for individual snap-type modular jacks.

2.5 MODULAR VOICE AND DATA JACKS

- .1 For installation on face plates.
- .2 Non-keyed, 4 pair, 8P/8W modular jacks, Category 6, T568A (ISDN) wiring.
- .3 Snap-in type connectors.
- .4 Color code for jacks:
 - .1 Voice – Black.
 - .2 Data – White
- .5 Arrange voice and data jacks in identical sequence at every outlet, with data jacks on top and voice on the bottom.

2.6 CATEGORY 6 UTP CONNECTORS

- .1 Applies to both voice and data terminations.
- .2 All UTP connectors at each horizontal cable run shall meet the following specifications:
 - .1 Voice horizontal cable runs shall use 8P/8W female RJ45 components at the faceplate end and direct IDC termination in the Telephone Cabinet.
 - .2 Data horizontal cable runs shall use 8P/8W female RJ45 components at both ends.
- .3 Cables shall be wired straight through, no crossover is allowed. Pin 1 at one end is connected to Pin 1 at the other end of the cables.
- .4 Components:
 - .1 Configured to support 8 position EIA/TIA, ISDN cabling, 1000Base T and Token Ring standards.
 - .2 Meet or exceed technical criteria outlines in TIA/EIA-568, “Transmission Performance Specifications for 4-Pair, 100 ohm, Category 6 Cabling”.
 - .3 Insulation Displacement Type (IDC), modular, non-keyed.
- .5 Connectors at outlet end; install in coverplate.

2.7 HORIZONTAL CABLE LABELS

- .1 Label all new voice and data cables.
- .2 Bold face laser quality printed labels, black print on white background.

- .3 Self adhesive, one piece label and clear cover wrapped around cable.
- .4 Wording on labels to be approved by Departmental Representative prior to manufacture.

2.8 INDOOR MULTI-PAIR TELEPHONE CABLE

- .1 Pairs as indicated, twisted, solid copper core, 100 ohm, 24 AWG, Category 3, FT4 rated.
- .2 Transmission requirements shall conform to or exceed all applicable section of the TIA/EIA 568 current specifications and addendums.

3 Execution

3.1 CATEGORY 6 UTP HORIZONTAL CABLE INSTALLATION

- .1 Install each cable in one continuous run from the IDC Connector to the jack on the faceplate. Breaks or spliced not allowed.
- .2 No single cable run shall exceed 90 metres in length, measure from the terminations on the Connector to each RJ45 faceplate jack. Ensure the distance is not exceeded before installing the cabling system.
- .3 Locate all cables:
 - .1 At least 130 mm from power lines carrying 2 kVA or less.
 - .2 At least 300 mm from power lines carrying 2 kVA to 5 kVA.
 - .3 At least 600 mm from power lines carrying more than 5 kVA.
 - .4 At least 300 mm from fluorescent fixtures.
- .4 Ensure that all clearances between the installed cables and any type of electrical equipment, lines, and lighting are met and/or exceeded such that EMI is well within acceptable industry specifications.
- .5 Should the Contractor encounter cable runs that cannot be installed to meet required clearance specifications, then the Contractor shall install fully satisfactory shielding.
- .6 Cable terminations:
 - .1 Terminate data cables with 8P/8W female RJ45 components at both ends.
 - .2 Terminate voice cables with 8P/8W female RJ45 components at faceplate end, direct IDC termination in the Telephone Cabinet.
- .7 Install all UTP cables according to the standards for a Category 6 installation in CSA-T529.
- .8 Cable bends shall not be less than the minimum radius specified by the manufacturer for the particular cable in use and shall be made without strain or stress to the cable.

- .9 All cables shall be installed in conduit raceway system unless otherwise indicated on contract drawings.
- .10 All cables shall be clearly labeled at both ends.
- .11 Use no more than 25 lbs of force to install the voice and data cabling in raceways.

3.2 CABLE SLACK FOR TERMINATED CABLES

- .1 For each cable run terminated, there shall be a minimum cable slack of 3 metres at the originating end (i.e. Patch Panel), and 300 mm at the outlet location.
- .2 Place cable slack in the LAN Cabinet or as deemed appropriate by the Departmental Representative, on condition that storage slack is neat.

3.3 UTP CABLE TERMINATIONS

- .1 All terminations to the UTP cable shall be properly connected using industry-standard Insulation Displacement Connection conventions and procedures to 8P/8W, T568A connector and in full compliance with the manufacturer's installation specifications and instructions.
- .2 Maintain the cable twist up to the connection point at both ends of the cables. Remove a maximum of 12 mm of the cable jacket measured from the connection point.
- .3 Terminate all four horizontal cable pairs at the RJ45 jack and patch panel.
- .4 Label each voice and data jack and voice connector strip as indicated using bold face laser quality labels. Label voice and data jacks as indicated.

3.4 UTP CABLE LABEL INSTALLATION

- .1 Install label on each end of cable.
- .2 Install label not less than 150 mm from termination end of cable.
- .3 All labels to be clearly visible and readable after final termination of cables without having to move or rotate cables.

3.5 CATEGORY 6 UTP CABLE TESTING

- .1 Testing, General:
 - .1 Perform a basic link test to verify and ensure full functional capabilities.
 - .2 Test each cable on a pair-to-pair basis ensuring continuity and eliminating the possibilities of shorts or reversals.
 - .3 Use testing equipment based on TDR (Time Domain Reflectometry) technology.

- .4 Test each cable to ensure compliance with transmission requirements outlined in the specification.
- .5 Test all cables.
- .2 Test all cables with a Level II-E tester for conformance with basic link performance as described in EIA/TIA-568 standards.
- .3 The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.
- .4 The test results records saved by the tester shall be transferred to a windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e. "As saved in the tester" at the end of each test and that these results cannot be modified at a later time.
- .5 Documentation of tests shall be given in report form and will, at a minimum, contain the following data:

OPERATOR:
LOCATION:

DATE:
CABLE TYPE:

CABLE #

TESTER, MAKE AND MODEL

TEST RESULTS (PAIRS):
 PINS 1,2 / PINS 3,6 / PINS 4,5 / PINS 7,8
 LENGTH:
 ATTENUATION:
 IMPEDENCE:
 WIRE MAP:
 NEXT (PAIR-TO-PAIR):
 PSNEXT:
 RETURN LOSS:
 ELFEXT (PAIR-TO-PAIR):
 PSELFEXT:
 PROPAGATION DELAY:
 DELAY SKEW:

- .6 No marginal passes or conditional passes will be accepted.
- .7 Provide paper copy of all test results for incorporation into Maintenance Manuals specified in Section 01 01 50 – General Instructions.

3.6 CATEGORY 6 UTP CABLE DOCUMENTATION AND CERTIFICATION

- .1 Provide record drawings upon completion:

-
- .1 Indicate all changes.
 - .2 Indicate cable Ids adjacent to outlets.
 - .3 Indicate conduit runs, pull boxes and conduit sizes on record drawings.
-
- .2 Provide a certificate document issued by the cable/component manufacturer, guaranteeing transmission capabilities of the cabling system to support 1000 Mbps applications for a period of 25 years.
 - .3 Installation technicians shall be certified through the manufacturer's certification program. Technicians shall provide evidence of their training certification, or Contractor shall supply documentation verifying their current participation in the manufacturer's certification program.
 - .4 Manufacturer's certification:
 - .1 The manufacturer's certification shall guarantee that design and installation on the part of the certified Contractor will not negate or void any portion of the certified system.
 - .2 In the event that the Contractor is no longer in business, the full certification remains valid and will be covered by the manufacturer.
 - .5 The installed structured cabling system shall be covered by a warranty which includes, as a minimum:
 - .1 25 Year Coverage.
 - .2 Warranty against defects in material and workmanship from the date of the interim acceptance of installation.
 - .3 Repair or replacement of a failed component, covering parts and labour, at no charge to the Owner.
 - .4 Single point of contact for all warranty service.
 - .6 Upon request at no additional cost, provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.
 - .7 Provide paper copy of all test results for incorporation into Maintenance Manuals specified in Section 01 01 50 – General Instructions.
 - .8 Provide electronic copy of all test results on CD/DVD format.

END OF SECTION

1 General

1.1 EXISTING IP CCTV SYSTEM

- .1 The existing IP CCTV System consists of the following:
 - .1 “Genetec” Version 4.8 operating System.
 - .2 Virtual server/storage; “Pivot3 vSTAC” storage appliances located in CER.
 - .3 Various Network User Stations (NVUS) located throughout Institution.
 - .4 “Planet Layer 3” Network Switches.
 - .5 “Planet” POE Injectors.

1.2 SCOPE OF WORK

- .1 Work under this contract includes but is not limited to:
 - .1 Provide 2 new IP CCTV Cameras as indicated on the drawings and specifications.
 - .2 Provide Category 6, UTP Cables from existing patch panel(s) in the building(s) to new IP CCTV Cameras as indicated.
 - .3 Provide all on-site programming of the existing “Genetec” operating system to incorporate the new IP CCTV cameras onto the existing NVR’s and NVU’s as directed by Departmental Representative.
 - .4 Provide all testing, aiming and adjustments to the new IP CCTV Cameras.
 - .5 Provide new “Genetec” camera licence (Om-E-1C) and failover licence (Om-E-FO) for new CCTV Cameras.
 - .6 Submit all camera test reports, Maintenance Handover Report.
 - .7 Provide test reports for all new Category 6, UTP Cabling.
 - .8 Provide new Category 6, UTP Patch Cables at Camera location, POE Injector, and Network Switch as indicated.
 - .9

1.3 CONTRACTOR QUALIFICATIONS

- .1 The contractor and all personnel performing any work related to this Section shall have successfully completed all training and received certification from “Genetec”.
- .2 The contractor and all personnel performing any work related to this Section shall have successfully completed all training and received certification for “Pivot3, Vstac” Network Video Recorder equipment.
- .3 Upon request by Departmental Representative, provide certified documentation of qualifications described above. Failure to meet or provide such documentation will be the basis for rejection of sub-contractor proposed for work under this section.

1.4 STANDARDS AND CODES

- .1 TIA/EIA, 568-D series standards – Commercial Building Telecommunications Standards.
- .2 NECA/BICSI 568-2006 – Standards for Installing Commercial Building Telecommunications Cabling.

.3 IEC EN 60950-1; EN 61000-4-3; EN 60529 IP66; EN 62262 IK10

.4 Canadian Electrical Code including all BC amendments and bulletins.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

2 Products

2.1 IP CAMERA

.1 Compatible with existing “Genetec”, Version 4.8 operating System.

.2 Multi sensor camera (with minimum two lenses) shall meet the following requirements;

.1 Camera case and dome must measure a base diameter less than 200mm and weigh less than 2.5kg

.2 Camera case and dome must be heavy-duty, vandal-resistant, dust-resistant and water-resistant, wall-mount housing consisting of fixed mounting frame and removable front plate

.3 Capable of continuous operation; start and operate from -40 Deg. To 50 Deg. C; start and operate from 20% to 90% non-condensing humidity

.4 Certified compliant to IEC EN 61000-4-3, Radiated RF immunity

.5 Mean Time Between Failures (MTBF) of at least 25,000 hours

.6 Meet safety standard IEC 60950-1 or CSA C22.2

.7 Front plate to have two polycarbonate windows to protect camera and IR LED illuminators

.8 Front plate to be recessed and secured to frame with security screws

.9 Adjustable mount to tilt camera up or down.

.10 1080P (1920 x 1080) resolution

- .11 True day/night camera with 2.6 mm lens. Camera lense must have a 35 Deg. to 80 Degree or greater horizontal angular view varifocal lens. The camera lens must be approved by the manufacturer of the camera for that camera
- .12 Digital wide dynamic range
- .13 Privacy masking
- .14 0.00 lux low light capability @ 50 IRE (IR ON)
- .15 Power-over-Ethernet (IEEE 802.3af), 24 VAC or 12 VDC
- .16 Integrated IR LEDs (20 m range)
- .17 Streaming: H.264, MPEG-4 or M-JPEG
- .18 Must interface over IPV4 TCP/IP; be able to operate on 100Base-TX (IEEE 802.3u); connect using an RJ45 connector and be ONVIF compliant
- .19 Camera model must be identified as “Certified” or “Supported by Design” in the Genetec Omnicast Supported Hardware camera list
- .20 Must retain its configuration over a power cycle
- .21 Automatic or remote back focus
- .22 Automatic Gain Control (AGC)
- .23 Automatic removable infrared cut filter for day/night transition
- .24 Camera case and dome must have threaded openings for conduits; a threaded plug to seal all unused openings; set screws to secure all conduit and plugs from inside the dome; tamper resistant heads on all externally accessible screws; permanently affixed label on the interior and exterior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement.

2.2 CATEGORY 6 UTP CABLE

- .1 Four (4) pair, unshielded twisted, solid copper core, 100 ohm, 24 AWG, Category 6, FT4 rated for two (2) new CCTV Cameras.
- .2 Green color outer jacket.
- .3 Transmission requirements shall conform to or exceed all applicable section of the TIA/EIA 5668-B current specifications and addendums for Category 6 cable and components.

2.3 CATEGORY 6 UTP CABLE CONNECTORS

- .1 8P/8W, Female, RJ45, Category 6 jack at Camera.
- .2 Suitable for 24 AWG, solid copper wire.
- .3 Meet or exceed technical criteria outlined in TIA/EIA 568, “Transmission Performance Specifications for 4-Pair, 100 ohm, Category 6 Cabling.
- .4 Cables shall be wired straight through, no crossover is allowed. Pin 1 at one end is connected to Pin 1 at the other end of the cable.

2.4 CATEGORY 6 UTP PATCH CORDS

- .1 Four (4) pair, unshielded twisted, stranded copper core, 100 ohm, 24 AWG, Category 6.
- .2 Green color outer jacket. Length as required.
- .3 Transmission requirements shall conform to or exceed all applicable section of the TIA/EIA 568-B current specifications and addendums for Category 6 cable and components.

2.5 CABLE LABELS

- .1 Bold face laser quality printed labels, black print on white background. No hand written labels will be accepted.
- .2 Self adhesive, one piece label and clear cover wrapped around cable.
- .3 Wording on labels to be approved by Departmental Representative prior to manufacture.

3 Execution

3.1 INSTALLATION OF CCTV CAMERA

- .1 Install cameras as indicated.
- .2 Adjust Field-of-View and focus camera as directed by Departmental Representative.
- .3 Caulk neatly around the conduits, junction boxes and entire camera enclosure between walls and ceiling with security caulking.

3.2 INSTALLATION OF CATEGORY 6 UTP CABLING

- .1 Supply & install new Category 6, UTP cable to new camera in conduit as indicated.
- .2 Terminate all new Category 6, UTP cables on existing Patch Panels as indicated.

- .3 Label both ends of all Category 6, UTP Cables indicating Camera I.D. and location. Wording on labels to be approved by Departmental Representative prior to manufacture.
- .4 Provide 3 m of slack cable at Patch Panel end of cable. Neatly coil slack cable to side of existing CCTV Cabinet.

3.3 INSTALLATION OF CATEGORY 6 UTP PATCH CORDS

- .1 Supply & Install one new Category 6 UTP Patch Cord for new Camera as follows:
 - .1 From existing Patch Panel to existing POE Injector.
 - .2 From existing POE Injector to existing POE Switch.
 - .3 From camera to female jack at Camera.

3.4 CATEGORY 6 UTP CABLE TESTING

- .1 Test all cables with a CAT6 certification analyzer that comply with all TIA/ISO standards.
- .2 No marginal passes or conditional passes will be accepted on these cables.
- .3 Replace entire length of cable for any cables that do not pass tests outlined in the specification.
- .4 Provide electronic and paper copy of all test results for incorporation into Maintenance Manuals specified in Section 01 01 50 – General Instructions.

3.5 PROGRAMMING CAMERA INTO THE EXISTING CCTV SYSTEM

- .1 Contractor shall program camera into the existing “Genetec” operating system as required to incorporate new and existing cameras into the system as directed by Departmental Representative.
- .2 Camera shall be recorded on existing “Pivot3 vSTAC” Virtual server/storage array.
- .3 Contractor shall program the existing “Genetec” operating system for viewing on existing Network Video User Stations as directed by Departmental Representative.
- .4 All programming to the existing system shall be carried out by personnel who have successfully completed all training and received necessary certification from “Genetec”.

3.6 MAINTENANCE HANDOVER REPORT

- .1 Submit a Maintenance Handover Report as per Appendix `A` of these Specifications.

- .2 Maintenance Handover Report to be completed in its entirety. Complete project information, Warranty Details, Distribution Details and Training Details.
- .3 Include a list of all equipment itemizing the locations, quantity, model number, serial number and latest revision level of all installed equipment.
- .4 Attach “Genetec” licence for new cameras to Maintenance Handover Report.
- .5 Insert copy of Maintenance Handover Report in each copy of Maintenance Manuals.
- .6 Provide Electronic Copy of Maintenance Handover Report in Microsoft Word format.

END OF SECTION

CORRECTIONAL SERVICE OF CANADA
TECHNICAL SERVICES BRANCH
ELECTRONICS SYSTEMS
MAINTENANCE HANDOVER REPORT

INSTITUTION:

DATE:

SYSTEM/EQUIPMENT:

APPLICABLE CONTRACT NO:

PWGSC PROJECT NO:

SPECIFICATIONS:

EQUIPMENT SUPPLIER (NAME AND ADDRESS):

SUPPLIER CONTACT (NAME AND TELEPHONE):

WARRANTY DETAILS:

Expiry date on materials/parts:

Expiry date on installation:

Expiry date on factory labour:

Travel & living expenses during the warranty period:

chargeable to CSC

not chargeable to CSC

Equipment transportation costs are paid by CSC for:

sending to the supplier

returning from the supplier

Negotiated rates for emergency repairs at site due to misuse/abuse during warranty period are as follows:

Not applicable.

Negotiated rates for labour at site after warranty period are as follows:

Not applicable.

DEFICIENCIES:None remain List attached **DOCUMENTATION:**

Maintenance manual:

Supplied

Due by ;

As-built drawings, cabling and wiring diagrams:

Supplied

Due by ;

Acceptance test results:

Supplied

Due by ;

DISTRIBUTION OF DOCUMENTATION:

1 copy to CESM sent on:

1 copy to RATIS/RTEO sent on:

2 copies to institution sent on:

SPARES:All delivered

Delivery to be completed by ;

EQUIPMENT LIST:See attached list. **MAINTENANCE TRAINING:**Completed

Scheduled for ;

SIGNATURE: Project Manager**DISTRIBUTION:** CESM, NHQ
RATIS/RTEO, RHQ

APPENDIX A
PRE-RENOVATION HAZARDOUS BUILDING MATERIAL-
ASSESSMENT

Public Services and Procurement Canada

PRE-RENOVATION HAZARDOUS BUILDING MATERIAL-ASSESSMENT

CSC Mission Medium

Relocation of Canteen - M Building

8751 Stave Lake Street, Mission, BC

Project # 30030366

August 1, 2019



Pre-Renovation Hazardous Building Material Assessment
Relocation of Canteen – M Building
CSC Mission Medium – 8751 Stave Lake Street, Mission, BC

Authored by:



Kenny Luong, AHERA
Technologist

Reviewed by:



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Senior Project Manager

PRE-RENOVATION HAZARDOUS BUILDING MATERIAL ASSESSMENT

Prepared for:

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1230 Government Street, Suite 401

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Tel 604 706 4785

Our Ref. 30030366

Date: August 1, 2019

Pre-Renovation Hazardous Building Material Assessment
Relocation of Canteen – M Building
CSC Mission Medium – 8751 Stave Lake Street, Mission, BC

VERSION CONTROL

Issue	Revision No	Date Issued	Page No	Description	Reviewed by
01	00	August 1, 2019	All	Final Report	Jerry Botti

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APPENDICES

- Appendix A: Site Photographs
- Appendix B: Laboratory Certificates of Analysis
- Appendix C: Floor Plan

ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-Containing Materials
Arcadis	Arcadis Canada Inc.
CLC	Canada Labour Code
COHSR	Canada Occupational Health and Safety Regulations
HPP	Hazard Prevention Program
LPB	Lead Based Paints
NIOSH	National Institute for Occupational Safety and Health
NJC	National Joint Council
OEL	Occupational Exposure Limit
OHS	Occupational Health and Safety
PCBs	Polychlorinated Biphenyls
PLM	Polarized Light Microscopy
PSPC	Public Services and Procurement Canada
RCMP	Royal Canadian Mounted Police
TEM	Transmission Electron Microscopy
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (Client) to conduct a pre-renovation hazardous building material assessment of the new canteen area in Building M, located at CSC Mission Medium - 8751 Stave Lake Street, Mission, BC.

The objective of the assessment was to identify specified hazardous building materials in preparation for building renovation. This assessment is intended to be used for pre-construction purposes only and may not provide sufficient detail for long term management of hazardous materials as required by Health and Safety regulations. The results of this assessment are intended for use with a properly developed scope of work and performance specification.

The assessed area was limited to the location of the new canteen in Building M, and included rooms 209, 213, 213C and 215 as shown in the drawings in Appendix C.

The assessment was performed on July 11 and July 26, 2019. The assessment was conducted by Kenny Luong, AHERA of Sterling IAQ Consultants Ltd.

Summary of Findings

Asbestos: Asbestos-containing materials (ACM) were confirmed to be present as follows:

Material	Location(s)	Total Quantity (square feet)	Condition	Asbestos Type (%)
Black Mastic	213C - Clearstory window	<1	Fair	2% Chrysotile
Grey Mastic	213C windows	<1	Good	Confirmed*

*This sample was confirmed asbestos during the 2017 Stantec investigation.

Lead: Lead is expected to be present in present in emergency light batteries. Lead is confirmed present in the following paints:

Color (substrate)	Location(s)	Total Quantity (square feet)	Condition	Concentration (ppm)
Grey Concrete	Floor – Scattered areas	15	Poor	4100
White Wood and Drywall	213C Perimeter walls and baseboards	320	Good	150
Grey Metal	Exterior side of east exit door	25	Fair	140

Silica: Crystalline silica is present in concrete and masonry.

Mercury: Mercury vapour is present in fluorescent light tubes (20) present in the assessed area.

Polychlorinated Biphenyls (PCBs): No PCB-containing window caulking was identified in assessed area. Light fixtures in the assessed area may consist of PCB-containing ballasts.

Ozone Depleting Substances: Two horizontal freezers were present in the assessed area. The coolant used in these freezers consisted of coolant (R22), which contains ODSs.

Mould: No mould or water-damaged building materials were noted in the assessed area.

Rodent Droppings: No rodent droppings were observed in the assessed area.

Recommendations

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations.

1. Remove and properly dispose of asbestos-containing materials prior to demolition or if disturbed by the planned renovation work.
2. Remove and properly dispose of PCB ballasts and mercury-containing items prior to demolition or if disturbed by the planned renovation work
3. Remove and recycle ODS prior to decommissioning.
4. Conduct tests for leachable lead and other metals on non-recyclable materials coated with lead paint.
5. Follow appropriate safe work procedures when handling or disturbing asbestos, lead and silica.

Please refer to Section 5 of this report for detailed recommendations regarding administrative, renovation or demolition activities.

Findings of this report are subject to our standard Limitations, as outlined in Section 7.

1 INTRODUCTION

1.1 Purpose

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (Client) to conduct a pre-renovation hazardous building material assessment of the new canteen area in Building M located at CSC Mission Medium - 8751 Stave Lake Street, Mission, BC.

The objective of the assessment was to identify specified hazardous building materials in preparation for building renovation. This assessment is intended to be used for pre-construction purposes only and may not provide sufficient detail for long term management of hazardous materials as required by Health and Safety regulations. The results of this assessment are intended for use with a properly developed scope of work and performance specification.

The assessed area was limited to the location of the new canteen in Building M, and included rooms 209, 213, 213C and 215 as shown in the drawings in Appendix C.

The assessment was performed on July 11 and July 26, 2019. The assessment was conducted by Kenny Luong, AHERA of Sterling IAQ Consultants Ltd.

1.2 Scope of Work

The scope of work for the project, as referenced in the Arcadis Workplan dated July 2, 2019, identifies the requirement to conduct a pre-renovation hazardous building material assessment within the new canteen to be constructed in Building M. Specifically the scope of work included:

- Review of existing documentation pertaining to hazardous materials in the study area.
- Design an assessment strategy that addresses the areas omitted in the existing documentation.

The assessment was conducted in accordance with applicable regulations. For the purpose of this assessment, hazardous building materials are defined as follows:

- Asbestos
- Lead
- Silica
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Mould (visible only)
- Ozone Depleting Substances
- Rodent Droppings

A general description of the building included in this assessment is provided in **Table 1** below:

Table 1. Building Description

Building Number (BU)	Building Name	Address	Total Assessed area m ²	Year Constructed	Building Description
M	Maintenance Building	8751 Stave Lake Street, Mission, British Columbia	90	1976	The single storey building consisted of predominantly concrete slab on grade with various types of vinyl flooring. Perimeter walls were of concrete block, covered by metal aluminum siding. The roof was open-webbed steel joists with a torch-on membrane.

2 PREVIOUS ASSESSMENTS

Arcadis was provided and instructed to rely on information presented in the following report:

- Hazardous Building Materials Assessment Building M – Maintenance, May 2017 – prepared by Stantec Inc.

3 SURVEY METHODOLOGY

3.1 Asbestos-Containing Materials

A separate set of samples is collected of each type of homogenous material suspected to contain asbestos. A homogenous material is defined by the US EPA as material that is uniform in texture and appearance, was installed at one time, and is unlikely to consist of more than one type or formulation of material. The homogeneous materials are determined by visual examination, available information on the phases of the construction and prior renovations.

Sample collection and analysis will be performed in general accordance with the requirements of the PSPC Asbestos Management Standard dated June 5, 2017 and B.C. Reg. 296/97.

The PSPC Asbestos Management Standard states the following:

Analysis of bulk samples are to be performed, where possible, using the United States Environmental Protection Agency method EPA/600/R-93/116 for Polarized Light Microscopy (PLM). In some instances, analysis must be performed using Transmission Electron Microscopy (TEM) (an example of this would be analysis of vinyl floor tile).

Arcadis proposes that one sample of each sample set (3) of vinyl floor tiles be analyzed by transmission electron microscopy (TEM) if the first two samples are reported negative by PLM.

In some cases, manufactured products such as asbestos cement pipe, are visually identified without sample confirmation.

Flooring mastic/adhesive are sampled and analyzed when present on the underside of flooring samples (vinyl floor tile and vinyl sheet flooring) and if adequate sample size is available on the floor tile.

PRE-RENOVATION ASBESTOS CONTAINING MATERIALS SURVEY

8751 Stave Lake Street, Mission, British Columbia

Attempts to distinguish and delineate asbestos-containing drywall compound from new non-asbestos drywall compound is often unachievable. Arcadis will collect drywall joint compound samples from exterior walls, columns or other locations which are unlikely to have been renovated in an attempt to determine the presence of asbestos in the original drywall joint compound.

Arcadis submits the bulk samples to a NVLAP accredited laboratory for analysis. The analysis is performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

Vermiculite insulation will be determined to contain any asbestos in accordance with the Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation (EPA/600/R-04/004, dated January 2004) published by the United States Environmental Protection Agency;

The asbestos analysis will be completed using a stop positive approach. Only one result of greater than the regulated criteria is required to determine that a material is asbestos-containing, but all samples must be analyzed to conclusively determine that a material is non-asbestos. The laboratory stopped analyzing samples from a homogeneous material once greater than the criteria was detected in any of the samples of that material. All samples of a homogeneous material were analyzed if no asbestos was detected. Where building materials are described in this report as non-asbestos, or described as containing no asbestos, this is subject to the limitations of the analytical method used and should be understood to mean no asbestos was detected.

Bulk samples of materials which could contain asbestos would be collected and submitted to EMSL Canada Inc. (EMSL) for analysis of asbestos content. In BC, asbestos-containing materials are defined as 0.5% or greater, or any amount if vermiculite.

3.2 Lead

Arcadis collects samples of distinctive paint finishes and surface coatings present in more than a limited application, where removal of the paint is possible. Arcadis collects samples by scraping the painted finish to include base and covering applications. Drawings included show sample locations.

For this proposal all paints containing lead at a concentration 90 ppm or greater are considered as lead-based. Paint and surface coatings are evaluated for condition.

Analysis for lead in paints or surface coatings will be performed in accordance with EPA Method No. 3050B/Method No. 7420; flame atomic absorption at laboratory accredited by the American Industrial Hygiene Association (AIHA).

Lead building products (e.g. batteries, lead sheeting, flashing) are identified by visual observation only. Additionally, lead may be present in a number of materials which were not assessed and/or sampled.

3.3 Silica

Arcadis identifies building materials suspected of containing crystalline silica (e.g. concrete, cement, tile, brick, masonry, mortar) by knowledge of current and historic applications and visual inspection only. Arcadis does not perform sampling of these materials for laboratory analysis of crystalline silica content, unless specifically requested by the Client.

3.4 Mercury

Building materials/products/equipment (e.g. thermostats, barometers, pressure gauges, light tubes), suspected to contain mercury were identified by visually inspection only. Dismantling of equipment

suspected of containing mercury was not performed. Sampling of these materials for laboratory analysis of mercury content was not performed.

Mercury spills or damaged mercury-containing equipment was recorded where observed.

3.5 Polychlorinated Biphenyls (PCBs)

Arcadis determines the potential for light ballast and wet transformers to contain PCBs based on the age of the building, a review of maintenance records and examination of labels or nameplates on equipment, where present and accessible. The information is compared to known ban dates of PCBs and Environment Canada publications.

Dry type transformers are presumed to be free of dielectric fluids and hence non-PCB.

Arcadis records spills or leakage of suspect PCB-containing fluids where observed or identified in historical documents.

Fluids (mineral oil, hydraulic or Askaral) in transformers or other equipment are not sampled for PCB content. Caulking will be sampled for PCB content; however other solids (paints etc.) will not be sampled for PCB content.

3.6 Suspect Visible Mould

Arcadis identifies the presence of suspect mould and water damage if visibly present in a significant quantity on exposed building surfaces. If any mould growth or water damage is concealed within wall cavities it is not addressed in this assessment.

3.7 Ozone Depleting Substances (ODS)

Arcadis determines the potential presence of ODS (chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, halons, etc.) in air conditioning units, chillers, commercial coolers and fire suppression systems by visual inspection of manufactures' labels or plates, maintenance records, or logbooks, etc.

3.8 Rodent Droppings

Arcadis will inspect the assessed area for visible signs of rodent droppings. If any rodent droppings are concealed within wall cavities it is not addressed in this assessment. No testing on rodent droppings will be performed.

4 RESULTS

4.1 Asbestos

During the course of our assessment, representative bulk samples of material were collected. The samples were forwarded to EMSL Canada Inc. in Burnaby, British Columbia for asbestos analyses. EMSL holds a current Certificate of Accreditation for Bulk Asbestos Fibre Analysis under the Voluntary Accreditation Program (NVLAP). Bulk sampling was performed in general accordance with the requirements specified in

PRE-RENOVATION ASBESTOS CONTAINING MATERIALS SURVEY

8751 Stave Lake Street, Mission, British Columbia

B.C. Reg. 296/97 and in the WorkSafe BC publication Safe Work Practices for Handling Asbestos. Analysis of bulk samples was performed following EPA Method 600/R-93/116 in conformity with the requirements specified in B.C. Reg. 296/97.

Results of bulk sample analysis for asbestos content are provided in Table 3. Laboratory certificates of analysis have been provided in **Appendix B**. Floor plans indicating sample locations are provided in **Appendix C**. Site Photographs provided in **Appendix A**. Bolded samples indicated results that exceed the criteria.

Table 3: Results of Bulk Sample Analysis for Asbestos

Sample Number	Sample Description	Sample Location	Asbestos Type %	Friable (Y/N)	Condition (action)
A1A	Drywall joint compound	215 southeast corner	None detected	Y	NA
A1B	Drywall joint compound	213C northwest corner	None detected	Y	NA
A1C	Drywall joint compound	213C southeast exterior	None detected	Y	NA
A1D	Drywall joint compound	213C east wall	None detected	Y	NA
A1E	Drywall joint compound	213C ceiling	None detected	Y	NA
A1F	Drywall joint compound	Southeast exit door	None detected	Y	NA
A1G	Drywall joint compound	Southeast exit vestibule northwest	None detected	Y	NA
A2A	Red Cove Board/Glue	215 perimeter	None detected	N	NA
A2B	Red Cove Board/Glue	215 perimeter	None detected	N	NA
A2C	Red Cove Board/Glue	215 perimeter	None detected	N	NA
A3A	Cream 12" VFT/Mastic	213C southwest	None detected	N	NA
A3B	Cream 12" VFT/Mastic	213C entrance	None detected	N	NA
A3C	Cream 12" VFT/Mastic	213C entrance	None detected	N	NA
A4A	Black Mastic	213C west window	None detected	N	NA
A4B	Black Mastic	213C southwest window	None detected	N	NA
A4C	Black Mastic	213C southeast window	None detected	N	NA
A5A	Brown Cove Board/Glue	213C perimeter	None detected	N	NA
A5B	Brown Cove Board/Glue	213C perimeter	None detected	N	NA
A5C	Brown Cove Board/Glue	213C perimeter	None detected	N	NA
A6A	Black Expansion Joint	Southeast exit door concrete slab	None detected	N	NA
A6B	Black Expansion Joint	Southeast exit door concrete slab	None detected	N	NA

PRE-RENOVATION ASBESTOS CONTAINING MATERIALS SURVEY
 8751 Stave Lake Street, Mission, British Columbia

Sample Number	Sample Description	Sample Location	Asbestos Type %	Friable (Y/N)	Condition (action)
A6C	Black Expansion Joint	Southeast exit door concrete slab	None detected	N	NA
A7A	Brown Caulking	213C exterior side of east window	None detected	N	NA
A7B	Brown Caulking	213C exterior side of east window	None detected	N	NA
A7C	Brown Caulking	213C exterior side of east window	None detected	N	NA
A8	Black Mastic*	Guard rail outside of east window	None detected	N	NA
A9	Black Mastic*	213C Clearstory window exterior flashing	Chrysotile 2%	N	Good
A10	Grey Mastic*	213C Clearstory window	None detected	N	NA
A11A	Levelling Compound	Southeast exit under door	None detected	N	NA
A11B	Levelling Compound	Southeast exit under door	None detected	N	NA
A11C	Levelling Compound	Southeast exit under door	None detected	N	NA

NA – Not applicable

* These samples were present in limited quantity; therefore, only one sample was collected.

The following building materials were common in the building: however, these materials do not contain asbestos and were not sampled during the survey:

- Metal walls and siding, wood paneling, wood baseboard and flooring, concrete, and similar man-made mineral fibers.

Asbestos-containing materials were confirmed present as follows:

Table 4: Summary of Confirmed Asbestos-Containing Materials

Material	Location(s)	Total Quantity (square feet ft ²)	Condition	Asbestos Type (%)
Black Mastic	213C Clearstory window exterior flashing	<1	Fair	Chrysotile 2%
Grey Mastic	213C windows	<1	Good	Confirmed*

*This material was confirmed asbestos in the 2017 Stantec assessment.

Asbestos-containing black mastic was observed on the exterior flashing directly underneath the clearstory windows in Room 213C. This material was in fair condition and was only present at the joining points to each piece of flashing. Asbestos-containing grey window mastic was identified in a 2017 Stantec assessment as outline on the appended drawing. No other asbestos-containing materials were identified in the survey of the subject area.

Visual inspection of the concrete block wall cavities did not identify any vermiculite. The 2017 Stantec report identified asbestos-containing drywall joint compound throughout the building; however, samples collected in the assessed are were non-asbestos. Arcadis collected seven (7) additional samples during our investigation and all samples were reported to be non-asbestos.

4.2 Lead

During the course of our site investigation, representative bulk samples of predominant paint types were collected by Arcadis staff. The samples were forwarded to EMSL Canada Inc. in Burnaby, British Columbia for lead analyses. Results of bulk sample analysis for lead content are provided in Table 5. The laboratory report is provided in Appendix B. Bolded samples indicate results that exceed the criteria.

Table 5: Results of Analyses of Bulk Samples for Paint for Lead

Sample No.	Sample Location(s)	Sample Description	Lead Content (mg/kg)
L1	Concrete Floor – Scattered Areas throughout the assessed area	Grey	4100
L2	213C Exterior Wood Baseboard	White	150
L3	East clearstory windows	White	<80
L4	213C West and South Walls	Tan	<80
L5	Metal structure at east exit doorway	Cream	<80
L6	East exit metal door - interior side	Orange	<80
L7	East exit metal door - exterior side	Grey	140

Lead was detected at a level the guideline level referenced by WorkSafeBC of 600 mg/kg in samples L1. Lead was detected at a level above the Health Canada definition of lead paint (90 mg/kg) in samples L2 and L7. Where one colour of paint is indicated in the sample descriptions in Table 5, only one layer of paint was observed. Where multiple colours are indicated in the sample description, multiple layers of paint were observed.

All paint applications were noted to be generally in good to fair condition.

4.3 Silica

Crystalline silica is a presumed component of the following materials where present in the assessed area:

- poured or pre-cast concrete
- masonry and mortar

4.4 Mercury

Mercury vapor is present in fluorescent lamps (20 tubes) present in the assessed area.

No mercury thermostats and switches manometers found in the assessed area.

4.5 Polychlorinated Biphenyls (PCBs)

Based on visual observations (evidence of T-8 fixtures), light fixtures in Room 213C will not contain PCB ballasts. However, four (4) fixtures outside of Room 213C, but inside the assessed area, are suspected to contain of PCB ballasts.

Caulking is present at exterior windows and doors. Three samples of black and grey caulking were collected and submitted to Bureau Veritas labs in Burnaby BC. The materials were confirmed to be non-PCB based on the threshold given in SOR/2008-273 (50 ppm).

4.6 Suspect Visible Mould

Suspect visible mould and/or water staining was not observed in the assessed area during the assessment.

4.7 Ozone Depleting Substances

Two (2) horizontal freezers were present in room 213C. These appliances contained coolant (R22), which is an ozone depleting substance.

4.8 Rodent Droppings

No rodent droppings were observed in the assessed area.

5 RECOMMENDATIONS

1. Prepare plans and performance specifications for hazardous material removal required for the planned work. The specifications should include the scope of work, safe work practices, personal protective equipment, respiratory protection, and disposal of waste materials.
2. Investigate any items excluded from the scope of work of this report. Ideally this investigation will be performed as part of the development of the specifications, or at a minimum immediately prior to commencing renovations when the areas are no longer occupied. Specifically, the following materials/areas need to be investigated if impacted by the proposed renovations:
 - Roofing membranes
3. Provide this report and the detailed plans and specifications to the contractor prior to bidding or commencing work.
4. Retain a qualified consultant to specify, inspect and verify the successful removal of hazardous materials.
5. Update the asbestos inventory upon completion of the abatement and removal of asbestos-containing materials.

5.1 Building Renovation Work

The following recommendations are made regarding renovation involving the hazardous materials identified.

Asbestos

Remove all asbestos-containing materials (ACM) prior to renovation, alteration, maintenance or demolition work or if ACM may be disturbed by the work.

If the identified ACM will not be removed prior to commencement of the work, disturbance of ACM must follow the appropriate asbestos precautions for the classification of work being performed.

Asbestos-containing materials must be disposed of at a landfill approved to accept asbestos waste.

Lead

Construction disturbance of lead in paint and coatings (or other materials) may result in over-exposure to lead dust or fumes. The need for work procedures, engineering controls and personal protective equipment will need to be assessed on a project-by-project basis and must comply with federal and provincial standards or guidelines. Performing an exposure assessment during work that disturbs lead in paints and

coatings may be able to alleviate the use of some of the precautions specified by these standards or guidelines.

Items painted with paints containing elevated levels of lead may be a hazardous waste. Test lead-painted materials for leachable lead and other metals prior to disposal. Well adhered paints containing elevated levels of lead on metal substrates do not require leachable lead analysis as the materials can be recycled with the paint intact.

Silica

Construction disturbance of silica-containing products may result in excessive exposures to airborne silica, especially if performed indoors and dry. Cutting, grinding, drilling or demolition of materials containing silica should be completed only with proper respiratory protection and other worker safety precautions that comply with federal and provincial standards or guidelines.

Mercury

Do not break lamps. Recycle fluorescent lamps when taken out of service.

PCBs

When light fixtures are removed, examine light ballasts for PCB content. If ballasts are not clearly labelled as "non-PCB" or are suspected to contain PCBs; package and ship ballasts for destruction at a federally permitted facility.

Mould

No mould was observed in the assessed area; if mould is uncovered inside wall cavities during hand demolition, use appropriate precautions and protect workers using methods that comply with provincial guidelines.

Ozone Depleting Substances

Remove and recover refrigerants prior to disposal in compliance with regulations. Used licensed technicians to perform this work.

6 REFERENCES

The following legislation and documents were referenced in completing the assessment and this report:

1. Occupational Health and Safety Regulation, B.C. Reg. 296/97, WorkSafe BC.
2. Safe Work Practices for Handling Asbestos, WorkSafe BC, 2012 Edition.
3. Hazardous Waste Regulation, B.C. Reg. 261/2006, BC Ministry of Environment.
4. Ozone Depleting Substances and Other Halocarbons Regulation, B.C. Reg. 220/2006, Environmental Management Act.
5. PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act.
6. Lead-Containing Paint and Coatings, Preventing Exposure in the Construction Industry, WorkSafe BC, June 2011.
7. Mould Guidelines for the Canadian Construction Industry, Standard Construction Document CCA 82 – 2004, Canadian Construction Association.
8. Minister of Justice. 2018. Canada Labour Code. R.S.C., 1985, c. L-2. August 27, 2018.
9. Minister of Justice. 2018. Canada Occupational Health and Safety Regulations. SOR/86-304. August 27, 2018.
10. Public Services and Procurement Canada. 2017. Asbestos Management Standard. June 5, 2017.
11. Transport Canada. 2017. Consolidated Transport of Dangerous Goods Regulations including Amendment SOR/2017-253.

7 LIMITATIONS

This report, prepared for Public Services and Procurement Canada does not provide certification or warranty, expressed or implied, that the investigation conducted by Arcadis identified all hazardous materials associated with the subject building. The work undertaken by Arcadis was directed to provide information on the presence of asbestos materials in construction materials based on visual inspection of readily accessible areas of the subject building, and on the results of laboratory analysis of a limited number of bulk samples of material for asbestos. The material in this report reflects Arcadis' best judgment in light of the information available at the time of the investigation, which was performed between July 11 – July 26, 2019 This report is not intended to be used as a scope of work or technical specification for remediation of hazardous materials. This report was prepared by Arcadis for Public Services and Procurement Canada. Any use which any other party makes of the report, or reliance on, or decisions to be based on it, is the responsibility of such parties.

APPENDIX A

Site Photographs

Project Photographs

New Canteen – Building M Maintenance
CSC Mission Medium
8751 Stave Lake Street, Mission, BC



Photo: 1

Date:
July 11, 2019

Description:
Asbestos-containing
black flashing mastic
(2% Chrysotile)



Photo: 2

Date:
July 11, 2019

Description:
Mastic on window
guardrail only on a
single pane (non
asbestos)

Project Photographs

New Canteen – Building M Maintenance
CSC Mission Medium
8751 Stave Lake Street, Mission, BC



Photo: 3

Date:
July 11, 2019

Description:
Non-asbestos vinyl
floor tile throughout
213C

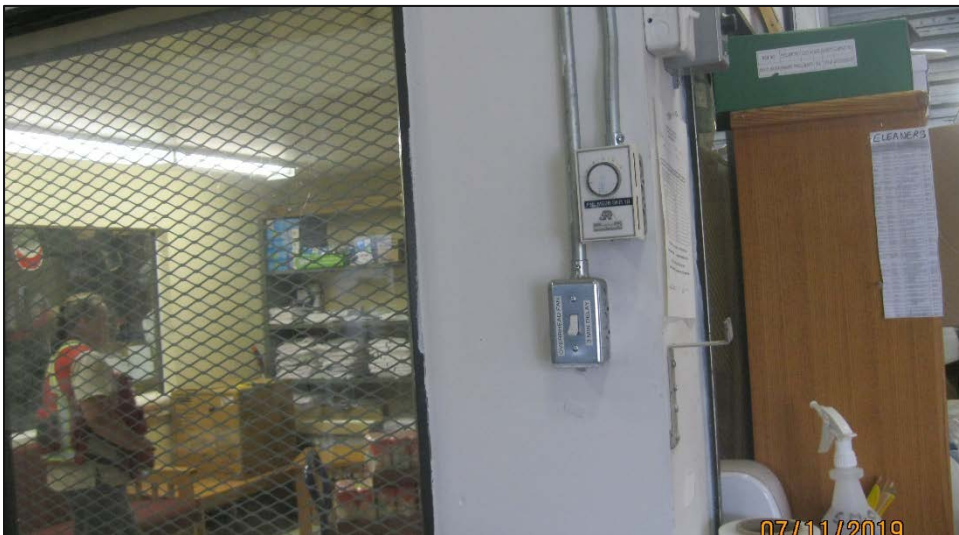


Photo: 4

Date:
July 11, 2019

Description:
Non-mercury
thermostat

Project Photographs

New Canteen – Building M Maintenance
CSC Mission Medium
8751 Stave Lake Street, Mission, BC



Photo: 5

Date:
July 11, 2019

Description:
2 horizontal freezers
in 213C – Ozone
depleting substances
in coolant.

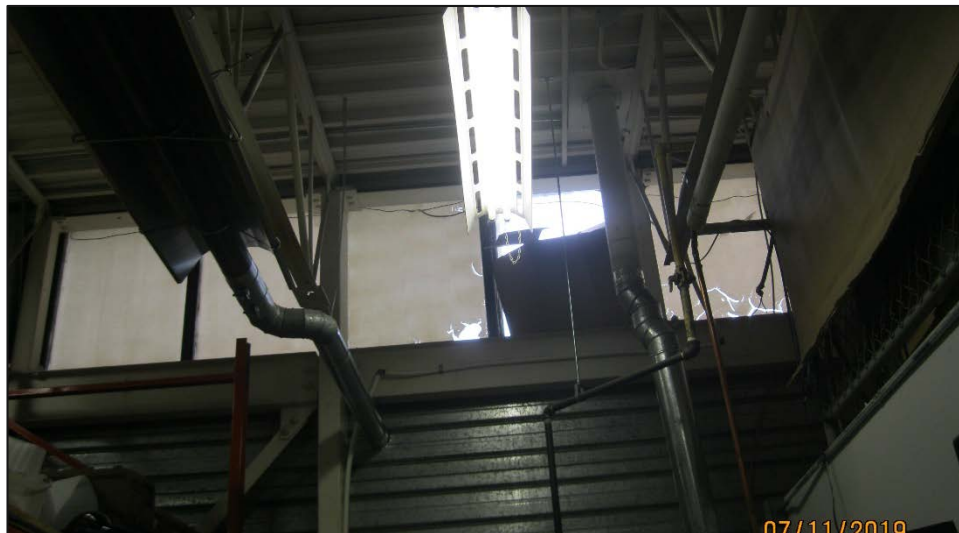


Photo: 6

Date:
July 11, 2019

Description:
2 Fluorescent light
fixtures north of
213C

Project Photographs

New Canteen – Building M Maintenance
CSC Mission Medium
8751 Stave Lake Street, Mission, BC



Photo: 7

Date:
July 11, 2019

Description:
2 Fluorescent light
fixtures south of
213C



Photo: 8

Date:
July 11, 2019

Description:
6 Fluorescent light
fixtures in 213C

Project Photographs

New Canteen – Building M Maintenance
CSC Mission Medium
8751 Stave Lake Street, Mission, BC



Photo: 9

Date:
July 11, 2019

Description:
Lead-based grey
paint on concrete
floor by west office
(4100 ppm)



Photo: 10

Date:
July 11, 2019

Description:
Sample L1 –
concrete floor
grey paint
(4100 ppm)

Project Photographs

New Canteen – Building M Maintenance
CSC Mission Medium
8751 Stave Lake Street, Mission, BC



Photo: 11

Date:
July 11, 2019

Description:
Lead paint (white)
on wood baseboard
around exterior of
213C (150 ppm)



Photo: 12

Date:
July 11, 2019

Description:
Lead paint (grey
with orange base
layer on metal
door exterior side)
140 ppm

APPENDIX B

Laboratory Certificates of Analysis



EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1
Phone/Fax: (604) 757-3158 / (604) 757-4731
<http://www.EMSL.com> / vancouverlab@EMSL.com

EMSL Canada Order 691901762
Customer ID: 55ACAV42
Customer PO: 10365916
Project ID:

Attn: Jerry Botti Phone: (604) 632-9941
ARCADIS Canada Inc. Fax:
308-1080 Mainland Street Collected:
Vancouver, BC V6B 2T4 Received: 7/12/2019
Analyzed: 7/16/2019
Proj: 10365916

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A1A **Lab Sample ID:** 691901762-0001

Sample Description: 215 SOUTHEAST CORNER/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A1B **Lab Sample ID:** 691901762-0002

Sample Description: 213C NORTHWEST CORNER/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A1C **Lab Sample ID:** 691901762-0003

Sample Description: 213C SOUTHEAST CORNER/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A1D **Lab Sample ID:** 691901762-0004

Sample Description: 213C EAST WALL/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A1E **Lab Sample ID:** 691901762-0005

Sample Description: 213C CEILING/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A1F **Lab Sample ID:** 691901762-0006

Sample Description: EAST EXIT DOORWAY/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A1G **Lab Sample ID:** 691901762-0007

Sample Description: EAST EXIT DOORWAY/DJC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	White	0.0%	100.0%	None Detected	



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EMSL Canada Order 691901762
Customer ID: 55ACAV42
Customer PO: 10365916
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A2A **Lab Sample ID:** 691901762-0008
Sample Description: 215 PERIMETER/RED COVE BOARD/GLUE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Red	0.0%	100.0%	None Detected	

Client Sample ID: A2B **Lab Sample ID:** 691901762-0009
Sample Description: 215 PERIMETER/RED COVE BOARD/GLUE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Red	0.0%	100.0%	None Detected	

Client Sample ID: A2C **Lab Sample ID:** 691901762-0010
Sample Description: 215 PERIMETER/RED COVE BOARD/GLUE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Red	0.0%	100.0%	None Detected	

Client Sample ID: A3A-Floor Tile **Lab Sample ID:** 691901762-0011
Sample Description: 213C/CREAM 12" VFT/MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/15/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A3A-Mastic **Lab Sample ID:** 691901762-0011A
Sample Description: 213C/CREAM 12" VFT/MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/15/2019	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: A3B **Lab Sample ID:** 691901762-0012
Sample Description: 213C/CREAM 12" VFT/MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/15/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A3C **Lab Sample ID:** 691901762-0013
Sample Description: 213C/CREAM 12" VFT/MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
TEM Grav. Reduction	7/16/2019	White	0.0%	100.0%	None Detected	

Client Sample ID: A4A **Lab Sample ID:** 691901762-0014
Sample Description: 213C WEST INTERIOR WINDOW/BLACK MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	



EMSL Canada Inc.

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<http://www.EMSL.com> / vancouverlab@EMSL.com

EMSL Canada Order 691901762
Customer ID: 55ACAV42
Customer PO: 10365916
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A4B **Lab Sample ID:** 691901762-0015
Sample Description: 213C NORTHWEST INTERIOR WINDOW/BLACK MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A4C **Lab Sample ID:** 691901762-0016
Sample Description: 213C SOUTHWEST INTERIOR WINDOW/BLACK MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A5A **Lab Sample ID:** 691901762-0017
Sample Description: 213C INTERIOR/BROWN COVE BOARD/GLUE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A5B **Lab Sample ID:** 691901762-0018
Sample Description: 213C INTERIOR/BROWN COVE BOARD/GLUE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A5C **Lab Sample ID:** 691901762-0019
Sample Description: 213C INTERIOR/BROWN COVE BOARD/GLUE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A6A **Lab Sample ID:** 691901762-0020
Sample Description: EAST EXIT CONCRETE FLOOR EDGE/BLACK EXPANSION JOINT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Brown	40.0%	60.0%	None Detected	

Client Sample ID: A6B **Lab Sample ID:** 691901762-0021
Sample Description: EAST EXIT CONCRETE FLOOR EDGE/BLACK EXPANSION JOINT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Brown	40.0%	60.0%	None Detected	

Client Sample ID: A6C **Lab Sample ID:** 691901762-0022
Sample Description: EAST EXIT CONCRETE FLOOR EDGE/BLACK EXPANSION JOINT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Brown	40.0%	60.0%	None Detected	



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EMSL Canada Order 691901762
 Customer ID: 55ACAV42
 Customer PO: 10365916
 Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A7A **Lab Sample ID:** 691901762-0023
Sample Description: 213C EAST WINDOW EXTERIOR SIDE/BROWN CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A7B **Lab Sample ID:** 691901762-0024
Sample Description: 213C EAST WINDOW EXTERIOR SIDE/BROWN CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A7C **Lab Sample ID:** 691901762-0025
Sample Description: 213C EAST WINDOW EXTERIOR SIDE/BROWN CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A8 **Lab Sample ID:** 691901762-0026
Sample Description: EXTERIOR RAILING AROUND WINDOW/BLACK MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	100.0%	None Detected	

Client Sample ID: A9 **Lab Sample ID:** 691901762-0027
Sample Description: EXTERIOR CLEARSTOREY WINDOW FLASHING/BLACK MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Black	0.0%	98.0%	2% Chrysotile	

Client Sample ID: A10 **Lab Sample ID:** 691901762-0028
Sample Description: CLEARSTOREY WINDOW/GREY MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/15/2019	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A11A **Lab Sample ID:** 691901762-0029
Sample Description: EXTERIOR EAST EXIT BASE OF DOOR/LEVELLING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Gray	0.0%	100.0%	None Detected	

Client Sample ID: A11B **Lab Sample ID:** 691901762-0030
Sample Description: EXTERIOR EAST EXIT BASE OF DOOR/LEVELLING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Gray	0.0%	100.0%	None Detected	



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EMSL Canada Order 691901762
Customer ID: 55ACAV42
Customer PO: 10365916
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A11C

Lab Sample ID: 691901762-0031

Sample Description: EXTERIOR EAST EXIT BASE OF DOOR/LEVELLING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	7/12/2019	Gray	0.0%	100.0%	None Detected	

Analyst(s):

- Dane Sorochuk PLM (27)
- Natalie D'Amico TEM Grav. Reduction (1)
- Nicole Yeo PLM (4)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 07/16/2019 13:27



EMSL Canada Inc.

2333 18th Avenue NE, Unit 48, Calgary, AB T2E 8T6
Phone/Fax: (403) 879-1149 / (403) 879-1152
<http://www.EMSL.com> CalgaryLab@EMSL.com

EMSL Canada Or 651905459
CustomerID: 55ACAV42
CustomerPO:
ProjectID:

Attn: **Jerry Botti**
ARCADIS Canada Inc.
308-1080 Mainland Street
Vancouver, BC V6B 2T4

Phone: (604) 632-9941
Fax:
Received: 07/15/19 10:38 AM
Collected:

Project: 10365916

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>Lead Concentration</i>
L1	651905459-0001 Site: CONCRETE FLOOR - GREY	7/15/2019	7/15/2019	0.2657 g	4100 ppm
L2	651905459-0002 Site: 213C EXTERIOR WOOD BASEBOARD - WHITE	7/15/2019	7/15/2019	0.2542 g	150 ppm
L3	651905459-0003 Site: EAST CLEARSTREY WINDOWS - WHITE	7/15/2019	7/15/2019	0.2566 g	<80 ppm
L4	651905459-0004 Site: 213C WEST AND SOUTH WALLS - TAN	7/15/2019	7/15/2019	0.2573 g	<80 ppm
L5	651905459-0005 Site: METAL STRUCTURE AT EAST EXIT DOORWAY - CREAM	7/15/2019	7/15/2019	0.2552 g	<80 ppm
L6	651905459-0006 Site: EAST EXIT METAL DOOR - INTERIOR SIDE - ORANGE	7/15/2019	7/15/2019	0.2621 g	<80 ppm
L7	651905459-0007 Site: EAST EXIT METAL DOOR - EXTERIOR SIDE - GREY	7/15/2019	7/15/2019	0.2665 g	140 ppm

Jefferson Salvador, Laboratory Manager
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.
Samples analyzed by EMSL Canada Inc. Calgary, AB CALA Accreditation #A3942

Initial report from 07/15/2019 16:46:02



Your Project #: 10365916
 Site Location: CSC MISSION MEDIUM
 Your C.O.C. #: 08471887

Attention: Jerry Botti

ARCADIS Canada Inc
 1080 Mainland St
 Suite 308
 Vancouver, BC
 CANADA V6B 2T4

Report Date: 2019/07/29
 Report #: R2759112
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B961200

Received: 2019/07/26, 13:50

Sample Matrix: Bulk
 # Samples Received: 3

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Non Routine/Non Validated Matrix Tested (2)	3	N/A	2019/07/26		
Polychlorinated Biphenyls in Soil (1)	3	2019/07/27	2019/07/27	CAL SOP-00149	EPA 8082A R1 m
Total PCBs in Soil (1)	3	N/A	2019/07/28		Auto Calc

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by BV Labs Calgary Environmental

(2) Sample(s) analyzed using methodologies that have not been subjected to Bureau Veritas Laboratories' standard validation process for the submitted matrix and is not an accredited method. Analysis performed with client consent, however results should be viewed with discretion.



Your Project #: 10365916
Site Location: CSC MISSION MEDIUM
Your C.O.C. #: 08471887

Attention: Jerry Botti

ARCADIS Canada Inc
1080 Mainland St
Suite 308
Vancouver, BC
CANADA V6B 2T4

Report Date: 2019/07/29
Report #: R2759112
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B961200
Received: 2019/07/26, 13:50

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Debbie Nordbruget, Key Account Specialist
Email: DNordbruget@bvlab.com
Phone# (250)385-6112

=====
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VERITAS**

BV Labs Job #: B961200
Report Date: 2019/07/29

ARCADIS Canada Inc
Client Project #: 10365916
Site Location: CSC MISSION MEDIUM

RESULTS OF CHEMICAL ANALYSES OF BULK

BV Labs ID		WE4002	WE4003	WE4004	
Sampling Date		2019/07/26	2019/07/26	2019/07/26	
COC Number		08471887	08471887	08471887	
	UNITS	P1	P2	P3	QC Batch
MISCELLANEOUS					
Sample Matrix	N/A	BULK	BULK	BULK	ONSITE



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BV Labs Job #: B961200
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POLYCHLORINATED BIPHENYLS BY GC-ECD (BULK)

BV Labs ID		WE4002		WE4003		WE4004		
Sampling Date		2019/07/26		2019/07/26		2019/07/26		
COC Number		08471887		08471887		08471887		
	UNITS	P1	RDL	P2	RDL	P3	RDL	QC Batch
Polychlorinated Biphenyls								
Aroclor 1016	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1221	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1232	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1242	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1248	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1254	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1260	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1262	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Aroclor 1268	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9525173
Total PCB	mg/kg	<0.60	0.60	<0.085	0.085	<0.11	0.11	9524574
Surrogate Recovery (%)								
NONACHLOROBIPHENYL (sur.)	%	92		98		94		9525173
RDL = Reportable Detection Limit								



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GENERAL COMMENTS

POLYCHLORINATED BIPHENYLS BY GC-ECD (BULK) Comments

Sample WE4002 [P1] Polychlorinated Biphenyls in Soil: Detection limits raised based on sample weight used for analysis. In addition detection limits raised due to matrix interference.

Sample WE4003 [P2] Polychlorinated Biphenyls in Soil: Detection limits raised based on sample weight used for analysis.

Sample WE4004 [P3] Polychlorinated Biphenyls in Soil: Detection limits raised based on sample weight used for analysis.

Results relate only to the items tested.



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QUALITY ASSURANCE REPORT

ARCADIS Canada Inc

Client Project #: 10365916

Site Location: CSC MISSION MEDIUM

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9525173	NONACHLOROBIPHENYL (sur.)	2019/07/27	97	50 - 130	99	50 - 130	89	%		
9525173	Aroclor 1016	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1221	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1232	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1242	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1248	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1254	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1260	2019/07/27	117	50 - 130	117	50 - 130	<0.010	mg/kg	NC	50
9525173	Aroclor 1262	2019/07/27					<0.010	mg/kg	NC	50
9525173	Aroclor 1268	2019/07/27					<0.010	mg/kg	NC	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).



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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

A handwritten signature in cursive script that reads "Jingyuan Song".

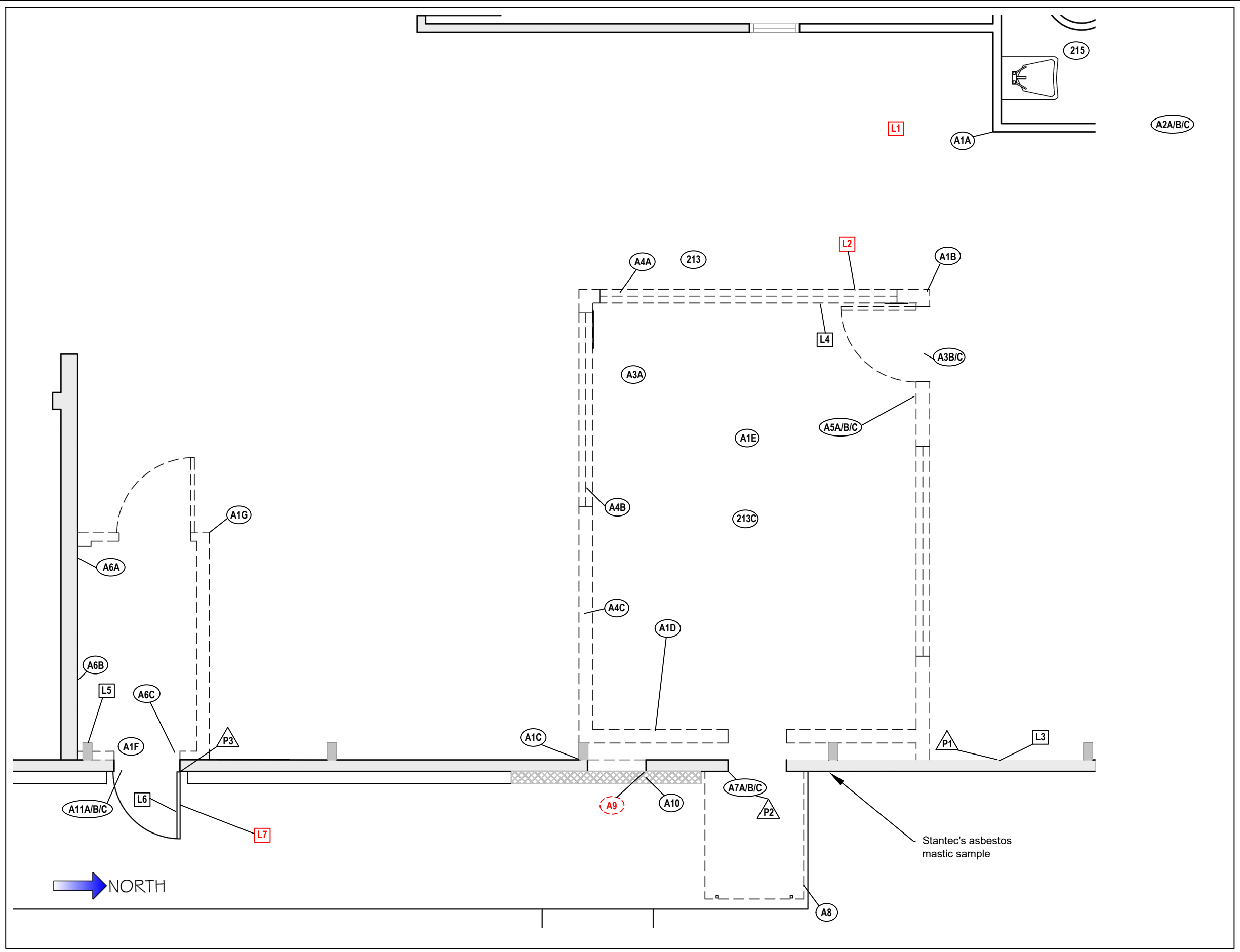
Jingyuan Song, QP, Organics – Senior Analyst

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APPENDIX C

Floor Plan

1 (3) G:\CADD\PWGSC\Mission Bldg MIDSS\Floor Plan.dwg



LEGEND

- A1A Asbestos Bulk Sample Location
- A9 Asbestos-Containing Bulk Sample Location
- L4 Lead Bulk Sample Location
- L2 Lead-Containing Bulk Sample Location
- P3 PCB Bulk Sample Location
- 213 Room Number

N.T.S

Title: PRE-RENOVATION HAZARDOUS MATERIAL ASSESSMENT			
Project: MISSION MEDIUM INSTITUTION BUILDING M			
Client:		PUBLIC SERVICES AND PROCUREMENT CANADA	
Project Number: 10365916	Drawn By: PAF	Plot Size:	Date: JULY 2019
			FIGURE 1 of 1

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