



**Public Works and
Government Services Canada**

Requisition No. EZ899-181607/A

DRAWINGS & SPECIFICATIONS
for


Mountain Institution
Healthcare Expansion

Project No.: R.077724.001

APPROVED BY:



Regional Manager, AES

2017-10-10
Date


Construction Safety Coordinator

2017-08-29
Date

TENDER:


Project Manager

2017-10-12
Date

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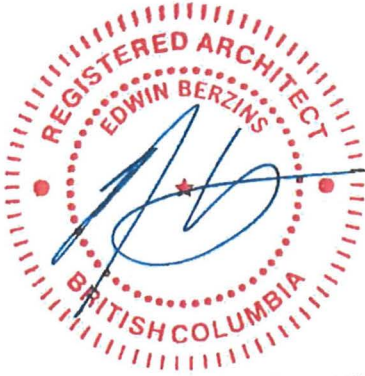
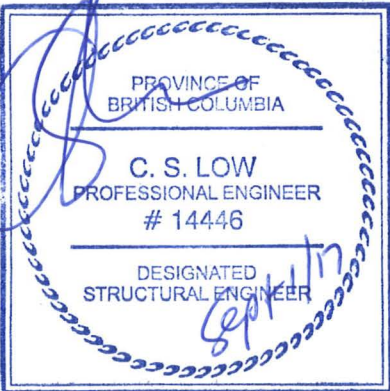

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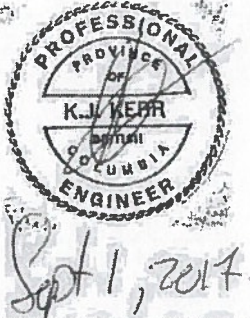

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END OF SECTION

CONSULTANTS – SEAL & SIGNATURE

<u>Discipline</u>	<u>Seal / Signature / Date</u>
<p>Architectural (Prime)</p> <p>Mallen Gowing Berzins Architecture Incorporated</p> <p>Edwin Berzins Architect – AIBC</p>	 <p>Sept 01 2017</p>
<p>Structural</p> <p>Bush Bohlman & Partners LLP</p> <p>Clint Low, P.Eng, Struct Eng</p>	
<p>Mechanical</p> <p>Integral Group Inc.</p> <p>Greg Pinder, P. Eng, PE</p>	 <p>2017-08-31</p>

<u>Discipline</u>	<u>Seal / Signature / Date</u>
Electrical AES Engineering Ltd. Philip O'Neill, P.Eng	
Civil Wedler Engineering LLP Kelly Kerr, P.Eng	
GEOTECHNICAL Braun Geotechnical Ltd. James Wetherill, P.Eng	

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Information Documents means information of any type and in any form, related to the Project and identified in this Section as such and do not include the Contract Documents.
- .2 Contract Documents include the Agreement, Definitions, Supplementary Conditions and General Conditions, Divisions 1 through 33 of the specifications, Schedules and Drawings.
- .3 Contractor is synonymous with Bidder.

1.2 STATUS OF INFORMATION DOCUMENTS

- .1 Information Documents, or any part thereof, are not part of the Contract unless specifically incorporated into Contract Documents by means of copying, transcribing or referencing.

1.3 USE OF AND RELIANCE UPON INFORMATION DOCUMENTS

- .1 Information Documents are made available to Bidder by Departmental Representative for the purpose of providing Bidder with access to information available to Departmental Representative.
- .2 Information Documents shall not be considered a representation or warranty that information contained therein is accurate, complete or appropriate, and do not form a part of the Contract Documents.
- .3 Bidder shall interpret and draw its own conclusions about Information Documents and is encouraged to obtain specialist advice with respect thereto. Departmental Representative assumes no responsibility for such interpretations and conclusions.
- .4 Information contained in Information Documents may be time sensitive and dates shall be considered when interpreting Information Documents.
- .5 Bidder may rely upon the data contained in Information Documents, or parts thereof, which are specifically incorporated into Contract Documents by means of copying, transcribing or referencing, but shall draw his own conclusions from such data and shall not rely on opinions or interpretations contained therein.

1.4 INFORMATION DOCUMENTS

- .1 Information Documents, in whole or in part, consist of the following:
 - .1 Appendix A:
 - .1 Geotechnical Evaluation entitled Revise Proposed Health Care Expansion – Mountain Institute by Braun Geotechnical Ltd., dated April 24, 2017, reference no. 15-6516.
And consisting of subsurface conditions, recommendations, foundation types, concrete, and pavement design is attached to this section for information only.

- .2 Appendix B:
 - .1 ES/STD-0232 Fixed Network Colour Dome Camera for Use in Federal Correctional Institutions
 - .2 ES/STD-0233 Indoor No-grip Corner Mount Network Colour Camera
 - .3 ES/SOW-0101 Statement of Work – Procurement & Installation of Electronic Security Systems
- .2 Direct inquiries during bid period to person identified in Instructions to Bidders to receive inquiries.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

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 Mountain Institution, Agassiz, B.C.
 - .1 Construction of a new health care building expansion and renovation work as indicated, Work to be completed in phases as indicated below and on Drawings.
 - .3 Work Sequence:
 - .1 Required Stages: refer to phasing plans on Drawings for additional requirements and as follows:
 - .1 Phase 1 – Construction of new expansion/addition.
 - .2 Phase 2 – Renovation of existing Healthcare Building G.
 - .3 During construction of the new expansion, existing Building G Healthcare should remain functional with minimum disturbance to day-to-day healthcare operation. Upon completion of new expansion, existing healthcare at Building G will be vacated for renovation. New expansion will operate healthcare programs with some temporary measures until completion of Building G Healthcare renovation. New addition will be fully occupied and functional before Phase 2.
 - .2 Maintain fire access/control of the occupied facilities always.
- .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 Phase 1: New Addition – Work required in existing Healthcare Building G to be performed between 1900 and 0600
 - .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:
 - .1 Reach Substantial Performance of the Work and Closeout for Phase 1 within 42 work weeks from the date of such notification. All building systems and medical equipment in the phase 1 new addition must be fully operational and commissioned before the completion of phase 1 will be accepted.
 - .2 Allow 6 weeks for Building Occupancy Application for authority having jurisdiction (CSC).
 - .3 Reach Substantial Performance of the Work and Closeout for Phase 2 within 12 work weeks of Phase 2 turn over to Contractor.
 - .4 Total project duration: 60 work weeks
 - .5 Closeout is to occur no later than two weeks from Substantial Performance of the Work for each phase.

- .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 (GANTT) 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 PWGSC paper work is acceptable.

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.
- .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 Each side of building for a total of 4.
 - .2 Interior of rooms and finishes 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 Accompany submissions with transmittal letter in duplicate.
- .4 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 Works and Government Services Canada (PWGSC) is for the sole purpose of ascertaining conformance with the general concept.
 - .2 The Departmental Representative's review does not mean that PWGSC 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 (BCBC2012) 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 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.
 - .2 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.
 - .3 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 Inspection Agencies:
 - .1 Independent Inspection/Testing Agencies will be selected by Departmental Representative for purpose of inspecting and/or testing

portions of Work. Cost of such services will be borne by the Contractor.

- .2 Provide equipment required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
 - .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative, Pay costs for retesting and reinspection.
- .2 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.
- .3 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.
- .4 Reports:
- .1 Submit (4) four copies of inspection and test reports to Departmental Representative.
- .5 Tests and Mix Designs:
- .1 Furnish test results and mix designs as may be requested.
- .6 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.
- .7 Mill Tests:
 - .1 Submit mill test certificates as requested and as required of specification Sections.
- .8 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 Dewatering:
 - .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
- .3 Water Supply:
 - .1 Arrange, pay for and maintain temporary water supply in accordance with local authority, governing regulations and ordinances.
 - .2 Permanent water supply system installed under this contract may be used for construction requirements provided that guarantees are not affected thereby. Replace damaged components.
- .4 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 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.
- .5 Temporary Communication Facilities:
 - .1 Provide and pay for temporary telephone and fax hook up, line(s) necessary for own use.
- .6 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 office of size to accommodate site meetings and Contractor's operations.
 - .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
 - .3 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 2.4 m high self-supporting welded mesh sectional modular fence, with mesh wires protruding over the top, temporary construction fencing. Provide lockable truck gate. Maintain fence in good repair. Remove temporary fencing around new addition at completion of phase 1 site work and new fence construction.
- .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 deep excavations, 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.
- .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.

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- .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.
- .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.

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- .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**" (used for complex Mechanical or Electrical Systems): 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 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
 - .11 Remove dirt and other disfiguration from exterior surfaces.
 - .12 Sweep and wash clean paved areas.
 - .13 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
 - .14 Clean roofs, downspouts, and drainage systems.
 - .15 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 Certificates required by Authority Having Jurisdictions for fire protection systems.
 - .7 Certificates required by Authority Having Jurisdictions for seismic restraints.
 - .8 Operation of systems have been demonstrated to Departments personnel.
 - .9 Work is complete and ready for Final Inspection.
- .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: 2007) with all as-built information on the diskettes.
 - .2 Four (4) sets of as-built plotted reproducible drawings.
 - .3 Four (4) sets of printed as-built drawings.
 - .4 Submit one copy of check plots to Departmental Representative prior to final printing of as-built drawings.
 - .5 Departmental Representative will supply copies of the original AutoCad files.
 - .6 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 Maintenance manual:
 - .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 Operations 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 DEFINITIONS

- .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 Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, 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 CPIC form and 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 PWGSC 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 PWGSC 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 requirements of Section 01 01 50 – General Instructions.
- .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 waved by the Director.

1.10 OVERTIME WORK

- .1 Conform to requirements of Section 01 01 50 – General Instructions.

- .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 PWGSC 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 PWGSC 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 INSTITUTIONAL 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 OF 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 PWGSC 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 PWGSC 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.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 INTENT

- .1 The intent of Delegated Design Submittals required by this section is to account for professional engineering responsibility for design, review and acceptance of components of Work forming a part of permanent Work in accordance with Building Code, and that has been assigned to a design entity other than Consultant including, but not limited to, the following:
 - .1 Design requiring structural analysis of load bearing components and connections.
 - .2 Design requiring compliance with fire safety regulations.
 - .3 Design requiring compliance with life or health safety regulations.
- .2 This section provides standard forms for submittal of Letter of Commitment and Letter of Compliance required complying with requirements of Building Code and design delegated to a professional Engineer within technical specification sections.
- .3 Delegated Design Submittals are not required for components of Work requiring engineering for temporary Work (i.e.: crane hoisting, engineered lifts, false Work, shoring, concrete formwork) that would normally form a part of Contractor's scope of Work.
- .4 The requirements of this section are in general conformance with recommended Responsibilities for Engineering Services for Building Projects published by Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), with regards to duties of specialty professionals appointed during construction period.
- .5 The requirements of this section do not diminish responsibilities of Consultant's role as Registered Professional of Record; submittals will be used by Consultant to establish that Work is substantially performed in accordance with Building Code.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete
- .2 Section 05 12 00 – Structural Steel
- .3 Section 05 21 00 – Steel Joists
- .4 Section 05 31 00 – Steel Deck
- .5 Section 05 50 00 – Metal Fabrications
- .6 Section 07 42 43 – Composite Metal Panels
- .7 Section 07 84 00 – Firestopping and Smokeseals
- .8 Divisions 23 and 26 Coordinate with disciplines for items requiring delegated design submittals.
- .9 Other Specification Section requiring delegated design.

1.3 DELEGATED DESIGN

- .1 Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated where professional design services or certifications by a design professional are specifically required of Contractor by Contract Documents.
- .2 If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Consultant.
- .3 Delegated design will be required for elements designed by a specialty professional, which may include:
 - .1 Elements normally fabricated off-site
 - .2 Elements that require specialized fabrication equipment or a proprietary fabrication process not usually available at job site (i.e.: open web steel joists, wood trusses, combination wood and metal or plywood joists, prefabricated wood or metal buildings, noise and vibration isolation devices, elevators).
 - .3 Elements requiring civil engineering, not normally a part of scope of services performed by architectural; structural; mechanical; electrical; or geotechnical disciplines of Consultant.

Part 2 Products

2.1 LETTER OF COMMITMENT

- .1 Submit a signed and sealed Letter of Commitment on company letterhead addressed to Consultant in accordance with format in Appendix A attached to the end of this Section prior to starting Work requiring design and seal of a professional engineer.

2.2 LETTER OF COMPLIANCE

- .1 Submit a signed and sealed Letter of Compliance on company letterhead addressed to Consultant in accordance with format in Appendix B attached to the end of this Section on completion of Work requiring design and seal of a professional engineer.

Part 3 Execution

3.1 IMPLEMENTATION

- .1 Include summary of Work described in technical specification section as a part of the required Letter of Commitment.
- .2 Prepare required submittals and present to Consultant within sufficient time to allow for Consultant's detailed review and acceptance.

END OF SECTION

APPENDIX A

LETTER OF COMMITMENT

Submit a signed and sealed letter of commitment on company letterhead in the form as follows:

[Date]

[Consultant]

[Consultant's Address]

Attention: [Consultant's Registered Professional of Record]

Re: Letter of Commitment for Delegated Design of [System of Component of Work]
[Name of Project]
[Project Number]
[City, Province]

As the retained registered professional engineer for design and field review of the above named component of Work and project, I hereby give assurance I am qualified to perform the following Work as required by Contract Documents:

1. [List appropriate design services for System or Component of Work];
2. Preparation of shop and erection documents;
3. Review fabrication of [structural] [fire rated] [life and health safety] components;
4. Review erection of [structural] [fire rated] [life and health safety] components.
5. [Modify list to suit System of Component of Work.]

I hereby give assurance that I will be responsible for above noted Work as described in Section [?????] – [Name of Section] of Project Manual, including requirements of addenda, change orders and change directives.

I also undertake to be responsible for field review of fabrication and erection of [structural] [fire rated] [life and health safety] components as required to ascertain substantial compliance with the Building Code and Contract Documents.

I will notify you in writing if my responsibility is terminated at any time during the course of Work covered by this Letter of Commitment.

Retained Professional Engineer

Signature

Date

(Apply seal)

APPENDIX B

LETTER OF COMPLIANCE

[Date]

[Consultant]

[Consultant's Address]

Attention: [Consultant's Registered Professional of Record]

Re: Letter of Compliance for Delegated Design of [System of Component of Work]
[Name of Project]
[Project Number]
[City, Province]

I hereby give assurance that I have fulfilled my obligations for field review as outlined by previously submitted Letter of Commitment.

I hereby give assurance that aspects of [structural] [life and health safety] Work as defined by previously submitted Letter of Commitment substantially comply with Contract Documents and Building Code.

Retained Professional Engineer

Signature

Date

(Apply seal)

Part 1 General

1.1 RELATED SECTION

- .1 Section 01 01 50 – General Instructions: Construction Schedules, Submittal Procedures, Temporary Utilities, Construction Facilities, Temporary Barriers and Enclosures.
- .2 Section 02 41 13 – Selective Site Demolition
- .3 Section 02 41 99 – Demolition for Minor Works

1.2 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .2 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
- .3 Government of Canada
 - .1 Canada Labour Code - Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .4 Province of British Columbia:
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulations
- .5 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .6 National Fire Code of Canada 2010 (as amended)
 - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
- .7 The Canadian Electric Code (as amended)

1.3 WORKERS' COMPENSATION BOARD COVERAGE

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

1.4 COMPLIANCE WITH REGULATIONS

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

1.5 SUBMITTALS

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 01 50 – General Instructions, Submittals.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
 - .1 Site Specific Health and Safety Plan, including Confined Space Work Plan and Silica & Rock Dust Exposure Control 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 current 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 Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 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 Site Specific 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:
 - .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, revising, 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 Add hazards on the "Preconstruction Assessment Form" (PAF) or list them as separate items in this section. The PAF must be referenced as an Appendix to this specification.

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. Should 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 speciality permits related to project before start of work.

1.13 FILING 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 HEALTH AND SAFETY PLAN

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

- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Site Specific Health and Safety Plan by Public Service and Procurement Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific 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 site staff.
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative site staff.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.

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 labelling 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 – General Instructions, Submittals.
 - .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 50 – General Instructions, Temporary Utilities.
 - .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 / Federal Regulations.
- .2 Removal and handling of asbestos will be in accordance with applicable Provincial / Federal Regulations.

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 PCBs in accordance with Provincial and Federal Regulations.

1.19 REMOVAL OF LEAD CONTAINING PAINTS

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition and/or remediation activities involving lead-containing paints in accordance with applicable Provincial / Territorial Regulations.
- .3 Dry Scraping/Sanding of any materials containing lead is strictly prohibited.
- .4 The use of Methylene Chloride based paint removal products is strictly prohibited.

1.20 SILICA AND ROCK DUST EXPOSURE CONTROL

- .1 Control Exposure of respirable crystalline silica and rock dust in compliance with Provincial regulations.

1.21 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.

1.22 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.

1.23 OVERLOADING

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

1.24 FALSEWORK

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

1.25 SCAFFOLDING

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 and B.C. Occupational Health and Safety Regulations.

1.26 CONFINED SPACES

- .1 Carry out work in confined spaces in compliance with Provincial / Territorial Regulations.

1.27 POWDER ACTUATED DEVICES

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

1.28 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.

1.29 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 DR is required prior to any gas or diesel tank being brought onto the work site.

1.30 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.

1.31 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.

1.32 POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Site Specific Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).
 - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.33 MEETINGS

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

1.34 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 Division 22 - Plumbing.
- .2 Division 23 - Heating, Ventilating and Air-Conditioning.
- .3 Division 25 - Integrated Automation (EMCS).
- .4 Division 26 - Electrical.
- .5 Division 28 - Electronic Safety and Security.

1.2 REFERENCES

- .1 Associated Air Balance Council (AABC): National Standards for Field Measurement and Instrumentation, Total Systems Balance, Air Distribution-Hydraulics Systems.

1.3 DEFINITIONS

- .1 Acronyms:
 - .1 Cx – Commissioning.
 - .2 EMCS - Energy Monitoring and Control Systems.
 - .3 O&M - Operation and Maintenance.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.

1.4 DESCRIPTION OF WORK

- .1 Includes general requirements for commissioning facilities and facility systems
- .2 Provide third party commissioning agent(s) for mechanical and electrical systems. Provide costs of commissioning in tender price.
- .3 Mechanical, Plumbing, Integrated Automation (EMCS) and Fire Protection Commissioning:
 - .1 Phase 1 – New Addition: mechanical plumbing and fire protection commissioning for Phase 1 shall include the equipment and systems shown in the area of Phase 1 and also connecting to the existing systems located in the area of Phase 2. See the following Drawings for further information:
 - .1 Drawings: M-1, M-4, M-5, P-3, P-4, P-5, F-2, F-3, F-4 and additional Drawings as required.

- .2 Phase 2 – Renovation: mechanical, plumbing and fire protection commissioning for Phase 2 shall include the equipment and systems shown in the area of Phase 2, renovations thereof, and not already commissioned as part of Phase 1. See the following Drawings for further information:
 - .1 Drawings: M-2, M-3, P-1, P-2, F-1, and additional Drawings as required.
- .1 Electrical, Electronic Safety and Security and BSCS Commissioning:
 - .1 Phase 1 – New Addition: Electrical, Electronic Safety and Security and BSCS commissioning for Phase 1 shall include the equipment and systems shown in the area of Phase 1 and also connecting to the existing systems located in the area of Phase 2. See the following Drawings for further information:
 - .1 Drawings: E001, E101, E201, E301, E302, E303 and additional Drawings as required.
 - .2 Phase 2 – Renovation: Electrical, Electronic Safety and Security and BSCS commissioning for Phase 2 shall include the equipment and systems shown in the area of Phase 2, renovations thereof, and not already commissioned as part of Phase 1. See the following Drawings for further information:
 - .1 Drawings: E061, E062, E100, E200 E300, and additional Drawings as required.

1.5 QUALITY ASSURANCE

- .1 Testing organization: current member in good standing of AABC certified to perform specified services.
- .2 Comply with applicable procedures and standards of the certification sponsoring association.
- .3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.6 SUBMITTALS

- .1 Submit test reports in accordance with Section 01 01 50 – General Instructions, Submittals.
- .2 Prior to start of Work, submit name of organization proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
- .3 Prior to start of Work, designate who has managerial responsibilities for coordination of entire testing and adjusting of electronic equipment.
- .4 Submit documentation to confirm organization compliance with quality assurance provision.

- .5 Submit 3 preliminary specimen copies of each of report forms proposed for use.
- .6 Ten (10) days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.
- .7 Submit reports of testing, adjusting and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.7 PROCEDURES – GENERAL

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify Departmental Representative 3 days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report to Departmental Representative any deficiencies or defects noted during performance of services.

1.8 CONTRACTOR'S RESPONSIBILITY

- .1 Prepare each system for testing and balancing.
- .2 Cooperate with testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.
- .5 Commissioning cost to be borne by Contractor.

1.9 PREPARATION

- .1 Provide instruments required for testing and adjusting operations.
- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing.
- .3 Test electronic system for proper operation and programming.
- .4 Identify each instrument used, and latest date of calibration of each.

1.10 FINAL REPORTS

- .1 Reports to be completed by organization having managerial responsibility.

- .2 Ensure each form bears signature of recorder and his supervisor.
- .3 Identify each instrument used, and latest date of calibration of each.

1.11 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in specified operating and program mode.
- .2 Commissioning work to be completed prior Contractor's request for Substantial Performance:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative
 - .2 Equipment, components and systems have been commissioned
 - .3 O&M training has been completed
- .3 Cx deliverables have been submitted and accepted by Departmental Representative.

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 02 41 99 – Demolition for Minor Works
- .2 Section 09 21 16 – Gypsum Board Assemblies

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- .1 Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - .1 Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - .2 Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - .3 Products: List products to be used and firms or entities that will perform the Work.
 - .4 Dates: Indicate when cutting and patching will be performed.
 - .5 Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - .6 Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure to the Departmental Representative prior to making cuts or modifications.
 - .7 Departmental Representative's Acceptance: Obtain acceptance of cutting and patching proposal before cutting and patching. Review and acceptance of cutting and patching proposal does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

- .1 Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load deflection ratio.
- .2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:
 - .1 Primary operational systems and equipment.
 - .2 Air or smoke barriers.

- .3 Fire protection systems.
 - .4 Control systems.
 - .5 Communication systems.
 - .6 Electrical wiring systems.
- .3 Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:
- .1 Water, moisture, or vapour barriers.
 - .2 Membranes and lashings.
 - .3 Exterior curtain wall construction.
 - .4 Equipment supports.
 - .5 Piping, ductwork, vessels, and equipment.
 - .6 Noise and vibration control elements and systems.
- .4 Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Departmental Representative's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm, including but not limited to the following:
- .1 Processed concrete finishes.
 - .2 Masonry.
 - .3 Ornamental metal.
 - .4 Preformed metal panels.
 - .5 Roofing.
 - .6 Firestopping and smoke seals.
 - .7 Window wall system.
 - .8 Stucco.
 - .9 Finished flooring.
 - .10 Finished coatings.
 - .11 Wall covering.
 - .12 HVAC enclosures, cabinets, or covers.
- .5 Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5

WARRANTY

- .1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

Part 2 Products

2.1 MATERIALS

- .1 General: Comply with requirements specified in other Sections of these Specifications.
- .2 Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:
 - .1 If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed:
 - .1 Provide X-ray or other approved methods to determine locations of existing services and reinforcing in existing concrete slabs and block walls before cutting and renovations. Advise Departmental Representative of findings before proceeding with the Work and revise penetration locations as required and directed by Departmental Representative. Existing concrete slab thickness is to be confirmed by Contractor.
 - .2 Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - .3 Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Temporary Support: Provide temporary support of Work to be cut.
- .2 Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- .3 Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- .4 Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

- .1 General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay:
 - .1 Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- .2 Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations:
 - .1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - .2 Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - .3 Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond core drill.
 - .4 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - .5 Proceed with patching after construction operations requiring cutting are complete.
- .3 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:
 - .1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - .2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - .3 Floors and Walls: Where walls or partitions that are removed extend from one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .1 Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

- .4 Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- .5 Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.
- .6 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 02 41 99 – Demolition for Minor Works

1.2 REFERENCES

- .1 Canadian Federal Legislation
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c.33
 - .2 Canadian Environmental Assessment Act (CEAA), 2012, c.37
- .2 Canadian Standards Association (CSA International)
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS)
- .4 Provincial Legislation
 - .1 Legislation specific to Authority Having Jurisdiction for work governed by this Section
- .5 Transport Canada
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- .5 Waste Audit (WA): detailed inventory of materials in building. Indicates quantities of reuse, recycling and landfill.
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
 - .2 Indicates quantities of reuse, recycling and landfill.

- .6 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Construction Meeting: Arrange a pre-construction meeting attended by Contractor's key personnel, Subcontractors representatives, Departmental Representative, and Consultant to discuss the following:
 - .1 Verify project requirements
 - .2 Review demolition conditions
 - .3 Coordination with other Subcontractors affected by work of this Section
 - .4 Examine existing site conditions adjacent to demolition work, prior to start of Work
 - .5 Waste reporting requirements

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
- .2 Waste Reduction Workplan: prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of haulers and waste receiving organizations.
- .3 Certificates: Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and re-use and recycling facilities for material removed from site on weekly basis.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:
 - .1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.
 - .2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.
- .2 Divert excess materials from landfill to site approved by Departmental Representative.
- .3 Separate for reuse and recycling and place in designated containers for each type of waste in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.
- .6 Label location of salvaged material's storage areas and provide barriers and security devices.
- .7 Ensure emptied containers are sealed and stored safely.
- .8 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt, and gypsum.
- .9 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

1.8 SITE CONDITIONS

- .1 Protect open excavations in accordance with requirements of the Authorities Having Jurisdiction.
- .2 Protect existing site features to remain or identified for salvage or re-use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by the Departmental Representative and at no cost to Departmental Representative:
 - .1 Remove and store salvaged materials to prevent damage.
 - .2 Store and protect salvaged materials as required for maximum preservation of material.
 - .3 Handle salvaged materials the same as new materials.
- .3 Perform selective site demolition work to prevent adverse affects to adjacent watercourses, groundwater and wildlife, and to prevent excess air and noise pollution:
 - .1 Do not dispose of volatile waste materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers; follow proper disposal procedures throughout the project.
 - .2 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Authorities Having Jurisdiction.
- .4 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.
- .5 Notify Departmental Representative before disrupting building access or services.
- .6 Should unidentified Asbestos Containing Materials (ACM) or other hazardous substance encountered in course of removal work or cutting and boring activities, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received from Departmental Representative.

Part 2 Products

2.1 EQUIPMENT

- .1 Use equipment suitable for work identified.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PREPARATION

- .1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect and Cap Identified Mechanical Services:
 - .1 Natural Gas Supply Lines: Remove in accordance with gas company requirements.
 - .2 Sewer and Water Lines: in accordance with Authorities Having Jurisdiction requirements, and securely plug to form watertight seal.
 - .3 Other Underground Services: Remove and dispose of as indicated on Drawings.
- .5 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

- .6 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PROTECTION

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

3.3 REMOVAL AND DEMOLITION OPERATIONS

- .1 Remove items indicated on Drawings; do not disturb items identified to remain in place.
- .2 Removal of Pavements, Curbs and Gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials where they are exposed and identified to remain.
 - .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
- .3 Excavate a minimum of 300 mm below pipe inverts, when removing pipes under existing or future pavement area.
- .4 Remove as many trees as required to complete demolition operations; prevent damage to trees identified to remain; obtain written permission from Departmental Representative prior to removal of trees not identified on Drawings:
 - .1 Relocate tree as indicated on Drawings.
 - .2 Sell or donate trees identified for removal and that are healthy and marketable; remove trees that are not healthy or marketable using alternate disposal methods.
 - .3 Grind, chip, or shred other vegetation for mulching and composting.
- .5 Stockpile topsoil for final grading and landscaping; provide erosion control and seeding if not immediately used.

- .6 Dispose of materials not identified for salvage or re-use on site at certified landfill site or recycling facility.

3.4 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.
- .2 Use soil treatments and procedures that are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

3.5 CLEANING

- .1 Remove debris, trim surfaces and leave work site clean, upon completion of Work.
- .2 Use cleaning solutions and procedures that are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 This Section includes, but not limited to, the following:
 - .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris.
 - .2 Selective demolition to allow new walls, bulkheads, ceilings, window, doors and other materials to meet existing construction as indicated.
 - .3 Repair procedures for selective demolition operations.
- .2 This Section does not include the following:
 - .1 Removal of hazardous materials or asbestos abatement.
 - .2 Demolition of structural elements.
 - .3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.
- .3 Phasing: work of this project will be constructed in phases. Refer to Section 01 01 50 – General Instructions, Summary of Work for required stages.

1.2 RELATED SECTIONS

- .1 Section 02 07 50 – Cutting and Patching
- .2 Section 02 41 13 – Selective Site Demolition
- .3 Section 03 35 00 – Concrete Finishing
- .4 Section 09 21 16 – Gypsum Board Assemblies
- .5 Section 09 91 99 – Painting for Minor Works
- .6 Division 20 – Mechanical: Specific requirements for demolishing, cutting, patching, or relocating mechanical items.
- .7 Division 26 – Electrical: Specific requirements for demolishing, cutting, patching, or relocating electrical items.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A10.8-2001, Safety Requirements for Scaffolding.
- .2 Canadian Federal Legislation
 - .1 Motor Vehicle Safety Act (MVSA), 1995
 - .2 Hazardous Materials Information Review Act, 1985
 - .3 Canadian Environmental Protection Act (CEPA), 1999, c.33
 - .4 Canadian Environmental Assessment Act (CEAA), 2012, c.37
- .3 Canadian Standards Association (CSA)
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 241-2013, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
- .5 Provincial Legislation
 - .1 Legislation specific to Authority Having Jurisdiction for work governed by this Section

1.4 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- .5 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Demolition Meeting: Conduct a pre-demolition meeting at Project site in accordance with requirements listed in Section 01 01 50 – General Instructions, Project Meetings, to confirm extent of salvaged and demolished materials; and to review Contractor's demolition plan prepared by a professional engineer.
- .2 Coordination:
 - .1 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.
 - .2 Coordinate with ongoing site operations, and limit the number of interruptions.
 - .3 Coordination with continuing occupancy of portions of existing building. The existing building G will be occupied and operational by the institution during work of this Contract. Note that Segregation is part of Building G.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
- .3 Material Ownership:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Departmental Representatives property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.6 SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
- .2 Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Departmental Representative reserves the right to make modifications where proposed methods interfere with the ongoing operations.
- .3 Provide the following submittals before starting work of this Section:
 - .1 Schedule of Selective Demolition Activities: Coordinate with Construction Progress Documentation, and indicate the following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Interruption of utility services.
 - .3 Schedule of selective demolition.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
 - .5 Locations of temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
 - .2 Submit detailed Waste Reduction Workplan in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of haulers and waste receiving organizations.
- .4 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.
- .5 Pre-demolition Photographs or Videotape: Submit photographs or videotape indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.
- .6 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:
 - .1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of architects and owners, for work of similar complexity and extent.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:
 - .1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.
 - .2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.
- .2 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:
 - .1 Conform to the British Columbia Occupational Health and Safety Act and Regulations.
 - .2 Conform to Workers' Compensation Board Regulations.
 - .3 Conform to local municipal bylaws and regulations governing this type of work.
- .3 Comply with regulations of local authorities having jurisdiction and standards referenced above. Where differences occur between the local regulations and referenced standards, the most restrictive requirement shall govern.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.
- .2 Except where otherwise specified, all materials indicated or specified to be permanently removed from the Place of the Work shall become Contractor's property. Maximize to the fullest extent possible, salvage, and recycling of such materials, consistent with proper economy and expeditious performance of the Work.
- .3 To reduce the quantity of material otherwise destined for disposal at a landfill, the Contractor is encouraged to consider utilizing the services of businesses and non-profit organizations that specialize in salvage and recycling of used building materials, but does so at his own option and risk.

1.9 SITE CONDITIONS

- .1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.
- .2 Protect open excavations in accordance with requirements of the Authorities Having Jurisdiction.
- .3 Departmental Representative will occupy portions of building immediately adjacent to selective demolition area:
 - .1 Conduct selective demolition so that operations will not be disrupted.
 - .2 Provide not less than 72 hours notice to Departmental Representative of activities that will affect operations

- .4 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities:
 - .1 Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- .5 Should unidentified Asbestos Containing Materials (ACM) or other hazardous substance encountered in course of removal work or cutting and boring activities, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received from Departmental Representative.

Part 2 Products

2.1 TEMPORARY SUPPORT STRUCTURES

- .1 Design temporary support structures required for demolition work necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

2.2 DEBRIS

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

2.3 EQUIPMENT

- .1 Provide all equipment required for safe and proper demolition.
- .2 Use equipment suitable for work identified.
- .3 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

2.4 REPAIR MATERIALS

- .1 Use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Submit samples to Departmental Representative for approval.
 - .2 Use material whose installed performance equals or surpasses that of existing materials.
 - .3 Comply with material and installation requirements specified in individual Specification Sections.
- .2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes. Gypsum based products are not acceptable for work of this Section. Refer to Section 03 35 00 for floor preparation.
- .3 Floor Preparation: Remove sub-floor ridges and bumps. Grind floor to provide uniform levelling between existing and new floor drains. Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Fill openings through slab with

cementitious fire stop. Clean and shot blast floor. Apply and average filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

- .4 Concrete Unit Masonry: Lightweight concrete masonry units and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- .5 Gypsum Board Patching Compounds: Joint compound to ASTM C475, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Assemblies.
- .6 Hoarding and Dust Screens: Refer to Section 01 01 50 – General Instructions, Temporary Barriers and Enclosures and as follows:
 - .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
 - .2 Maintain and relocate protection until such work is complete.

2.5 EXISTING MATERIALS

- .1 Items to be retained for re-use in new construction include, but are not limited to the following:
 - .1 As indicated on Drawings.
 - .2 Confirm with Departmental Representative any materials that appear to be in re-usable condition prior to disposal.

Part 3 Execution

3.1 EXAMINATION

- .1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Verify that utilities have been disconnected and capped as required.
- .3 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .4 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .5 Notify the Departmental Representative where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit a written report to Departmental Representative.
 - .2 Departmental Representative will issue additional instructions or revise drawings as required to correct conflict.

- .6 Engage a Professional Engineer to survey condition of building when removing elements that may result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- .7 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- .1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.
- .2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - .1 Arrange to shut off affected utilities with utility companies.
 - .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound.
- .3 Coordinate with mechanical and electrical sections for shutting off, disconnecting, removing, and sealing or capping utilities.
- .4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- .1 Identify and mark all equipment and materials identified to be retained by Departmental Representative or to be re-used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.
- .2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.
- .3 Confirm that all electrical and telephone service lines entering building are not disconnected.
- .4 Do not disrupt active or energized utilities crossing the demolition site.
- .5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.
- .6 Mark all materials required to be re-used, store in a safe place until ready for re-installation.
- .7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.

- .8 Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

3.4 PROTECTION

- .1 Take precautions to guard against damage to adjacent work. Be liable for any damage or injury caused.
- .2 Cease operations and notify Departmental Representative if safety or any adjacent work appears to be endangered. Do not resume operations until reviewed with Departmental Representative.
- .3 Prevent debris from blocking drainage inlets and systems and ground draining, and protect material and electrical systems and services that must remain in operation.
- .4 Keep noise, dust, and inconvenience to occupants to minimum.
- .5 Protect building systems, services and equipment.
- .6 Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain and as follows:
 - .1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - .2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - .3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - .4 Cover and protect furniture, furnishings, and equipment that have not been removed.
- .7 Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
 - .1 Provide temporary weather tight enclosure for building exterior.
 - .2 Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures.
 - .3 Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- .8 Provide and maintain fire prevention equipment and alarms accessible during demolition.
- .9 Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
- .10 Do Work in accordance with Section 01 35 33 – Health and Safety Requirements.

3.5 CONCRETE SLAB REINFORCING

- .1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non-destructive, non-ionizing radio frequency locators.
- .2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Engineer where slab features interfere with core drilling.
- .3 Notify the Engineer immediately for further instructions where coring or cutting will damage existing slab features.

3.6 CORING, DRILLING AND SAW-CUTTING CONCRETE

- .1 Complete an x-ray or ultrasound inspection of affected concrete area before coring. Employ the services of an experienced inspector. Confirm with Departmental Representative before coring or drilling, location of reinforcing steel and raceways that may be present.
- .2 Perform coring and drilling after normal working hours, unless specified otherwise. Confirm coring and drilling times with Departmental Representative.
- .3 Wet or dry core drilling and saw-cutting are acceptable. Reduce amount of cooling water used to minimum required and collect water used in suitable containers, or use a suitable vacuum system that will collect water.
- .4 Do not core structural beams or cut conduits or reinforcing steel without written permission from Departmental Representative.

3.7 SELECTIVE DEMOLITION

- .1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.
- .2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.
- .3 Demolish in a manner to minimize dusting and to prevent migration of dust.
- .4 Burning of demolition materials is not permitted.
- .5 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self levelling grout.
- .6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.
 - .1 Provide bond beams in new openings cut into existing concrete masonry unit walls.
 - .2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.
- .7 Demolish existing flooring and adhesive remnants as follows:
 - .1 Apply fine mist water spray to floors to minimize dust generation during removal. Avoid spraying near electrical outlets.
 - .2 Demolish existing residual floor finishes, remove and dispose of off site.
 - .3 Remove adhesive to the greatest extent possible using scrapping tools and as follows:

- .1 Do not use solvent based cleaners to remove adhesive remnants.
 - .2 Lightly shot blast or grind floor using machine designed for purpose to remove adhesive remnants.
 - .3 Vacuum floor ready for application of skim coating.
 - .4 Repair all slab depressions and damage with cementitious patching compound.
 - .5 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials and in accordance with Section 03 35 00.
- .4 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through resilient flooring materials and carpets.
- .8 Demolish existing tile finishes. Remove setting bed or adhesive to the greatest extent possible using mechanical scrapping tools and as follows:
- .1 Saw cut edge of tile for clean and even transition joint between existing tile to remain and new flooring materials.
 - .2 Lightly shot blast or grind floor to remove remnants of setting materials.
 - .3 Vacuum floor ready for application of skim coating.
 - .4 Repair all slab depressions and damage with cementitious patching compound. Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.
- .9 Fill all openings in gypsum board walls with gypsum board and framing to match existing, skim coat to make wall smooth and even.
- .10 Demolish ceiling finishes as indicated on Drawings.
- .11 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
- .12 Patch and repair all mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.8 PATCHING AND REPAIRING

- .1 Floors and Walls: refer to Section 02 07 50 – Cutting and Patching and as follows:
- .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
 - .2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
 - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .4 Patch with durable seams that are as invisible as possible.
 - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

- .6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
- .7 When requested, test and inspect patched areas after completion to demonstrate integrity of installation.
- .2 Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
- .3 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.

3.9 SALVAGE

- .1 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .2 Remove items to be reused, store as directed by Departmental Representative and re-install under appropriate section of specification.

3.10 DISPOSAL

- .1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

3.11 CLEANUP

- .1 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.
- .2 Maintain access to exits clean and free of obstruction during removal of debris.
- .3 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights-of-way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA O86-14, Engineering Design in Wood.
 - .3 CAN/CSA S269.3-M92 (R2013), Concrete Formwork.

1.4 QUALITY ASSURANCE

- .1 Do concrete formwork in accordance with CSA A23.1 and CSA O86, except where specified otherwise.
- .2 Do falsework in accordance with CAN/CSA S269.3, except where specified otherwise.

1.5 SHOP DRAWINGS

- .1 Comply with CAN/CSA S269.3 and with WorkSafeBC regulations for falsework drawings.
- .2 Where formwork requires review by a professional engineer the shop drawings for such work shall bear the stamp and signature of a qualified Professional Engineer registered in the Province of British Columbia.
- .3 A copy of the falsework and formwork drawings shall be kept at the job site while the temporary supporting structure is under construction or use.
- .4 Provide fully dimensioned shop drawings for all exposed concrete walls showing form tie locations, embedded plates, reglets, and reveals.

1.6 SITE MOCK-UPS

- .1 Erect formwork for exposed concrete walls and circular concrete column full-size mock-ups as directed at permanent locations designated by the Departmental Representative within the building for examination and acceptance of appearance of surface finish, form tie locations, details, jointing, assembly, and alignment.
- .2 The mock-ups required shall include the following:
 - .1 A cold joint between two pours using standard fibreglass column forms.
 - .2 A sample wall representing Class 1 Architectural Concrete finish of size designated by the Departmental Representative.
 - .2 A sample wall representing Class 2 Smooth Form finish of a size designated by the Departmental Representative.
- .3 Adjust formwork for mock-up installations at no extra cost to the Departmental Representative as required to meet requirements indicated on the drawings. Accepted mock-ups shall become part of permanent work and shall be minimum standard to which balance of concrete shall match, subject to passing of tests.

1.7 SAMPLES & PROTOTYPES

- .1 Material Samples: if applicable, submit the following samples of materials for approval to the Departmental Representative. Approved samples shall be used as the acceptable standard for all materials used on the project.
 - .1 Forming materials, including Class 1 Architectural Concrete finish materials.

- .2 Gaskets, sealing materials, and form jointing system (as applicable).
- .3 Ties, cones, and recessed precast concrete plugs, where specified.
- .4 Rustication strips, reveals, and reglet forming material.
- .5 Form release agent.
- .6 Expansion and isolation joints.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Formwork Lumber: plywood and wood formwork materials to CSA O86 and CSA A23.1.
- .2 Falsework Materials: to CAN/CSA S269.3.
- .3 Class 1 – Architectural Concrete Finish: all exposed exterior and interior concrete surfaces, high density overlay plywood similar to Simpson's Multipour HDO plywood, or steel forms, for Architectural Concrete Finish in accordance with CSA A23.1, Clause 8.3.4, Formwork for Special Architectural Finishes. Minimum thickness of plywood 20 mm. Forms shall not have patches, broken edges, or joint widths greater than 2 mm.
- .4 Class 2 – Smooth Form Finish: all exposed interior concrete surfaces, including slab soffits, plywood with non-absorptive liner such as urethane coating or medium density overlay plywood for Smooth Form Finish in accordance with CSA A23.1, Clause 7.9.2.6, Smooth-Form Finish. Forms shall not have patches, broken edges, or joint widths greater than 2 mm.
- .5 Class 3 – Rough Form Finish: all concealed concrete surfaces including elevator shafts, pits and trenches, plywood or shiplap, for Rough Form Finish in accordance with CSA A23.1, Clause 7.9.2.5, Rough-Form Finish.
- .6 Circular Forms: Use one only of the following types to produce a smooth surface without fins, of uniform texture and appearance.
 - .1 Full-height (one piece) fibreglass circular forms with one vertical joint.
 - .2 Full-height steel circular forms in two (2) sections with welded steel flanges for bolting together.
 - .3 Full-height SonaTube with a continuous liner that leaves the surface smooth and seamless.
 - .4 Use same type of circular forms throughout the project.
 - .5 Position joint(s) in circular forms as directed by the Departmental Representative.
 - .7 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. The portion remaining in the concrete shall not be less than 25 mm from the surface of the concrete. All exposed concrete formwork shall use coil ties with 63.5 mm recessed cones and a black plastic filler plug recessed 25 mm as per architectural details.
 - .8 Form Release Agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.

3.0 EXECUTION

3.1 ERECTION

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Obtain the Departmental Representative's approval for use of earth forms.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Construct falsework in accordance with CAN/CSA S269.3.
- .5 Prior to constructing formwork for architectural concrete (formed surfaces prominently exposed to view), submit shop drawings for review showing all

- details of formwork including panel sizes, joint locations, tie spacing and location, joint sealing, and other formwork details with the Departmental Representative and obtain written approval to proceed. This clause applies to Class 1 Architectural Concrete only.
- .6 Construct forms to produce finished concrete conforming to shape, dimensions, locations, and levels indicated within the following tolerances. Tolerances shall not be cumulative.
 - .1 Deviation from vertical line: 6 mm in 3000 mm, 10 mm in 6000 mm, and 20 mm in 12000 mm or more.
 - .2 Deviation from flat surface for walls, slabs, and roof slabs: 8 mm in 3000 mm.
 - .3 Deviation from horizontal: 6 mm in 3000 mm.
 - .4 Deviation of linear building lines from established position in plans and related position of columns, walls, and partitions: plus or minus 8 mm.
 - .5 Deviation in cross sectional dimensions of columns or beams, or in thickness of slabs and wall: plus or minus 6 mm.
 - .7 Obtain the Departmental Representative's permission before framing openings not indicated in concrete beams or columns, and framing openings in walls greater than 300 mm x 300 mm.
 - .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
 - .9 Clean formwork in accordance with CSA A23.1 before placing concrete.
 - .10 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 1 day for walls and sides of beams or in accordance with Section 03 35 00.
 - .2 1 day for columns or in accordance with Section 03 35 00.
 - .3 28 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.
 - .4 1 day for footings and abutments.
 - .11 Wall, column and beam side forms shall not be removed until concrete has achieved 10 MPa minimum strength and form removal will not damage concrete.
 - .12 Beam and suspended slab soffit formwork shall not be removed until concrete has achieved 22 MPa minimum strength. Re-shore as per Clause 3.2.
 - .13 Re-use of formwork and falsework subject to the requirements of CSA A23.1.

3.2 RE-SHORING

- .1 Arrange forms to allow stripping without removal of the principal shores, where these are required to remain in place.
- .2 Immediately after removal of formwork, re-shore in two directions so that no large areas of new construction are permitted to support their own weight. Install re-shores at mid-span of members and at locations specified by the formwork and falsework design professional engineer, but in no case more than 3000 mm centre to centre. Tighten re-shores to carry the weight of new construction and any other loads imposed thereon. Do not over-stress new construction by over-tightening.
- .3 Forms not directly supporting the weight of concrete may be removed as soon as the stripping operation will not damage the concrete.
- .4 Re-shores to remain in position for a minimum period of 28 days after concrete placement.

3.3 ARCHITECTURAL CONCRETE FINISH

- .1 In addition to the requirements specified herein, and in Clause 8.3.4 of CSA A23.1, formwork for architectural concrete shall also comply with the following:
 - .1 Ensure that formwork is constructed so that finished concrete surfaces will be free from any imperfections as a result of, but not limited to,

- misalignment or warping of forms, misalignment or warping of plywood or steel elements, inadequate tightness of forms, mortar leakage and any texture imparted by formwork.
- .2 Establish pattern for form ties and reveals in accordance with pattern for form ties and reveals indicated on the drawings.
 - .3 Back all edges of forms and brace to assure that mortar leakage is eliminated. Carefully inspect forms prior to erecting to ensure debris has not entered formwork voids.
- .2 Maintain true right-angled corners for all exposed edges of concrete, unless otherwise indicated.
 - .3 Joint widths shall be no greater than 2 mm.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

- .1 Concrete Forming & Accessories: Section 03 10 00
- .2 Cast-in-Place Concrete: Section 03 30 00
- .3 Concrete Unit Masonry: Section 04 22 00
- .4 Post-Installed Concrete Anchors: Section 05 05 19

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A1064/A1064M-13, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .3 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA G30.18-09, Billet-steel Bars for Concrete Reinforcement.
 - .3 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.4 SOURCE QUALITY

- .1 Provide the Departmental Representative with certified copies of mill test reports of reinforcing steel, showing physical and chemical analysis, minimum five (5) weeks prior to commencing reinforcing work.
- .2 Inform the Departmental Representative of proposed source of material to be supplied.
- .3 Testing of the reinforcement will be at the discretion of the Departmental Representative. As a minimum, there will be one tensile and one bend test for each bar size used on the project.

1.5 SUBSTITUTES

- .1 Submit substitutes in accordance with Section 01 01 50.
- .2 Substitution of different size bars permitted only upon the written approval of the Departmental Representative.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Reinforcing Steel: to CSA G30.18, billet steel, Grade 400, unless indicated otherwise on Drawings.
- .2 Welded Steel Wire Fabric: to ASTM A1064/A1064M. Provide in flat sheets only.
- .3 Chairs, Bolsters, Bar Supports, Spacers: to CSA-A23.1 (non-metallic).
- .4 Mechanical Splices: to develop the full capacity of the bar size being spliced, as manufactured by Dayton Superior (Bar Grip), or Lenton, or alternate pre-approved by the Departmental Representative subject to the approval of the Departmental Representative.
- .5 Dowel Bars: to develop full capacity of the bar size being spliced, as manufactured by Dayton Superior or alternate pre-approved by the Departmental Representative.
- .6 Weldable Rebar Dowels: as noted on the drawings. Field welding by others.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CSA-A23.1 and ACI 315R.
- .2 Obtain the Departmental Representative's approval for locations of reinforcement splices other than shown on Drawings. Stagger splices in adjacent bars.
- .3 Horizontal reinforcement to be made continuous around corners by use of corner bars of same size and strength as horizontal bars and as indicated on the Drawings.
- .4 Bars noted as continuous to be spliced in accordance with Drawings, staggered where possible.
- .5 Provide standard hook length for all bars noted "H1E", unless noted otherwise.
- .6 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and list.

3.0 EXECUTION

3.1 FIELD BENDING

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

3.2 PLACING

- .1 Place reinforcing steel as indicated on drawings and in accordance with CSA A23.1.
- .2 Metal reinforcement shall be protected by thickness of concrete indicated on drawings or as specified in CSA A23.1.
- .3 Clean reinforcing steel of excess rust and previously deposited concrete prior to placing concrete.
- .4 Use non-metallic chairs and bolsters to support all reinforcement. Reinforcement shall be accurately placed and secured against displacement. Chairs in exposed concrete beam, slab band, and slab soffits shall be placed in a regular pattern. Randomly placed strips of "caterpillar" chairs shall be avoided.
- .5 Anchor bolts, dowels, and steel embedment's shall be set before concrete placement and shall not be inserted into placed concrete.
- .6 The Department Representative shall be notified when the reinforcing steel is in place and in sufficient time to permit an inspection of same prior to concrete placement.
- .7 Cooperate with trades placing in-slab electrical services and radiant heating piping. Do not damage or displace items placed by other trades.
- .8 Drilled dowels to existing concrete shall be installed with ejection adhesive epoxy to the standard embedment specified by the manufacturer or as shown on the drawings, in accordance with Section 05 05 19.
- .9 Reinforcement shall be spliced only in locations shown on the drawings or as approved in writing by the Department Representative.
- .10 Where reinforcing bars are interrupted by formwork, provide threaded couplers that develop the full capacity of the bar being spliced or dowels with lap lengths specified on the drawings.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

- .1 Concrete Forming & Accessories: Section 03 10 00
- .2 Concrete Reinforcement: Section 03 20 00
- .3 Concrete Finishes: Section 03 35 00

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-13, Cementitious Materials Compendium.
 - .3 CAN/CSA-A3001-13, Cementitious Materials for Use in Concrete.
 - .4 CAN/CSA-A363-M88, Cementitious Hydraulic Slag.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C494-16, Standard Specification for Chemical Admixtures for Concrete.
 - .3 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-51M, Polyethylene Sheet for Use in Building Construction.

1.4 CERTIFICATES

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

1.5 QUALITY CONTROL

- .1 Submit proposed quality control procedures to the Departmental Representative for review.

1.6 SAMPLES AND PROTOTYPES

- .1 Material samples: submit the following samples of materials for approval to the Departmental Representative. Approved samples shall be used as the acceptable standard for all materials used on the project.
 - .1 Forming materials, including Class 1 Architectural Concrete finish materials.
 - .2 Gaskets, sealing materials, and form jointing system (as applicable).
 - .3 Ties, cones, and recessed precast concrete plugs, where specified.
 - .4 Rustication strips, reveals, and reglet forming material.
 - .5 Form release agent.
 - .6 Expansion and isolation joints.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Portland cement: Type GU or Type HS, as required to CSA A3000 and CSA A3001.

- .2 Cementitious hydraulic slag: to CSA A363.
- .3 Water: to CSA A23.
- .4 Aggregates: to CSA A23. Coarse aggregates to be normal density.
- .5 Air entraining admixture: to ASTM C260.
- .6 Chemical admixtures: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Super-plasticizer: to CAN3-A266.5 "Guidelines for the use of Super-plasticizing Admixtures in Concrete".
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, portland cement, water reducing and plasticizing agents of pouring consistency, capable of developing a compressive strength of 50 MPa at 28 days.
- .9 Concrete curing and sealing compound: where slabs are to receive resilient flooring or carpeting, use curing compounds compatible with flooring adhesive. Do not use where bond required for additional concrete or surface coating. Acceptable products are as specified in Section 03 35 00.
- .10 Bonding agent: formulated for bonding new concrete to cured concrete. Acceptable products are as specified in Section 03 35 00.
- .11 Waterstops: extruded PVC with factory welded corner and intersecting pieces.
- .12 Pre-moulded joint fillers, expansion and isolation joints: bituminous impregnated fibre board to ASTM D1751.
- .13 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .14 Under slab vapour barrier membrane: polyethylene film, 0.25 mm (10 mil.) thickness, to CGSB 51-GP-51M, in accordance with Section 07 27 19.
- .15 Control joints: all areas of slab-on-grade concrete require saw-cut joints. See structural and architectural drawings for layout pattern and depth of cut. Joint pattern to match architectural finish patterns. Depth of cut to be 30 mm minimum unless noted otherwise. Cuts to be done within 24 hours of pour but after such time that cutting will not damage the slab edges at the cuts.

2.2 CONCRETE MIXES

- .1 Proportion normal density concrete in accordance with CSA A23.1, Alternative 1, to give the properties shown on the structural drawings.
- .2 Mix designs are to be established in accordance to CSA A23.1, Clause 4.3.5.1 or Clause 4.3.5.2.
- .3 Concrete mix designs to be submitted to the Departmental Representative for review prior to commencing work.

3.0 EXECUTION

3.1 GENERAL

- .1 Do cast-in-place concrete work in accordance with CSA A23.1.

3.2 WORKMANSHIP

- .1 Obtain the Departmental Representative's approval before placing concrete. Provide 24 hours' notice, minimum, prior to placing concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix design.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain the Departmental Representative's approval of proposed method for protection of concrete during placing and curing. Provide minimum of 3 day moist curing for all slabs with an exposure class of N and 7 day moist cure for all other exposure classes.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 Concrete shall not be deposited on concrete which has hardened sufficiently to

cause the formation of seams or plains of weakness. If a section cannot be placed continuously, construction joints shall be located as permitted by the Departmental Representative. All pour and construction joints shall be formed with a straight-edge fixed to formwork. Placing shall be carried out at such a rate that concrete which is being integrated with fresh concrete is still plastic.

- .7 Compact concrete with high-frequency vibrators applied directly to concrete by experienced personnel. Do not over-vibrate.
- .8 In locations where new concrete is dowelled to already completed work, drill holes in existing concrete. Attach steel dowels of deformed steel reinforcing bars with an epoxy adhesive to the depths shown on the drawings or specified by the manufacturer, in accordance with Section 05 05 19. Intentionally roughen interface between existing and new concrete to 6 mm amplitude.
- .9 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period, such as corners of columns, walls, and stair nosings, shall be especially protected with wood furring. All exposed concrete floor surfaces shall be protected from staining and damage by suitable means.
- .10 Do not place load upon new suspended concrete until the concrete has reached the design 28 day strength, or has been suitably shored for the anticipated loads and/or as authorized by the Departmental Representative.

3.3 INSERTS

- .1 Set sleeves, ties, pipe hangers, brace bay base hardware, embed plates, and other inserts and openings as indicated or specified elsewhere.
- .2 Sleeves and openings in slabs and walls greater than 300 mm x 300 mm not indicated on structural drawings must be approved by the Departmental Representative.
- .3 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where expressly detailed on the structural drawings or approved by the Departmental Representative.
- .4 Electrical conduits shall not be larger in outside diameter than one-third the thickness of the slab or wall in which they are embedded nor spaced closer than three diameters on centre.
- .5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Departmental Representative before placing of concrete.
- .6 Verify locations and sizes of sleeves and openings shown on the structural drawings with architectural, mechanical, and electrical drawings.
- .7 Set special inserts for strength testing as indicated and as required by Non-Destructive Method of Testing Concrete.
- .8 Anchor bolts: set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
- .9 Dovetail Anchor Slots: install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

3.4 PLACING GROUT

- .1 Grout underside of steel column and beam bearing plates with non-shrinking grout to manufacturer's instructions. Place grout to cover steel shims left in place.

3.5 TOLERANCES

- .1 Concrete tolerances to be in accordance with CSA A23, or as noted in Section 03 10 00 sub-section 3.1.6.

3.6 PATCHING

- .1 General:
 - .1 Areas to be repaired shall be determined by the Departmental Representative and shall not exceed 0.2 m² for each 100 m² of surface

- area, and shall be widely dispersed. Repairs shall match the surrounding area. Patching of horizontal paving will not be accepted.
- .2 Before commencing any repair work, the Contractor shall confirm repair procedures with the Departmental Representative and establish by trial mix the formula required. The Contractor shall demonstrate his repair techniques on a prototype sample panel.
- .2 The following are key steps to making a repair to architectural concrete:
- .1 Prepare the area to be repaired. This should include achieving the desired finish in the surrounding area. Remove loose particles and chip out part of the sound concrete to avoid feather edge repairs.
 - .2 Proportion the repair mix by weight according to the same proportions as used in the concrete mix but substituting a portion of white cement for grey cement. This should be based on tests to determine what is required to match the finished surface.
 - .3 Apply a coat of bonding material to the root of the areas to be repaired, being careful to avoid dripping on any surface to be exposed.
 - .4 Fill in the area to be repaired with mortar of the stiffest consistency that will permit placing. Consolidate in place and strike off so as to leave the repaired area slightly higher than the surrounding surface to permit initial shrinkage. The repair shall be left undisturbed for at least one hour before being textured.
 - .5 The repaired area shall be cured by suitable means to minimize shrinkage and cracking and provide a durable finish.
 - .6 Clean the repaired area to remove laitance and match the surrounding area.
- .3 Repair of cracks in concrete slabs and slabs-on-grade shall be the sole responsibility of the Contractor to satisfy the requirements of the floor finishes.

3.7 FINISHING

- .1 Formed surface: the finishes to be provided for the various formed surfaces shall be:
- .1 Unexposed Finish:
 - .1 This finish shall apply to formed surfaces which are not exposed to view and where roughness is not objectionable.
 - .2 The surface, in general, shall not require any treatment after form removal, other than repair of defective concrete, snap-tie holes, and the removal of ridges and surface irregularities.
 - .2 Class 1 Architectural Concrete Finish:
 - .1 This finish shall apply to formed exterior architectural concrete surfaces which are exposed to view, in accordance with Section 03 35 00.
 - .3 Class 2 Smooth Form Finish:
 - .1 This finish shall apply to formed exposed interior Class 2 concrete surfaces in accordance with Section 03 35 00.
- .2 Unformed surface: the finish to be provided for the various unformed surfaces shall be:
- .1 Plastic Concrete Surfaces:
 - .1 Working of the concrete surface shall take place while it is sufficiently plastic to achieve the desired shape, plane, and texture. Screeding shall be followed by one or more of the operations of darbying, floating, trowelling, and tooling of edges and joints, in that order, to provide the surface finish specified in the drawings or by the Departmental Representative.
 - .2 Initial finishing shall be accomplished by screeding, darbying, or bull floating and shall be performed in accordance with the requirements of CSA A23.1, Clause 7.6, Finishing of Concrete Floor Surfaces.

- .3 Initial finishing operations shall be completed before any bleed or free water appears on the concrete surface. Overworking, which can bring excessive fines to the concrete surface, shall not be permitted.
- .4 Final finishing shall be accomplished by mechanical floating, mechanical trowelling, creation of the specified surface finish, and tooling or edges and joints, in that order. Exposed edges and corners shall be as detailed. Surfaces at tooled edges shall be trowelled and sand-blasted to remove tool edge marks. Hand floating and trowelling shall only be permitted in small areas of restricted access. All final finishing procedures shall conform to the requirements of CSA A23.1, Clause 7.6.4, Final Finishing.
- .5 Final finishing shall commence after bleed water has disappeared from the surface and when the concrete has stiffened sufficiently to prevent the working of excess water to the surface. No additional dry cement or water shall be used to facilitate finishing.
- .6 The final finish to be provided shall be as specified on the drawings and in accordance with Section 03 35 00 for floor finishes.

3.8 WATERSTOPS

- .1 Install waterstops at all joints in all foundation walls surrounding below grade occupied spaces to provide continuous water seal. Do not distort or pierce waterstop to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.
- .2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections.

3.9 JOINT FILLERS

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

3.10 CONTROL JOINTS

- .1 Provide control joints in foundation walls in accordance with the details on the drawings at maximum 6.1 m on centre. Align joints to suit architectural features.
- .2 Provide saw-cut joints in all slabs-on-grade and concrete paving in accordance with the details on the drawings and to suit the Departmental Representative finishes. Review locations with the Departmental Representative.

3.11 HOUSEKEEPING AND EQUIPMENT PADS

- .1 Provide concrete pads and curbs under equipment where indicated on drawings and as specified in Division 22, Division 23, Division 26, any other applicable division, and to approved shop drawings. Dowel pads and curbs to base slab in accordance with details on the drawings.

3.12 EXTERIOR SLABS-ON-GRADE AND PAVING

- .1 Exterior slabs-on-grade used for pedestrian access only shall be a minimum 100 mm thick reinforced with 10M at 350 mm each way. Slabs-on-grade and paving for vehicle access shall be minimum 175 mm thick reinforced with 15M at

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- 300 mm each way. Thicken edges to 300 mm.
 - .2 Provide minimum 100 mm thick layer of 20 mm minus clean crush gravel base under exterior slabs.
 - .3 Provide control joints at 3000 mm on centre each way unless noted otherwise.

3.13 QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Departmental Representative in accordance with CSA A23.1. Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2.
- .2 Testing Laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under the same conditions as concrete which they represent.
- .3 If results of tests show concrete to be less than specified in quality or strength, the Departmental Representative shall have the right to have the mix designs altered for the remainder of the work at no cost to the Departmental Representative. Further testing and remedial measures required by CSA A23.1 shall be done, the costs of this work paid for by the Contractor.
- .4 Inspection or testing by the Departmental Representative will not augment or replace Contractor quality control nor relieve them of their contractual responsibilities.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 This section relates to civil concrete work external to the building, relevant to concrete walks and cast-in-place concrete associated with subsurface utility works, manholes, catchbasins, lawn drains, watermains, sewers and drainage.
- .2 Building structure concrete is specifically excluded from the scope of this section.

1.2 RELATED SECTIONS

- .1 Section 32 16 15 – Concrete Walks, Curbs and Gutters
- .2 Section 33 05 13 – Manholes and Catchbasin Structures
- .3 Section 33 11 16 – Site Water Utility Distribution Piping

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .2 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
 - .3 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .3 CSA International
 - .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Provide to Departmental Representative, 4 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 Quality Control Plan (QCP): provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements. The QCP is to include details of the sampling
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and testing of concrete in compliance with CSA-A23.1. The results of all testing are to be furnished to the Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

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

2.3 MATERIALS

- .1 Cement: to CSA A3001.
- .2 Water: to CSA A23.1/A23.2.
- .3 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.
- .4 Welded steel wire fabric: to ASTM A185.
- .5 Premoulded joint filler:
 - .1 Bituminous impregnated fibreboard: to ASTM D1751.
- .6 Joint sealer/filler: grey to CAN/CGSB-19.24, Type 1, Class B.
- .7 Sealer: boiled linseed oil to ASTM D260, mixed with mineral spirits 1:1 proprietary poly-siloxane resin blend.
- .8 Waterstops: extruded ribbed PVC strips, 12MPa tensile strength, minimum 350% elongation, minus 45 to plus 80 degrees centigrade working temperature.
- .9 Supplementary and other concrete materials: to CSA A23.1/A23.2.

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 – FIELD QUALITY CONTROL.

- .2 Intended application: Pavements, walks, curbs and gutters and exposed site concrete.
 - .1 Uniformity and workability: free of surface blemishes, loss of mortar, colour variations, segregation.
 - .2 Durability and class of exposure: C-2.
 - .3 Compressive strength at 28 days: 32 MPa minimum.
 - .4 Nominal maximum aggregate size 20 mm.
- .3 Intended application: Subsurface civil works.
 - .1 Uniformity and workability: free of loss of mortar, segregation.
 - .2 Durability and class of exposure: C-4.
 - .3 Compressive strength at 28 days: 25 MPa minimum.
 - .4 Nominal maximum aggregate size 28 mm.
 - .5 For cast-in-place manhole bases achieve reduced permeability in the long term.
- .4 Concrete supplier's certification required.
- .5 Provide quality management plan to ensure verification of concrete quality to specified performance.

Part 3 Execution

3.1 PREPARATION

- .1 Provide Departmental Representative 24 hours notice before each concrete pour.
- .2 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.
- .3 Protect previous Work from staining.
- .4 Clean and remove stains prior to application of concrete finishes.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.
 - .2 Sleeves and openings greater than 100 mm x 100 mm not indicated, must be reviewed by Departmental Representative.

3.3 FINISHES

- .1 Formed surfaces exposed to view: in accordance with CSA A23.1/A23.2, unless specified otherwise.
- .2 Pavements, walks, curbs and exposed site concrete:

- .1 Screed to plane surfaces and using aluminum, magnesium or wood floats.
- .2 Provide round edges and joint spacings using standard tools.
- .3 Trowel smooth and provide lightly brushed / broomed non-slip finish, unless specified otherwise.

3.4 CONTROL JOINTS

- .1 Form control joints at spacing as indicated below, to CSA A23.1/A23.2 and install joint sealer/filler.
- .2 Spacings as follows:
 - .1 Expansion joints at 9.0m maximum spacing (typical)
 - .2 Control joints at 3.0m maximum spacing (typical)
 - .3 Dummy joints at 1.5m maximum spacing (typical)
 - .4 Isolation joints around all features, such as street light bases, which protrude through the concrete.
 - .5 Contractor to layout jointing pattern in the field for review and approval by the Departmental Representative before concrete is poured. Contractor is to provide 2 complete working days' notice before review.

3.5 EXPANSION AND ISOLATION JOINTS

- .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface to CSA A23.1/A23.2.

3.6 CURING

- .1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.7 SEALING APPLICATION

- .1 After curing is complete, apply poly-siloxane resin blend sealer at 4 m²/L.

3.8 FIELD QUALITY CONTROL

- .1 Concrete testing: to CSA A23.1/A23.2 by independent testing laboratory. A minimum of two sets of test samples per concrete batch are required.

3.9 CLEANING

- .1 Use trigger operated spray nozzles for water hoses.
- .2 Designate cleaning area for tools to limit water use and runoff.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 American Concrete Institute (ACI):
 - .1 ACI 117-10, ACI Manual of Practice: Specifications for Tolerances for Concrete Construction and Materials, (ACI 117-10) and Commentary.
 - .2 ACI 301-10, Specification for Structural Concrete.
 - .3 ACI 302.1R-15, ACI Manual of Practice: Guide for Floor and Slab Construction.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .2 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .4 Canadian Standards Association (CSA)
 - .1 CSA-A23.1- 05/A23.5-05 (R2015), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete, Includes Updates through No. 1 (2011).
- .5 International Concrete Repair Institute (ICRI)
 - .1 ICRI 310-2013, Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.
- .6 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.

1.3 PERFORMANCE REQUIREMENTS

- .1 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.

- .2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.
- .3 Include application instructions for concrete floor treatments.
- .2 Submit closeout data in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions and submit a complete list of floor care products that will be required for on-going maintenance.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
 - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power:
 - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
 - .1 Make the work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature:
 - .1 Maintain ambient temperature of not less than 10 degree C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Arrange for ventilation system to be operated during installation of concrete floor treatment materials by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with Section 01 01 50 – General Instructions, Temporary Utilities.
 - .3 Provide continuous ventilation during and after coating application.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 F1-Finishing: Floors having a straightedge value of ± 8 mm over 3050 mm with overall F-number of $F_F 20 \times F_L 15$; floors having an SWI of 4 mm; similar to CSA A23.1 Class A Slab Finishing.
- .2 F3-Finishing: Floors having a straightedge value of ± 5 mm over 3050 mm with overall F-number of $F_F 30 \times F_L 25$; meeting requirements for CSA A23.1 Class C slab finishing.

2.2 LEVELLING MATERIALS

- .1 Underlayment: Cementitious, self levelling, single component, polymer modified underlayment and manufacturer's low VOC recommended primer, for application thicknesses to a minimum feather edge to 13 mm; and as follows:
 - .1 Performance properties:
 - .1 Mixing ration: 4.73 to 5.0 L of water per 22.7 kg of powder.
 - .2 Cured Density: approximately 2.1 kg per L
 - .3 Compressive Strength (ASTM C349):
 - .1 1 day: > 8.62 MPa
 - .2 7 days: > 18.6 MPa
 - .3 28 days: >29.0 MPa
 - .4 Flexural Strength (ASTM C348 and CAN/CSA-A23.2):
 - .1 1 day: > 3.45 MPa
 - .2 7 days: > 3.93 MPa
 - .3 28 days: > 7.24 MPa
 - .5 Pull-Out Strength (Direct Tensile Bond test – rupture in concrete substrate, CAN/CSA-A23.2):
 - .1 3 days: > 1.79 MPa
 - .2 7 days: > 2.07 MPa
 - .3 28 days: >2.41 MPa
 - .2 Patching and Flash Patching Materials: Cementitious based, polymer modified, fine aggregate, single component, rapid curing, early strength floor patching compounds having high adhesion with manufacturer's recommended primer and surface profile; for application in thicknesses to a minimum of 4 mm to 25 mm, and as follows:
 - .1 Performance Properties: at 23°C:
 - .1 Compressive Strength (ASTM C109 and CAN/CSA-A5):
 - .1 3 hours: > 24.1 MPa
 - .2 1 day: > 34.5 MPa
 - .3 7 days: > 37.9 MPa
 - .4 28 days: > 48.3 MPa
 - .2 Compressive Strength (ASTM C39):

- .1 28 days: > 41.4 MPa
- .3 Flexural Strength (ASTM C348 and CAN/CSA A23.2):
 - .1 28 days: >6.9 MPa
- .4 Slant/Shear Bond Strength (ASTM C882)
 - .1 1 day: 12.4 MPa
 - .2 7 days: 17.2 MPa
- .5 Length Change (ASTM C157):
 - .1 28 days (water): $\leq +0.15\%$
 - .2 28 days (air): $\leq +0.15\%$
- .6 Splitting Tensile Strength (ASTM C496)
 - .1 1 day: 2.76 MPa
 - .2 28 days: 4.14 MPa
- .7 Freeze/Thaw Resistance at 300 cycles (ASTM C666): 98%
- .8 Rapid Chloride Permeability (ASTM C1202)
 - .1 28 days: < 1000 coulombs
- .9 Scaling Resistance at 25 cycles (ASTM C672): 0 rating; no scaling

2.3 HARDENERS

- .1 Hardener: Sodium silicate, permanent penetrating sealer, hardener and densifier:
 - .1 Liquid applied, water based, chemically reactive.
 - .2 Non-toxic, non-flammable, and anti-dusting have low or no VOC.
 - .3 Colour: colourless
 - .4 Performance Properties:
 - .1 Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779
 - .2 Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
 - .3 Hardening: As follows when tested in accordance with ASTM C39:
 - .1 After 7 Days: An increase of at least 40% over untreated samples.
 - .2 After 28 Days: An increase of at least 38% over untreated samples.
 - .4 Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C1028.
 - .5 Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.
 - .6 Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.
- .2 Water: potable.

2.4 SEALING COMPOUNDS

- .1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based, clear.
 - .1 Surface sealers manufactured or formulated with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, hexavalent chromium and their compounds are not acceptable.
 - .2 Surface sealer shall be compatible with the hardener and shall be manufactured by hardener manufacturer.
 - .3 Surface sealer shall have less than 100g/l of VOC in accordance with SCAQMD Rule #1113.

2.5 MIXES

- .1 Mixing, ratios and application in accordance with manufacturers instructions.

2.6 ACCESSORIES

- .1 Joint Filler Strips:
 - .1 Floor Isolation Joints: ASTM D1751, bituminous impregnated fibreboard, or ASTM D1752, cork or self-expanding cork, 13 mm thick minimum.
 - .2 Edge Joint Filler: ASTM D1751, bituminous impregnated fibreboard, 13 mm thick minimum.
- .2 Control Joint Filler:
 - .1 Two component, 100% solids, epoxy-urethane, load bearing, self levelling sealant.
 - .1 Performance Properties:
 - .1 Shore Hardness (ASTM D2240): 75 to 80A
 - .2 VOC: < 28 g/L
 - .3 Elongation (ASTM D412): > 450%
 - .4 Tensile Strength (ASTM D412): > 4.14 MPa
 - .5 100% Modulus (ASTM D412): > 270%
 - .6 300% Modulus: (ASTM D412): > 435%
 - .7 Tear Strength (ASTM D624, Die C): 150 pli
 - .8 Tear Abrasion (ASTM D4060): 840 mg loss
- .3 Exterior Tactile Warning Strips: cast-in-place, replaceable, tactile walking surface with dome pattern that complies with CSA B651 and is weather and wear resistant:
 - .1 Colour: to be selected by Departmental Representative from manufacturers standard colours.
 - .2 Size: as indicated on Drawings.
 - .3 Performance Criteria:
 - .1 Wheel Load Test: 4722 kg to AASHTO HS20-44
 - .2 Compressive Strength: \geq 172 MPa to ASTM D695
 - .3 Flexural Strength: \geq 207 MPa to ASTM D790
 - .4 Tensile Strength: \geq 86 MPa ASTM D638

- .5 Coefficient of Thermal Expansion: $1.35 \times 10^{-6}/^{\circ}\text{C}$ to ASTM D696
- .6 Static Coefficient of Friction: ≥ 0.8 wet/dry to ASTM C1028
- .7 Flame Spread Index: ≤ 25 to ASTM E84
- .8 Water Absorption: $\leq 0.05\%$ ASTM D570
- .9 Abrasive Wear Index lw: > 500 ASTM C501
- .10 Accelerated Weathering: $\Delta E < 5$ to ASTM G155
- .11 Freeze/Thaw: no effect to ASTM C1026
- .12 Salt Spray (300 hours): no effect to ASTM B117
- .13 Accelerated Aging Cycle Testing: no effect to ASTM D1037
- .14 Chemical Resistance: no effect to ASTM D543

Part 3 Execution

3.1 EXAMINATION

- .1 Prepare floor surface in accordance with CSA A23.1.
- .2 Verify that slab surfaces are ready to receive work and elevations are as instructed by manufacturer.

3.2 REPAIRS

- .1 Inspect surfaces for defects immediately after removal of forms. Repair or patch defects within 48 hours of removal of forms with cure repairs same as new concrete with Departmental Representative's permission.
- .2 Defective Areas: where patches are allowed, repair and patch areas to match surrounding areas in texture and colour.

3.3 PREPARATION OF EXISTING SLAB

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
- .2 Saw cut control joints to CSA-A23.1, 24 hours maximum after placing of concrete.
- .3 The tops of all floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated on the drawings, ready to receive the specified finish.
- .4 The minimum floor flatness (F_F) required is to CSA-A23.1/A23.2, Table 16, Class B slab finishing, straight edge tolerance $\pm 6\text{mm}$ over 3050. Floors having an overall F-number of $F_F 25 \times F_L 20$.
- .5 Interior floors indicated as exposed concrete are to be finished in accordance with the slab finishing schedule on the structural drawings. For slab areas not noted in the finishing schedule, slabs shall be smooth concrete with steel trowel finish.
- .6 Depress floor slabs where shown and as required for floor finishes.

- .7 Remove any curing agents used during concrete installation a minimum of 28 days prior to installation of flooring materials.
- .8 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.
- .9 Use protective clothing, eye protection, and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.4 FINISHING FORMED SURFACES

- .1 Requirements listed below apply to normal structural concrete; refer to Section 03 30 00 for additional requirements for formed exposed architectural concrete.
- .2 Unspecified Finish: Provide following finishes as applicable when finish of formed surfaces is not specifically indicated:
 - .1 Unexposed Surfaces:
 - .1 Rough form finish for concrete not exposed to view.
 - .2 Exposed Surfaces:
 - .1 Smooth form finish for concrete surfaces exposed to view.
- .3 Rough Form Finish: Leave surfaces with texture imparted by forms; patch tie holes and defects; remove fins longer than 6 mm high.
- .4 Smooth Form Finish: Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces with number of seams kept to a minimum, uniformly spaced in an orderly pattern; patch tie holes and defects; completely remove fins.
- .5 Related Unformed Finish: Strike-off concrete smooth and finish with using texture matching adjacent formed surfaces at tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces; continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces.

3.5 FINISHING FLOORS AND SLABS

- .1 Finish floors and slabs in accordance with CSA A23.1 and ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces; do not wet concrete surfaces.
- .2 Unspecified: Provide following finishing classes as applicable when finishing requirements for floors is not specifically indicated:
 - .1 Exterior Slabs: F1-Finishing Class with a broom finish.
 - .2 Interior Slabs: F3-Finishing Class with a trowelled finish.
- .3 Scratch Finishing:
 - .1 Texture concrete surface that have been screeded and bull-floated or darbied while still plastic.
 - .2 Use stiff brushes, brooms, or rakes to produce a profile amplitude of 6 mm in 1 direction.
 - .3 Apply scratch finishing to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

- .4 Float (Initial) Finishing:
 - .1 Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power driven floats.
 - .2 Re-straighten, cut down high spots, and fill low spots.
 - .3 Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
 - .4 Apply float finishing to surfaces indicated and receiving trowel finishing.
- .5 Trowel (Final) Finishing:
 - .1 Commence trowel finishing after all bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface.
 - .2 Apply first trowelling and consolidate concrete by hand or power-driven trowel after applying float finishing; continue trowelling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance; repair or smooth any surface defects that would telegraph through applied coatings or floor covering.
 - .3 Apply a trowel finishing to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - .4 Finish surfaces to the tolerances indicated above.
- .6 Broom Finishing:
 - .1 Apply a broom finishing to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - .2 Slightly roughen trafficked surface by brooming with fibre bristle broom perpendicular to main traffic route immediately after float finishing.
 - .3 Coordinate required final finishing with Departmental Representative before application.

3.6 APPLICATION: GENERAL

- .1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
- .2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
- .3 Clean overspray. Clean sealant from adjacent surfaces.
- .4 Cure concrete in accordance with manufacturers recommended procedures.

3.7 APPLICATION: LIQUID APPLIED FLOOR HARDENER

- .1 Apply liquid floor hardener in accordance with manufacturer's written instructions after initial floating.
- .2 Cure concrete in accordance with manufacturer's recommended instructions.
- .3 Apply hardener to horizontal and vertical exposed concrete to remain unfinished.

3.8 INSTALLATION: TACTILE WARNING STRIP

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

3.9 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 07 21 13 – Board Insulation
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 46 19 – Steel Siding
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim
- .6 Section 07 92 00 – Sealants
- .7 Section 09 21 16 – Gypsum Board Assemblies
- .8 Section 09 91 99 – Painting for Minor Works

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A116-11, Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric.
 - .2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A153/A153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM A307-12, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - .5 ASTM A641/A641M-09a, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .6 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .7 ASTM A1011/A1011M-14, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - .8 ASTM C140/C140M-14, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - .9 ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .10 ASTM C 597-16, Standard Test Method for Pulse Velocity Through Concrete
 - .11 ASTM C 1383-15, Standard Test Method for Measuring the P-Wave Speed and the Thickness of Concrete Plates Using the Impact-Echo Method.
- .2 Brick Industry Association (BIA)
 - .1 Technical Note No. 20-2006, Cleaning Brick Work.

- .3 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN/CSA-A165 Series-14, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2, and A165.3)
 - .3 CSA A179-14, Mortar and Grout for Unit Masonry.
 - .4 CSA A370-14, Connectors for Masonry.
 - .5 CAN/CSA A371-14, Masonry Construction for Buildings.
 - .6 CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014), Update No. 3 (2014).
 - .7 CSA S304.1-14, Design of Masonry Structures.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate lines, levels and coursing with work of other Sections.
 - .2 Obtain built-in items prior to start of this work.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor, Subcontractor, material supplier and Departmental Representative in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements including specification and details for project.
 - .2 Confirm required mortar, grout and concrete testing; review batch control and grouting procedures.
 - .3 Co-ordination with related Work including, but not limited to, air/vapour membranes and insulation.
 - .4 Review cavity drainage requirements and methods for keeping mortar out of cavity spaces.
 - .5 Coordinate crack control measures.
 - .6 Review requirements for reinforcement at corners and wall intersections.
 - .7 Review membranes and membrane flashing materials and details used for construction.
 - .8 Confirm trowelled or tooled joints to concealed and exposed masonry faces.
 - .9 Review methods for controlling efflorescence during construction.
 - .10 Review hot and cold weather requirements.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Provide manufacturer's printed product literature, specifications and data sheet. Indicate masonry types, shapes, sizes, and textures.
 - .2 Cementitious Materials:

- .1 Include brand, type, and name of manufacturer for site mixed mortar materials.
- .2 Submit proposed mix proportions and sand analysis reports and compressive strength reports on the proposed mortar mix(es).
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals Procedures.
 - .1 Provide 3 concrete masonry units (face only) to show texture and colour variance for each type of masonry unit used.
 - .2 Obtain review comments from Departmental Representative prior to ordering.

1.5 QUALITY ASSURANCE

- .1 Conform to CAN/CSA A371, except as modified by this specification.
- .2 The masonry contractor shall be a member in good standing with the Masonry Institute of British Columbia and be qualified under the current Technical Masonry Certification (TMC) program.
- .3 The masonry Subcontractor shall have a minimum of five (5) years of experience on projects of similar size and magnitude and shall provide continuous active supervision by a journeyman mason while masonry work is in progress.
- .4 Masonry work shall be performed by experienced, qualified journeyman masons under the direct and continual full-time supervision of certified masons.
- .5 Before starting masonry work establish mix proportions based on the limitations set out in Table 2 of CSA A179.
- .6 Test laboratory prepared samples of the proposed mortar(s) for compressive strength in accordance with CSA A179, by a laboratory approved by the Departmental Representative. The Contractor will pay for the cost of all mortar testing.
- .7 Connectors and joint reinforcement shall conform to CSA A370.
- .8 Miscellaneous masonry accessories, and their use where not otherwise specified but shown or required for proper completion of the Work, shall conform to CSA A371.
- .9 Regulatory Requirements: Provide fire resistance rated materials and construction identical to those of assemblies with fire resistance ratings determined by ULC Listings.
- .10 The Contractor must engage a testing agency, approved by the Departmental Representative, and conduct ultrasound or impact-echo non-destructive testing per ASTM C 597 or ASTM C1383 standards on all grouted masonry walls, to confirm grouted cores are properly set without voids and grout is properly bonded to the masonry blocks and reinforcement. The Contractor will pay for the cost of all non-destructive testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver masonry units on pallets or cubes, suitably protected from road grime and moisture absorption due to exposure to rain or melting snow.

- .2 Unload and store on dry, level areas, without direct contact with the ground.
- .3 Remove plastic wrappings from concrete masonry units and cover with waterproof coverings which will provide protection from the elements but allow for air circulation.
- .4 Deliver cement, lime, and mortar in dry condition with manufacturer's label intact and store under waterproof cover and protected from elements.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 SITE CONDITIONS

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
 - .1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.
 - .2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.
- .2 Provide adequate bracing for masonry during construction and until permanent lateral supports are in place.

Part 2 Products

2.1 CONCRETE MASONRY UNITS

- .1 Standard Concrete Masonry Units: to CAN/CSA A 165.1 and as follows:
 - .1 Classification: H/15/B/M (standard) except as modified by fire resistance requirements.
 - .2 Fire Rated Concrete Masonry Units: Aggregate type and equivalent thickness as required to provide fire resistance indicated, determined in accordance with Building Code and as indicated on Drawings.
 - .3 Size (Nominal): As indicated on Drawings
 - .4 Special shapes: provide plain end, bull-nosed and double bull-nosed units for exposed corners as indicated on Drawings. Lintels and bond beams are constructed using knock-out lintel units. Provide additional special shapes as indicated.

2.2 MORTAR AND GROUT MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
 - .1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10); colour as selected by Departmental Representative.
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
- .3 Aggregate: supplied by one supplier.

- .1 Fine Aggregate: to CAN/CSA A179, natural sand or crushed stone.
- .2 Course Aggregate: to CAN/CSA A179.
- .4 Water: clean and potable.
- .5 Lime:
 - .1 Quick Lime: to CAN/CSA A179.
 - .2 Hydrated Lime: to CAN/CSA A179, Type S.
- .6 Colour Additives:
 - .1 Use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample. Admixtures to be approved prior to use. Use in accordance with the specific manufacturer's recommendations.
 - .1 Colour: as selected by Departmental Representative from manufacturer's standard range.
- .7 Mortar Mixes
 - .1 Mortar for exterior masonry above grade:
 - .1 Loadbearing: type S based on proportion specifications.
 - .2 Non-Loadbearing: N based on proportion specifications.
 - .2 Mortar for interior masonry:
 - .1 Loadbearing: type N based on proportion specifications.
 - .2 Non-Loadbearing: N based on proportion specifications.
 - .3 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for grouted reinforced masonry: type S based on property specifications.
- .8 Mortar Mixing:
 - .1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to be within 1% accuracy.
 - .2 Mix mortar ingredients in accordance with CAN/CSA A179 in quantities needed for immediate use.
 - .3 Maintain sand uniformly damp immediately before mixing process.
 - .4 Do not use admixtures, including pigments, air entraining agents, accelerators, retarders, water repellent agents, or other admixtures; unless approved in writing by the Departmental Representative.
 - .5 Do not use anti-freeze compounds including calcium chloride or chloride based compounds.
 - .6 Use a batch type mixer in accordance with CAN/CSA A179.
 - .7 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
 - .8 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.

- .9 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.
- .9 Grout Mixes:
 - .1 Bond Beams: grout mix 20 MPa strength at 28 days; 200-250 mm slump; premixed type in accordance with CAN/CSA-A23.1.
 - .2 Lintels: grout mix 20 MPa strength at 28 days; 200-250 mm slump; premixed type in accordance with CAN/CSA-A23.1.
 - .3 Grout: Minimum compressive strength of 20 MPa at 28 days. Maximum aggregate size and grout slump: 200-250 mm slump CAN/CSA A179.
- .10 Grout Mixing:
 - .1 Mix batched and delivered grout in accordance with CAN/CSA-A23.1 transit mixed.
 - .2 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA A179 fine grout.
 - .3 Add admixtures in accordance with manufacturer's instructions; mix uniformly.
 - .4 Do not use calcium chloride or chloride based admixtures.

2.3 GALVANIZING

- .1 The following galvanizing requirements apply to steel anchors, ties, reinforcing and accessories where requirements are not otherwise specifically listed:
 - .1 Ties and Reinforcing:
 - .1 Mill Galvanized (Interior Use): In accordance with ASTM A116, Class 3.
 - .2 Hot Dip Galvanized (Exterior, including inner wythe of exterior wall construction and High Humidity Use): In accordance with ASTM A153, Class B-2.
 - .2 Hot Dip Hardware and Bolts: In accordance with ASTM A153, Class B-2 regardless of location.
 - .3 Hot Dip Sheet Steel: In accordance with ASTM A653, Coating Designation Z600, regardless of location.
 - .4 Structural Shapes and Pipes: In accordance with ASTM A123, Grade 85, regardless of location.

2.4 REINFORCEMENT

- .1 Bar reinforcement: Steel to CAN/CSA A371 and CAN/CSA G30.18, Grade 400 unless indicated otherwise on drawings.
- .2 Masonry Joint Reinforcement: In accordance with to CSA A371 and ASTM A496, with corrosion protection in accordance with CSA S304 and CSA A370, and as follows:
 - .1 Interior Walls: Mill galvanized, carbon steel.
 - .2 Exterior Walls: Hot dip galvanized, carbon steel.
 - .3 Wire Size for Side Rods: W1.7 or 3.8 mm diameter.
 - .4 Wire Size for Cross Rods: W1.7 or 3.8 mm diameter.

- .5 Spacing of Cross Rods, Tabs, and Cross Ties: At a maximum of 400 mm o/c.
- .6 Lengths: A minimum of 3000 mm, with prefabricated corner and tee units.
- .3 Connectors: In accordance with to CSA A370 and CSA S304 with hot dip galvanized finish.
- .4 Single Wythe Masonry Joint Reinforcement: Either ladder or truss type with single pair of side rods.

2.5 TIES AND ANCHORS

- .1 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:
 - .1 Deflection: Maximum 2 mm, including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.
 - .2 Positive restraint at position of maximum adjustment.
 - .3 Free play of multi-component ties maximum 1.2 mm when assembled in all possible configurations.
 - .4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.
- .2 Lateral Partition Supports (Top of Wall Anchors):
 - .1 Angle Support: Fabricated from 2.657 mm core metal thickness angled steel plate having 75 mm long legs fastened to deck structure to allow vertical movement of masonry assembly; hot dip galvanized; coordinate with Section 07 84 00 for firestopping insulation and smoke seals.
 - .2 Plate Support: Fabricated from 2.657 mm core metal thickness steel plate with 10 mm diameter metal 150 mm long welded to plate having closed end plastic tube fitted over rod that allows rod to move in and out of tube; hot dip galvanized after fabrication.
- .3 Conventional Bolts:
 - .1 Anchor Bolts: steel bolts in accordance with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized in accordance with ASTM A153, Class C.
 - .2 Plate anchors: steel to ASTM A36, weld square of circular steel plate perpendicular to axis of steel bar threaded on opposite end.
 - .3 Through bolt rods: to ASTM A307 threaded rod or threaded ASTM A36 bar stock.

2.6 FLASHING

- .1 Metal Flashing: Provide metal flashing materials in accordance with Section 07 62 00.
- .2 Coordinate supply and installation of flexible flashing materials with Section 07 26 00, provide only materials that are compatible with materials listed in Section 07 26 00 and that form the basis of the contract.
- .3 Butyl Rubber Base Flashing: minimum 1.2 mm thick butyl sheet rubber strips.

- .4 Sheet Steel Base Flashing: minimum 0.60 mm thick, to ASTM A653, formed as detailed, galvanized with Z275 zinc coating.
- .5 Modified Bitumen Base Flashing: SBS modified sheet membrane, minimum 1.0 mm thick self-adhering type or minimum 3.0 mm thick torch-applied type.

2.7 ACCESSORIES

- .1 Firestopping: As specified under Section 07 84 00.
- .2 Sealants: As specified under Section 07 92 00, and as follows:
 - .1 Vertical Sealant: Colour to match brick
 - .2 Horizontal Sealant: Colour to match mortar
- .3 Joint Filler: Control Joint Fillers: Preformed rubber, neoprene or polyvinylchloride, size and profile to suit intended application and as indicated on drawings.
- .4 Bond Breaker Strips: #15 asphalt saturated, organic roofing felt in accordance with CSA A123.3.
- .5 Cavity wall insulation in accordance with Section 07 21 13.
- .6 Air and vapour barrier membrane in accordance with Section 07 26 00.
Coordinate through wall flashings listed in this section with products that form the basis of the contract.

2.8 CLEANING COMPOUNDS

- .1 Use low VOC products in compliance with SCAQMD Rule 1168.
- .2 Compatible with substrate and acceptable to concrete masonry manufacturer for use on products.

Part 3 Execution

3.1 EXAMINATION

- .1 Before starting Work, verify surfaces and conditions are ready to accept work of this Section. Report defects in writing to the Departmental Representative. Commencement of installation constitutes acceptance of existing conditions.
- .2 Examine work of other Sections upon which work of this section is dependent. Should discrepancies be found which affect the proper performance of the work of this section, do not commence work until such discrepancies have been resolved. Perform Work with minimal cutting and patching.

3.2 PREPARATION

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

3.3 APPLICATION

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

3.4 INSTALLATION: GENERAL

- .1 Construction to conform to CAN/CSA A371.
- .2 Where mortar has started to harden at units requiring repositioning, remove and replace with fresh mortar.
- .3 Masonry horizontal and vertical joints to be 10 mm thick except where adjustments are necessary to maintain the bond pattern or to adjust coursing.

3.5 INSTALLATION: CONCRETE MASONRY UNITS

- .1 Standard concrete block units:
 - .1 Bond: as indicated on Drawings and if not indicated, confirm with Departmental Representative.
 - .2 Coursing height: 200 mm for one block and one joint.
 - .3 Jointing: as indicated on Drawings and if not indicated, confirm with Departmental Representative.
- .2 Special Shapes:
 - .1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
 - .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
 - .3 End bearing: not less than 200 mm as indicated on drawings.
 - .4 Install special site cut shaped units.
- .3 Grouting and Concrete Core Fills:
 - .1 Fill cores in hollow concrete masonry units with concrete as indicated on drawing.
 - .2 Use concrete where indicated, and also for vertical core filling, lintel beams, bond beams and other filled cores where reinforcing steel is indicated.
 - .3 Use fine grout where the space being grouted is 50 mm or less in its least dimensions; use concrete in all other applications that call for grout.
 - .4 Use square end concrete masonry units wherever a full or half concrete masonry unit will receive concrete fill.
 - .5 Use full mortar bedding of cross webs for cavities that are filled.
 - .6 Fill cores in lifts of 1200 mm maximum; provide cleanout openings for lifts in excess of 1200 mm where Consultant has accepted larger lifts.
 - .7 Consolidate core fill during placement by vibration or puddling.
 - .8 Stop concrete core fill 38 mm below top surface of lift when ever filling will be stopped for more than a 1 hour time duration.
 - .9 Secure vertical reinforcement in position at top and bottom of core, and a maximum 1200 mm spacing, refer to Drawings for location of vertical reinforcement.
 - .10 Fill voids solid with mortar so that ties and anchors are set in full mortar bed where masonry walls abut steel or concrete columns.

- .4 Cull out masonry units, in accordance with CAN/CSA A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.
- .5 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .6 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .7 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .8 Install movement joints and keep free of mortar where indicated.
- .9 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .10 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.
- .11 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .12 Tamp units firmly into place.
- .13 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .14 Strike concealed joints flush.
- .15 After mortar has achieved initial set up, tool joints.
- .16 Do not interrupt bond below or above openings.

3.6 TOLERANCES

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

3.7 INSTALLATION: CONNECTORS AND REINFORCEMENT

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

3.8 BONDING AND TYING

- .1 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CAN/CSA A370, CAN/CSA A371, and manufacturer's instructions.
 - .1 Install horizontal joint reinforcement 400 mm on centre.
 - .2 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
 - .3 Place joint reinforcement continuous in first and second joint below top of walls.
 - .4 Lap joint reinforcement ends minimum 200 mm.
 - .5 Connect stack bonded unit joint corners and intersections with strap anchors 400 mm on centre.

3.9 REINFORCED LINTELS AND BOND BEAMS

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

3.10 GROUTING

- .1 Grout masonry in accordance with CSA-S304.1, CAN/CSA A371 and CAN/CSA A179 and as indicated.
- .2 Provide minimum 24 hours notice prior to placing concrete.

3.11 ANCHORS

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

3.12 LATERAL SUPPORT AND ANCHORAGE

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

3.13 CONTROL AND EXPANSION JOINTS

- .1 Install control and expansion joint materials in unit masonry as masonry progresses; do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- .2 Form control joints in concrete masonry consisting of a complete vertical break free from mortar using one of the following methods:
 - .1 Break joint reinforcement at control joints, but extend bond beam reinforcing 400 mm into wall across control joint and wrap with 0.15 mm polyethylene bond breaker.

- .2 Fit bond breaker strips into hollow contour in ends of concrete masonry units on one side of control joint; fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - .3 Install preformed control joint gaskets designed to fit standard sash block.
 - .4 Install interlocking units designed for control joints; install bond breaker strips at joint; keep head joints free and clear of mortar or rake out joint for application of sealant.
 - .5 Install temporary foam plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
 - .6 Refer to Drawings for control and expansion joint locations, and vertical reinforcing requirements; confirm location with Departmental Representative before installation; confirm with Departmental Representative where not shown on Drawings.
- .3 Install a minimum 10 mm high horizontal, pressure relieving joints by either leaving an air space or inserting a compressible filler, sealant and backer rod specified in Section 07 92 00; locate horizontal, pressure relieving joints beneath shelf angles supporting masonry.
 - .4 Locate joints at 6000 mm centres maximum and at a maximum of 4000 mm from any corners, any other indication notwithstanding.

3.14 FIELD BENDING

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

3.15 INSTALLATION: FLASHINGS

- .1 Build in flashings in masonry in accordance with CAN/CSA A371.
 - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity is interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.
 - .2 In cavity walls and veneered walls, carry flashings from front edge of exterior masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
 - .1 For masonry backing embed or bond flashing 25 mm in joint.
 - .2 For concrete backing, insert or bond flashing into reglets.
 - .3 For wood frame backing, staple flashing to walls behind water resistive paper, and lap joints.
 - .4 For gypsum board and glass fibre faced sheathing backing, bond to wall using manufacturer's recommended adhesive.
 - .3 Lap joints 150 mm and seal with adhesive.

- .2 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.
- .3 Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall.

3.16 REPAIR/RESTORATION

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

3.17 CLEANING

- .1 Clean in accordance with Section 01 01 50 – General Instructions, Cleaning.
- .2 Concrete Unit Masonry:
 - .1 Progress Cleaning:
 - .1 Standard Concrete Unit Masonry:
 - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
- .3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

- .1 Concrete Forming & Accessories: Section 03 10 00
- .2 Cast-in-Place Concrete: Section 03 30 00
- .3 Concrete Unit Masonry: Section 04 22 00
- .4 Structural Steel: Section 05 12 00
- .5 Painting: Section 09 90 00

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A108-13, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - .3 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
 - .5 ASTM A307-12, Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi tensile strength.
 - .6 ASTM A325-10e1, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .7 ASTM A510/A510M-13, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.
 - .8 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.
 - .9 ASTM B633-15, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - .10 ASTM C882/C882M-13a, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
 - .11 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.
 - .12 ASTM D695-15, Standard Test Method for Compressive Properties of Rigid Plastics.
 - .13 ASTM E488/E488M-15, Standard Test Methods for Strength of Anchors in Concrete Elements.
 - .14 ASTM F436/F436M-16, Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
 - .15 ASTM F593-13ae1, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - .16 ASTM F594-09 (2015), Standard Specification for Stainless Steel Nuts.
- .2 Canadian Standards Association (CSA)
 - .1 CSA W59-13, Welded Steel Construction.
 - .1 CSA G30.18-09, Billet-steel Bars for Concrete Reinforcement.
- .3 International Standards Organization (ISO)
 - .1 ISO 898, Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel.

1.4 SUBMITTALS

- .1 Submittals are to be in accordance with Section 01 01 50.
 - .1 Submit product data for proprietary products and materials that include:

- .1 Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
 - .2 Manufacturer's published installation instructions.
 - .3 Installer qualifications & procedures: submit installer qualifications as stated in Section 1.5. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
- .2 Closeout submittals: submit the following:
- .1 Record documents: project record documents for installed materials in accordance with Section 01 01 50.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: the installer shall be experienced in installing anchors equal to type, and into the substrate material required for this project.
- .2 Installer Training: prior to construction, train all personnel involved in installation on-site with the manufacturer or the manufacturer's representative. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
 - .1 hole drilling procedure
 - .2 hole preparation & cleaning technique
 - .3 adhesive injection technique & dispenser training / maintenance
 - .4 rebar dowel preparation and installation
 - .5 proof loading/torquing
- .3 Installers to provide proof of training upon request of the Departmental Representative.
- .4 Evaluations, reports, and listings: anchors and related materials shall be listed by one or more of the following agencies, as applicable:
 - .1 ICC Evaluation Service
 - .1 Anchors shall be manufactured under an approved quality assurance program with follow-up inspections by an inspection agency under ISO/IEC 17020 by a recognized accreditation body conforming to the requirements of ISO/IEC 17011.
 - 2. IAPMO Uniform Evaluation Service
 - .1 Anchors shall be manufactured under an approved quality assurance program with follow-up inspections by an inspection agency under ISO/IEC 17020 by a recognized accreditation body conforming to the requirements of ISO/IEC 17011.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products to job site in manufacturer's or distributor's packaging undamaged, complete with installation instructions.
- .2 Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

1.7 PROJECT CONDITIONS

- .1 Adhesive anchors shall be installed in concrete having a minimum age of 21 days at time of anchor installation.
- .2 Anchoring adhesives must be stored at temperatures prescribed by the manufacturer and must not be used beyond the expiration date.
- .3 The anchor or fastener coating, plating or steel type must provide suitable corrosion resistance for the environment in which the anchor or fastener is installed.

2.0 PRODUCTS

2.1 GENERAL

- .1 All cast-in-place and post-installed anchors shall be submitted in accordance with Section 1.4 to the Departmental Representative for review and approval. All proposed anchors systems must be approved in writing by the Departmental Representative prior to use.
- .2 All anchor products shall be capable of achieving the intended performance requirements as indicated on the Drawings and Specifications.
- .3 Substitutions: substitute in accordance with Section 1.4.
 - .1 Only manufacturers with an ICC-ES or IAPMO-UES listing will be considered for substitution requests.
 - .2 The contractor shall submit, for the Departmental Representative to review, calculations that are prepared & sealed by a registered Professional Engineer in the Province of British Columbia demonstrating that the substituted product is capable of achieving the pertinent equivalent performance values of the specified product using the appropriate design procedure and/or standard(s) as required by the 2015 National Building Code of Canada.
 - .3 In addition, the calculations shall specify the diameter and embedment depth of the substituted product.
 - .4 Any increase in material costs for such submittal shall be the responsibility of the contractor.

2.2 MATERIALS

- .1 Fasteners and Anchors:
 - .1 Anchor bolts: to ASTM A307.
 - .2 Stud headed concrete anchors: to CSA W59.
 - .3 Carbon and alloy steel nuts: to ASTM A563.
 - .4 Carbon steel washers: to ASTM F436.
 - .5 Carbon steel threaded rod: to ASTM A36, or ASTM A193 Grade B7, or ISO 898 Class 5.8.
 - .6 Wedge / expansion anchors: to ASTM A510, or ASTM A108.
 - .7 Stainless steel bolts, hex cap screws, and studs: to ASTM F593.
 - .8 Stainless steel nuts: to ASTM F594.
 - .9 Zinc plating: to ASTM B633.
 - .10 Hot-dip galvanizing: to ASTM A153.
 - .11 Reinforcing steel dowels: billet steel, Grade 400, deformed bars to CSA G30.18-09 unless indicated otherwise.
- .2 Epoxy Adhesive:
 - .1 Bond strength: to ASTM C882M.
 - .2 Compressive strength and modulus: to ASTM D695.
 - .3 Tensile strength at 7 days: to ASTM D638.

2.3 CAST-IN-PLACE BOLTS

- .1 Anchors, bolts, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts including associated nuts and washers in accordance with ASTM A153.
- .2 Stud headed concrete anchors shall conform to CSA W59, Type B. Size and embedment length as indicated on Drawings. Install studs in accordance with Section 05 12 00.

2.4 DRILLED-IN ANCHORS

- .1 Wedge / expansion anchors: wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings. Type and size as indicated on Drawings.

- .1 Interior use: unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
- .2 Exterior use: as indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 or Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
- .2 Cartridge injection adhesive anchors: threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
 - .1 Interior use: unless otherwise indicated on the drawings, provide carbon steel threaded rods conforming to ASTM A36, ASTM A193 Grade B7, or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
 - .2 Exterior use: as indicated on the drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 or Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
3. Reinforcing dowels shall be CSA G30.18, Grade 400.
- .3 Epoxy adhesive: injectable adhesive shall be used for installation of all reinforcing steel dowels or threaded anchor rods and inserts into existing concrete to the specified embedment indicated on the Drawings.
 - .1 Adhesive shall be furnished in side-by-side refill packs which keep component A and component B separate. Side-by-side packs shall be designed to compress during use to minimize waste volume. Side-by-side packs shall also be designed to accept static mixing nozzle which thoroughly blends component A and component B and allows injection directly into drilled hole.
 - .2 Only injection tools and static mixing nozzles as recommended by manufacturer shall be used. Manufacturer's instructions shall be followed.
 - .3 Injection adhesive shall be formulated to include resin and hardener to provide optimal curing speed as well as high strength and stiffness.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Examine supporting base materials and environmental conditions. Do not begin installation until base materials have been properly prepared.
- .2 Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- .3 Install only if environmental conditions are in compliance with manufacturer's recommendations for installation conditions.

3.2 INSTALLATION

- .1 Cast-in-place anchors: use templates to locate anchors accurately and securely in formwork in accordance with Section 03 30 00.
- .2 Drilled-In Anchors:

- .1 Drill holes with rotary impact hammer drills using carbide-tipped bits. Alternate drilling methods, such as diamond coring, must be approved by the Departmental Representative. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the drawings, all holes shall be drilled perpendicular to the concrete surface.
 - .1 Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
 - .2 Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Departmental Representative if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
 - .3 Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- .2 Perform anchor installation in accordance with manufacturer instructions.
- .3 Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- .4 Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.3 REPAIR OF DEFECTIVE WORK

- .1 Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, non-metallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of material and workmanship will be carried out by an independent Testing Agency designated and approved by the Departmental Representative.
- .2 Testing: 10% of each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors shall not be torque tested unless otherwise directed by the Departmental Representative. If more than 10% of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Departmental Representative.
 1. Tension testing shall be performed in accordance with ASTM E488.
 2. Torque shall be applied with a calibrated torque wrench.

3. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive anchors at proof load shall not exceed $D/10$, where D is the nominal anchor diameter.
- .3 Minimum anchor embedment's shall be as shown on the Drawings. Proof loads and torques shall be as specified by the manufacturer.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

- | | | |
|----|-------------------------|------------------|
| .1 | Steel Joists: | Section 05 21 00 |
| .2 | Steel Deck: | Section 05 31 00 |
| .3 | Miscellaneous Metals: | Section 05 50 00 |
| .4 | Painting: | Section 09 90 00 |
| .5 | Cast-in-Place Concrete: | Section 03 30 00 |

1.3 REFERENCES

- .1 Canadian Standards Association (CSA):
- .1 CSA S16-14, Design of Steel Structures.
 - .2 CSA G40.20-13, General Requirements for Rolled or Welded Structural Quality Steel.
 - .3 CSA G40.21-13, Structural Quality Steel.
 - .4 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminium.
 - .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
 - .7 CAN/CSA G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .2 American Society for Testing and Materials (ASTM International):
- .1 ASTM A307-12, Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength.
 - .2 ASTM A325-10e1, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .3 ASTM A500-13, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .4 ASTM A992/A992M-11, Standard Specification for Structural Steel Shapes.
 - .5 ASTM A627-03(2011), Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities.
 - .6 ASTM A1011/A1011M-15, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - .7 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .8 ASTM A575-96(2013)e1, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
 - .9 ASTM A576-90b(2012), Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 - .10 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
 - .11 ASTM A635/A635M-15, 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.
 - .12 ASTM A29/A29M-16, Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
- .3 Canadian Institute of Steel Construction / Canadian Paint Manufacturing Association (CISC/CPMA):
- .1 CISC/CPMA 1-73a (1975), A Quick-Drying One-Coat Paint for Use on Structural Steel.

- .2 CISC/CPMA 2-75 (1975), A Quick-Drying Primer for Use on Structural Steel.

1.4 QUALITY CONTROL

- .1 Prior to commencement of work, submit two (2) certified copies of mill reports covering chemical and physical properties of steel used in this work.

1.5 DESIGN OF DETAILS AND CONNECTIONS

- .1 Design details and connections in accordance with requirements of CSA S16.
- .2 High strength bolt connections to conform to ASTM A325, bearing type. Bolts in bracing connections to be torqued.
- .3 For standard steel connections, select details from CISC Handbook of Steel Construction to ensure structural adequacy.
- .4 Connections for beams are to be designed for:
 - .1 A shear at each end of the beam equal to 50% of the total uniformly distributed factored loads for a laterally supported beam of the span shown, OR,
 - .2 A shear at each end of the beam equal to 35% of the total uniformly distributed factored load for a laterally supported beam of the span shown acting simultaneously with the axial force shown on the brace bay drawings. The axial force for a W-section beam should be assumed to be tension or compression.
- .5 Bracing connections to be designed for the factored loads noted on structural drawings.

1.6 SHOP DRAWINGS

- .1 Submit shop detail and erection drawings in accordance with Section 01 01 50.
- .2 Shop drawings of non-standard connections designed by the steel fabricator to be signed and sealed by a Professional Engineer registered in the Province of British Columbia. Provide Schedules S-B and S-C for the Departmental Representatives records.
- .3 On erection drawings, indicate member size, base plate elevation, anchor bolt size and location and other information necessary for assembly.
- .4 Submit description of methods, sequence of erection and type of equipment to be used in erecting structural steel, if requested.
- .5 Indicate welds by welding symbols defined in CSA W59.
- .6 Structural steel shop drawings are to be produced using 3D structural steel detailing software such as Xsteel or StruCAD.
- .7 Steel fabricators connection design engineer shall submit sketches and calculations for proposed brace bay and drag strut connection details prior to formal submission of shop drawings for review by the Departmental Representative.

1.7 PROPRIETARY PRODUCT SUBMITTALS

- .1 Submittals are to be in accordance with Section 01 01 50.
 - .1 Submit product data for proprietary products and materials that include:
 - .1 Product and technical information.
 - .2 Manufacturer's published installation instructions.
 - .2 Closeout submittals: submit the following:
 - .1 Record documents: project record documents for installed materials in accordance with Section 01 01 50.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Structural steel wide flanges, welded wide flanges, angles, plates, and channels: to CSA G40.21, Grade 350W.

- .2 Square and rectangular hollow structural sections: to CSA G40.21, Grade 350W, Class C.
- .3 Structural strut channels: to ASTM A1011 SS Grade 33, or, ASTM A653 Grade 33.
- .4 Structural strut fittings: to ASTM A575, ASTM A576, ASTM A36, or, ASTM A635.
- .5 Anchor bolts: to ASTM A307.
- .6 Stud headed concrete anchors: to ASTM A29 Grade 1020.
- .7 Ordinary bolts, nuts and washers: to ASTM A307.
- .8 High strength bolts, nuts and washers: to ASTM A325.
- .9 Welding materials: to CSA W59 and certified by the Canadian Welding Bureau.
- .10 Shop paint primer: to CISC/CPMA 1-73a.
- .11 Hot dip galvanizing: galvanize steel, where indicated, to CSA G164, minimum zinc coating of 600 g/m².
- .12 Shear stud connectors: to CSA W59, Appendix H.
- .13 Tool resisting round steel bars: to ASTM A627, Grade 2 Composite T.R. Steel.

2.2 FABRICATION

- .1 Fabricate structural steel, as indicated, in accordance with CSA S16 and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59.
- .3 Continuously seal HSS members with cap plates and by continuous welds. Grind smooth.
- .4 Reinforce openings to maintain required design strength.
- .5 Shop weld weldable rebar dowels to steel embed plates. Weldable rebar supplied by this section.
- .6 Unless noted otherwise, hot-dip galvanize all exterior exposed steel, except exterior steel that is exposed to view which shall receive an epoxy paint finish in accordance with Section 09 90 00.
- .7 All exposed welds to be continuous, ground smooth, and formed to match profile of the adjacent steel members.
- .8 All exterior member welds to be continuous. Welds to fully seal joints between components.
- .9 Selection of strut framing members, fittings, and related accessories, shall be submitted to the Departmental Representative for review and approval. All proposed systems must be approved in writing by the Departmental Representative prior to use. All strut system components shall be capable of achieving the performance requirements as indicated on the Drawings and Specifications.

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16 except where members to be encased in concrete, spray fire-proofed, or galvanized.
- .2 Structural steel to receive primer paint only to have SP-2 surface preparation.
- .3 All exposed structural steel to receive a finish coat shall have SP-6 surface preparation (commercial sandblast).

3.0 EXECUTION

3.1 GENERAL

- .1 Do welding in accordance with CSA W59 and as noted on the drawings.
- .2 Fabrication and erection companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO WORK COMPLETED BY OTHER TRADES

- .1 Verify dimensions of work completed by other trades before commencing fabrication and report any discrepancy and potential problem areas to the Departmental Representative and await instructions.

3.3 MARKING

- .1 Mark materials in accordance with CSA G40.20. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

3.4 ERECTION

- .1 Erect structural steel as indicated in accordance with CSA S16 and in accordance with reviewed erection drawings.
- .2 Obtain written permission from the Departmental Representative prior to field cutting or altering of structural members not shown on shop drawings.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection. Touch-up galvanizing with "Galvacon" or equivalent to manufacturer's recommendations.
- .4 Temporarily brace and shore structural steel as required for erection stability. Member sizes and design forces are for final erected conditions with steel decking attached and may not be adequate for the erection operation.

3.5 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by an independent Testing Agency designated and approved by the Departmental Representative in accordance with CSA S16.
- .2 The testing and inspection program shall include, but not be limited to:
 - .1 Shop fabrication:
 - .1 Review of mill certificates, weld procedures, and welder qualifications.
 - .2 Review of workmanship on steel fabrication for conformance with project specifications.
 - .3 Visual examination of all welds.
 - .4 Magnetic particle testing of approximately 5% of all welds.
 - .5 Complete ultra-sonic examination of all full-strength, full-penetration welds.
 - .6 Random check of structural steel member sizes.
 - .2 Field inspection:
 - .1 Review weld procedures and welder qualifications.
 - .2 Visual examination of all field welds including steel decking attachment to structural steel.
 - .3 Magnetic particle or other non-destructive testing of approximately 5% of field welds.
 - .4 Complete ultra-sonic examination of all full-strength, full-penetration field welds.
- .3 The above testing shall not be considered as a substitute for the fabricator's and erector's quality control programs.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

- .1 Masonry: Section 04 20 00
- .2 Structural Steel: Section 05 12 00
- .3 Steel Deck: Section 05 31 00
- .4 Painting: Section 09 90 00

1.3 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CSA S16-14, Design of Steel Structures.
 - .2 CSA G40.21-13, Structural Quality Steel.
 - .3 CSA S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .4 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .2 Canadian Institute of Steel Construction / Canadian Paint Manufacturing Association (CISC/CPMA):
 - .1 CISC/CPMA 1-73a (1975), A Quick-Drying One-Coat Paint for Use on Structural Steel.

1.4 DESIGN OF STEEL JOISTS

- .1 Design steel joists and bridging in accordance with CSA S16 for loads indicated on the drawings including:
 - .1 Snow drifting in accordance with the National Building Code of Canada (NBCC) 2015.
 - .2 Suspended equipment and partition loads.
 - .3 Mechanical equipment and roof pads.
- .2 Design all open web steel joists and bridging details for a minimum net factored uplift of 1.0 kPa, unless otherwise noted on the drawings.
- .3 Allow for a 4.5 kN dead point load on the top and bottom chords at any location of the joist.
- .4 Limit snow load deflection to L/360. Limit dead load and snow load deflection to L/240.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 01 50.
- .2 Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer registered in the Province of British Columbia.
- .3 Indicate joist spacing, bearing and anchorage details, bridging, framed openings, accessories, schedule of materials, depth, moment of inertia, camber and loadings, including special loadings from snow drifting, supported equipment, ceilings, and partitions.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Structural steel: to CSA G40.21 and CSA S136.
- .2 Welding materials: to CSA W59.
- .3 Shop paint primer: to CISC/CPMA 1-73a or approved equal.

2.2 FABRICATION

- .1 Fabricate steel joists and accessories in accordance with CSA S16 and shop

- drawings.
- .2 Weld in accordance with CSA W59.
- .3 Provide bottom chord extensions on column lines and where indicated.

2.3 SHOP PAINTING

- .1 Clean, prepare surface and shop prime steel to CISC/CPMA 1-73a, and in accordance with MPDA. Refer to Section 09 90 00.

3.0 EXECUTION

3.1 ERECTION

- .1 Erect steel joists and bridging as indicated in accordance with CSA S16 and in accordance with reviewed shop drawings.
- .2 Obtain written permission from the Departmental Representative prior to field cutting or altering joists or bridging.
- .3 Touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.2 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by a testing laboratory designated by the Departmental Representative.
- .2 The Contractor will pay all costs of tests.
- .3 Costs of re-inspection and re-testing of deficient work shall be paid for by the Contractor.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

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

1.2 RELATED WORK

- .1 Cast-in-place concrete: Section 03 30 00
- .2 Structural steel: Section 05 12 00
- .3 Steel Joists: Section 05 21 00
- .4 Miscellaneous Metals: Section 05 50 00
- .5 Painting: Section 09 90 00

1.3 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CSA S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .2 CSA W47.1 09, Certification of Companies for Fusion Welding of Steel.
 - .3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .2 Canadian Sheet Steel Building Institute (CSSBI):
 - .1 CSSBI 10M-13, Standard for Steel Roof Deck.
 - .2 CSSBI 12M-15, Standard for Composite Steel Deck.
 - .2 CSSBI B13-06, Design of Steel Deck Diaphragms.
- .3 American Society for Testing and Materials (ASTM International):
 - .1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.4 DESIGN CRITERIA

- .1 Design steel deck using limit states design in accordance with CSA S136 and CSSBI 10M and CSSBI 12M. Steel decking shall safely carry dead, live, and diaphragm loads as indicated on the drawings.
- .2 Steel deck and connections to steel framing to carry dead, live, and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.
- .2 Deflection under specified live load only shall not exceed $1/240^{\text{th}}$ of span for roofs and $1/360^{\text{th}}$ of span for floors, except that when gypsum board ceilings are hung directly from decking, live load deflection shall not exceed $1/360^{\text{th}}$ of span.

1.5 SUBMITTALS AND SUBSTITUTIONS

- .1 Submittals are to be in accordance with Section 01 01 50.
 - .1 Product data and samples: submit manufacturer's specifications, catalogs and installation instructions. Include laboratory test reports, manufacturer's certifications and other data to show compliance with the Drawings and Specifications.
 - .2 Certifications: submit certifications for mill tests, mechanical fasteners, shear connectors, deformed anchor bars, and galvanizing.
- .2 Substitutions: substitute in accordance with Section 01 01 50.
 - .1 The contractor shall submit, for the Departmental Representative to review, calculations that are prepared & sealed by a registered Professional Engineer in the Province of British Columbia demonstrating that the substituted product is capable of achieving the pertinent equivalent performance values of the specified product using the appropriate design procedure and/or standard(s) as required by the 2015 National Building Code of Canada.

- .2 Any increase in material costs for such submittal shall be the responsibility of the contractor.

1.6 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 01 50.
- .2 Each drawing submitted shall clearly indicate decking layout, profile, dimensions, core thickness, side seam connections, connections to supports and spacing's, projections, openings, and reinforcement details and accessories.
- .3 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Zinc Iron Alloy (ZF) Coated Steel Sheet: to ASTM A653/A653M Structural Quality Grade 230 and galvanized with Z275 zinc coating class for steel roof deck, and ZF75 zinc coating class for composite steel floor deck.
- .2 Flute closures: closed cell foam neoprene or purpose made, fire rated as required, profiled to deck corrugation, 25 mm thick, over deck, under deck, and under roofing where indicated on drawings. Closures supplied to General Contractor for installation by others.
- .3 Metal flute closures: zinc coated steel to match decking profile and coating class.
- .5 Primer: zinc rich, ready mix to CGSB 1-GP-181M.
- .6 Self-tapping screws: #14 ga. (0.185 in.) plated.

2.2 TYPES OF DECKING

- .1 Metal deck shall be manufactured by those listed in Section 2.1 or approved equal.
- .2 Composite Steel Floor Decks: single fluted element with minimum steel core thickness and nominal depth as noted on drawings, deformed ribs for composite action.
- .3 Steel Roof Decks: single fluted element with minimum steel core thickness and nominal depth as noted on drawings, deformed ribs for composite action.

2.3 MECHANICAL FASTENERS

- .1 Selection of fastener types to be as recommended by the manufacturer for the application. All fasteners shall be reviewed and approved in writing by the Departmental Representative prior to use.
- .2 Powder-actuated mechanical fasteners for roof deck and floor deck applications shall have minimum 12 mm diameter steel washers, knurled shanks, ballistic points and electroplated zinc coating conforming to ASTM B 633, SC 1, Type III. Powder-actuated mechanical fasteners shall be recognized by ICC-ES AC43, SDI listed and approved by Factory Mutual and Underwriter's Laboratories for wind uplift. Powder-actuated mechanical fasteners shall also be listed by Underwriter's Laboratories for fire resistive steel roof deck assemblies in accordance with TLSX & TGKX designs.

3.0 EXECUTION

3.1 GENERAL

- .1 Structural steel work: in accordance with CSA S136 and CSSBI 10M and CSSBI 12M.
- .2 Examination of field conditions: contractor shall examine all surfaces and features to which work must be attached or applied, abut or clear and shall verify, by measurements at the project site, all dimensions affecting the work of this Section. Starting of work shall represent acceptance by Contractor of surfaces,

dimensions and conditions as suitable and correct for performing the work as specified.

- .2 Field measurements: contractor shall verify, by measurements at the site, all existing dimensions that affect the work of this Section. Field dimensions varying from those on the design drawings or accepted shop drawings shall be brought to the Departmental Representative's attention in writing.

3.1 ERECTION

- .1 Erect metal decking as indicated to manufacturer's instructions.
- .2 Deck end laps shall be not less than 150 mm and formed over supports. Floor deck to be butt jointed over supports.
- .3 Immediately after decking is permanently secured in place touch up galvanized surface with primer where burned by welding or damaged by screw installation.
- .4 Attach metal cell closures at locations shown to contain poured concrete or to conceal deck flute packing or insulation and at other locations where indicated on drawings.
- .5 Clean up and remove all debris of this trade from site.

3.2 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 Framing of deck openings 150 mm to 300 mm shall be as recommended by the manufacturer except as otherwise indicated. No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 For deck openings over 300 mm square and for areas of concentrated load, reinforce in accordance with structural framing details and notes.

3.3 CONNECTIONS

- .1 Fasten decking to supporting steel with mechanical fasteners, as indicated on the drawings.
- .2 Mechanically fasten side joints at maximum 300mm centres, and as noted on the drawings.
- .3 Mechanically fasten decking to seismic shear lugs and drag lines as noted on the drawings.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Design wall framing system to resist wind loads and building loads in accordance with Section 01 35 00 – Delegated Design Submittals including, but not limited to, the following components:
 - .1 Studs subjected to lateral loads.
 - .2 Top and bottom tracks.
 - .3 Bridging and bracing.
 - .4 Top and bottom track connections to main structure, including fabrications to accommodate main structure deflections; top of wall anchor allowing for dead load deflections during construction and live load deflections after construction.
 - .5 Head, sill and jamb members at wall openings.
 - .6 Framing component connections.

1.2 RELATED SECTIONS

- .1 Section 01 35 00 – Delegated Design Submittals
- .2 Section 04 22 00 – Concrete Unit Masonry
- .3 Section 05 12 00 – Structural Steel
- .4 Section 05 50 00 – Metal Fabrications
- .5 Section 06 10 00 – Rough Carpentry
- .6 Section 07 26 00 – Vapour Retarders
- .7 Section 07 46 19 – Steel Siding
- .8 Section 09 21 16 – Gypsum Board Assemblies
- .9 Section 09 22 16 – Non-Structural Metal Framing

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA S16-14 Design of Steel Structures.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

- .3 CAN/CSA S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members, Includes Update No.1 (2014), Update No.2 (2014), Update No.3 (2015).
- .4 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
- .5 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
- .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 51-06, Lightweight Steel Framing Design Manual – 2nd Edition.
 - .2 SSF3 – February 2006, 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 S5-11, Guide Specification for Wind Bearing Steel Studs.
- .5 The Master Painters Institute (MPI) / Architectural Painting Specification Manual
 - .1 MPI # 18, Organic Zinc Rich Primer.

1.4 DEFINITIONS

- .1 **Minimum Uncoated Steel Thickness:** Minimum uncoated thickness of lightweight steel framing shall be not less than 95% of the thickness used in the design for the framing system:
 - .1 Lesser thicknesses may be permitted at bends arising from the cold forming process.
 - .2 Metal thicknesses listed in this section are minimum uncoated steel thickness; exclusive of any subsequent coatings or treatments.
- .2 **Delegated Design Professional Engineer:** The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce delegated design submittals and shop drawings to meet the requirements of the Project; who is registered in the province of the Work; and who is not the Consultant.
- .3 **Letters of Commitment and Compliance:** Documents prepared by the delegated design professional engineer as recommended by APEGA's Responsibilities for Engineering Services for Building Projects.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 **Coordination:** Coordinate work of this Section with work of other sections that may have items supported by or built into axially load bearing lightweight structural steel framing systems including; but not limited to, masonry supports and connectors, doors, windows, plumbing fixtures, and electrical fixtures and panels.

1.6 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit product data for mechanical fasteners, indicating sizes, shear, and pull-over loading capacity where applicable. Provide data indicating thickness and type of corrosion protection coating.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
 - .2 Indicate locations, dimensions, openings and requirements of related work.
 - .3 Indicate welds by welding symbols as defined in CSA W59.
- .3 Submittals shall bear the seal of a professional engineer registered in the Province of the Work.
- .4 Submit delegated design professional engineer's design notes and calculations upon request of the Departmental Representative.
- .5 Submit Letter of Commitment, signed and sealed by the professional engineer required by the Work of this Section in compliance with Section 01 35 00 – Delegated Design Submittals; professional engineer shall define applicable responsibilities in the completed Letter of Commitment and Letter of Compliance in compliance with the intent of the Building Code. Submit in conjunction with Shop drawings.
- .6 Submit evidence of welder qualifications specified in this Section.
- .7 Prior to declaration of Substantial Performance, submit Trade Contractor's design engineer to certify substantial compliance with the system design by submitting a Letter of Compliance, signed and sealed by the retained professional engineer required by the Work of this Section in compliance with Section 01 35 00 - Delegated Design Submittals.

1.7 QUALITY ASSURANCE

- .1 Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:
 - .1 Seal and signature to shop drawings and design submittals.
 - .2 Field review of installed components.
 - .3 Completion of Letters or Commitment and Compliance specified in Section 01 35 00 – Delegated Design Submittals.
- .2 Welding shall be performed by company certified by the Canadian Welding Bureau to CSA W47.1 for the type of work being performed; welding shall conform to CSA W59.

- .3 Clearly mark steel thickness exclusive of coating by embossing, stamping with indelible ink or by colour coding.
- .4 Provide minimum 72 hours notice to Departmental Representative prior to commencement of work of this Section; increase notice period where time period spans weekends or statutory holidays.
 - .1 Do not conceal lightweight steel framing system until reviewed by Departmental Representative.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
- .2 Handle and protect galvanized materials from damage to zinc coating.
- .3 Store materials flat, blocked off the ground in a manner to prevent kinking or permanent set.
- .4 Bent, kinked or twisted studs and track will be rejected.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Perform design, fabrication and erection of the work of this Section based on Limit States Design principles using factored loads and resistances, determined in accordance with CAN/CSA S136.
- .2 Conform to the requirements of indicated fire resistance ratings.
- .3 Design wall framing system capable of withstanding design loads within limits and under design loads indicated on Drawings, and as follows:
 - .1 Dead Loads: Weights of materials and construction.
 - .2 Lateral Loads: Design for wind loads using normal importance factors listed in the Building Code for deflection and strength, modified by the appropriate exposure, gust and pressure (internal and external) factors in accordance with Building Code structural commentaries.
 - .3 Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 70°C.
 - .4 Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure upward and downward movement of 13 mm; or larger gap as may be required to accommodate structural movement.

- .5 Design deflection detail so that free floating vertical members are restrained from horizontal movement by means of continuous bridging, nested or boxed tracks, or sliding or flexible web connections.
- .6 Maximum allowable deflection under 1 in 50 year sustained wind loading shall be as follows:
 - .1 Behind metal cladding – stud deflection limited to $L/360$.
- .7 Allow for movement of the structure; design lightweight steel framing end connections to accommodate floor and roof deflections such that framing are not loaded axially; limit free play and movement in connections perpendicular to the plane of framing to ± 0.50 mm relative to the building structure.
- .8 Design connections between light steel framing members using bolts, welding or sheet metal screws.
- .9 Design bridging to prevent member rotation and member translation perpendicular to the minor axis, and as follows:
 - .1 Design for secondary stress effects due to torsion between lines of bridging.
 - .2 Design exterior wall framing to accommodate horizontal deflection without allowing for collateral contribution of sheathing materials.
 - .3 Design bridging at 1530 mm centres maximum, closer spacing may be required by design to satisfy structural requirements; spaced at even intervals over the span of the member.
- .4 Stud, sill and top track sizes and thicknesses, and fastening details indicated in this Section and on the Drawings shall be considered as minimums only, spacing indicated as maximum permissible, except where changes are required to meet design criteria, and as follows:
 - .1 Design head, sill and jamb members to frame openings larger than 100 mm in any dimension.
 - .2 Design components or assemblies to accommodate specified tolerances of the structure.
 - .3 Sill and Top Tracks:
 - .1 Double track system, outer track flanges with depth to suit vertical deflection and width of studs.
 - .2 Sill tracks, minimum 33 mm deep flanges and width of studs.
 - .4 Movement Connection Clips: Purpose made clip designed to allow structural member vertical movement and to transfer wind suction or pressure to structural frame.
 - .5 Maximum design spacing of stud members: as indicated on Drawings. Confirm stud spacing with Engineer prior to application.
 - .6 Maximum spacing for top and bottom track connections to the structure shall not exceed 812 mm centres.
 - .7 Minimum design thickness for wall framing members shall be as follows:
 - .1 64 mm: 0.836 mm
 - .2 92 mm: 0.836 mm
 - .3 101 mm: 0.836 mm

- .4 140 mm: 0.836 mm
- .5 152 mm: 0.836 mm
- .6 184 mm: 0.91 mm
- .7 203 mm: 1.12 mm
- .8 Minimum thickness for walls supporting masonry veneer shall be 1.22 mm regardless of minimum thickness indicated above, or thicker as required to suit design conditions.
- .8 Bridging Channel: 1.22 mm minimum.
- .9 Clip Angles: 1.52 mm minimum.
- .5 Clearly mark steel thickness exclusive of coating by embossing, stamping with indelible ink or by colour coding.

2.2 MATERIALS

- .1 Steel: to CSA S136, fabricated from ASTM A653/A653M, Grade 230 steel.
- .2 Zinc coated steel sheet: quality to ASTM A653/A653M, with Z180 for exterior wall assemblies and Z275 for masonry veneer assemblies designation coating. Departmental Representative will accept hot dipped aluminum zinc alloy in accordance with ASTM A792/A792M provided that corrosion protection meets or exceeds requirements established by ASTM A653/A653M.
- .3 Fasteners and Welding Materials:
 - .1 Welding materials conforming to CSA W59; electrodes minimum 480 MPa tensile strength.
 - .2 Bolts and nuts conforming to ASTM A307 or ASTM A325, with washers and hot-dip galvanized finish.
 - .3 Metal to Metal: Sheet metal screws conforming to ASME 18, with minimum 0.008 mm thick galvanized coating and #8 Ø; self-drilling, self-threading, case hardened type; hex, pan, and low-profile head profile type to suit application; length sufficient to penetrate not less than 3 fully exposed threads beyond joined materials.
 - .4 Metal to Concrete: Drilled insert, minimum 8 mm Ø; **do not use Powder Actuated Fasteners.**
 - .5 Metal to Structural Steel: Secure track to structural steel over 8 mm thickness with direct connection powder actuated fastening system with nails for profiled metal sheet.
 - .6 Concrete-to-Steel Top Track Corrugated Ties: Corrugated steel conventional strip tie; 22 mm wide x 100 mm total length including 20 mm up stand x 0.76 mm nominal core metal thickness, hot dip galvanized; corrugations 2.5 mm deep x 10 mm apart; meeting requirements of CAN/CSA A370.
 - .7 Drilled Inserts: Steel, cadmium plated or hot dipped galvanized, sizes as indicated on Drawings.
- .4 Touch up primer: zinc rich, to CAN/CGSB 1-GP-181.
- .5 Moisture Barrier: Insulating, moisture resistant, closed cell, 6 mm thick foam strip x width of framing member, length as required.
 - .1 Density (ASTM D35, Suffix W, Method B): 48 kg/m³

- .2 Compressive Strength (ASTM C3575, Suffix D)
 - .1 At 10%: 21 KPa
 - .2 At 25%: 48 KPa
 - .3 At 50%: 103 Kpa
- .3 Water Absorption (ASTM D3575, Suffix L): < 0.5 kg/m²
- .4 Tensile Strength at Peak (ASTM D3575, Suffix T): 50 psi
- .5 Tensile Elongation (ASTM D3575, Suffix T): 60%
- .6 Tear Strength (ASTM D3575, Suffix G): 3.0 N/mm
- .6 Thermal Insulation: as indicated in Section 07 21 13.
- .7 Shims: Load bearing, high density multi-monomer plastic, non-leaching.

2.3 STEEL STUD DESIGNATIONS

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

2.4 METAL FRAMING

- .1 Framing Components: Provide framing components in metal core thickness, profiles and spacing as determined by delegated design professional engineer including; but not limited to, the following:
 - .1 C-shaped, punched wall framing with stiffened flanges
 - .2 U-shaped un-punched track without stiffened flanges
 - .3 Headers and jamps; columns, posts and beams using manufacturer's proprietary shapes having stiffened flanges
 - .4 Vertical deflection clips using manufacturers proprietary bypass or head clips; as appropriate to installation, capable of accommodating upward and downward vertical movement of primary structure using a positive mechanical attachment to wall framing web
 - .5 Slotted or double deep leg deflection track using manufacturer's proprietary system allowing free vertical movement under primary structural elements
 - .6 Floor joist framing and rim track
 - .7 Roof joists framing
 - .8 Roof rafter framing
 - .9 Ceiling joist framing
- .2 Framing Accessories: Provide accessories of manufacturer's standard thickness and configuration including; but not limited to, the following:
 - .1 Supplementary framing
 - .2 Drift clips
 - .3 Bracing, bridging, and solid blocking
 - .4 Web stiffeners
 - .5 Anchor clips
 - .6 End clips
 - .7 Foundation clips

- .8 Gusset plates
- .9 Stud kickers, knee braces, and girts
- .10 Joist hangers and end closures
- .11 Hole reinforcing plates
- .12 Backer plates

2.5 SOURCE QUALITY CONTROL

- .1 Ensure mill reports covering material properties are reviewed by Departmental Representative.

Part 3 Execution

3.1 GENERAL

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

3.2 ERECTION

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at 800 mm on centre maximum, unless lesser spacing prescribed on shop drawings.
- .3 Erect studs plumb, aligned and securely attached with two screws minimum, welded in accordance with manufacturer's recommendations.
- .4 Seat studs into bottom tracks and single piece top track or two piece telescoping 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 30 mm and maximum of 40 mm.
 - .2 Do not fasten tracks together.
 - .3 Stagger joints.
- .6 Install studs at not more than 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 1500 mm maximum.
 - .1 Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .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.

3.3 ERECTION TOLERANCES

- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than +/- 3.0 mm from design spacing.
- .4 Gap between end of stud and track web: not more than 4.0 mm.

3.4 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.	610 min.
102	40 max.	105 max.	610 min.
152	64 max.	114 max.	610 min.

- .2 Limit distance from centerline of last unreinforced cutout to end of member to less than 305 mm.

3.5 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 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 04 22 00 – Concrete Unit Masonry
- .3 Section 05 12 00 – Structural Steel
- .4 Section 05 21 00 – Steel Joists
- .5 Section 05 31 00 – Steel Deck
- .6 Section 06 10 00 – Rough Carpentry
- .7 Section 06 40 00 – Architectural Woodwork
- .8 Section 07 61 00 – Sheet Metal Roofing
- .9 Section 07 62 00 – Sheet Metal Flashing and Trim
- .10 Section 09 21 16 – Gypsum Board Assemblies
- .11 Section 09 91 99 – Painting for Minor Works

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A36/A36M-14 Standard Specification for Carbon Structural Steel.
 - .2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .3 ASTM A153/A153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM A269/A269M-15, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .5 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .6 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .7 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .8 ASTM A780/A780M-09(2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .9 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.
 - .10 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .11 ASTM F593-13a, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - .12 ASTM A276/A276M-15, Standard Specification for Stainless Steel Bars and Shapes.

- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA-S16-14, Design of Steel Structures.
 - .4 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).
- .3 The Environmental Choice Program
 - .1 CCD-047a-98, Paints, Surface Coatings.
 - .2 CCD-048-98, Surface Coatings - Recycled Water-borne.
- .4 National Association of Architectural Metal Manufacturers (NAAMM)
 - .1 NAAMM AMP 555-92, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).

1.3 ADMINISTRATIVE REQUIRMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada and indicate VOC content for:
 - .1 Finishes, coatings, primers and paints.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

- .2 For items where design is delegated to fabricator, provide shop drawings signed and sealed by the professional engineer registered in Province of Work, responsible for the design as indicated in Section 01 35 00.

1.5 QUALITY ASSURANCE

- .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 555.
- .4 Perform Work to the highest standard of modern shop and field practice, by personnel experienced in this Work. Accurately fit joints and intersecting members in true planes with adequate fastening. Build and erect the Work plumb, true, square, straight, level, accurate to the sizes shown, and free from distortion or defects.
- .5 Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- .6 Welding: Qualify procedures and personnel according to the following:
 - .1 Welders shall be qualified by Canadian Welding Bureau for classification of work being performed.
 - .2 The fabricator shall be certified to CSA W47.1, Division 1 or 2.1.
 - .3 Do welding inspection to CSA W178.
 - .4 Resistance welding: to CSA W55.3.
 - .5 Fusion welding: to CSA W59.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Exercise due care in storing, handling and erecting all materials and support all materials properly at all times so that no piece will be bent, twisted or otherwise damage structurally or visibly.
- .2 Correct damaged material and where the Departmental Representative deems damage irreparable, replace the affected items at no additional expense to the Departmental Representative.
- .3 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed.
- .4 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 JOB CONDITIONS

- .1 Coordinate this Work with the remainder of the Work and exercise the necessary scheduling to ensure that all Work is carried out and all items incorporated during the appropriate construction phase.
- .2 Provide instructions and drawings to other trades for setting bearing plates, anchors bolts, and other members that are built in to work of other trades.
- .3 Protect other Sections of the Work from damage by this Section of the Work.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.
- .2 Hollow Structural Sections: In accordance with CAN/CSA G40.20/G40.21, Grade 350W, Class C.
- .3 Steel pipe: to ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads, finish as indicated.
- .4 Welding materials: to CSA W59.
- .5 Welding electrodes: to CSA W48 Series.
- .6 Fasteners: Bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws, and machine bolts.
 - .1 Unfinished fasteners: In areas not exposed to public, use unfinished bolts conforming to ASTM A307, Grade A, with hexagon heads and nuts. Supply bolts of lengths required to suit the thickness of the material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
 - .2 Finished fasteners:
 - .1 In areas exposed to public use, bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts to be hot dip galvanized in accordance with ASTM A153/A153M or CAN/CSA-G164.
 - .2 For joining stainless steel components use stainless steel fasteners of same type.
- .7 Structural bolts: to ASTM A325.
- .8 Stainless steel fasteners, washers and nuts: to ASTM F593, 18-8 austenitic stainless steel (Grade 8 - B8/B8A), sized as required for purpose intended, or as otherwise indicated. Cold finished: Condition B, cold worked, per ASTM A276.
- .9 Aluminum Extrusions: ASTM B221/B221M, alloy 6063-T6.
- .10 Strut Channel System:
 - .1 All channel members shall be fabricated from structural grade steel conforming with ASTM A653, Grade 33

- .2 All fittings shall be fabricated from steel conforming with ASTM A36
- .3 Strut system components shall be Hot-Dipped Galvanized finished in accordance with ASTM A153.
- .11 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat, round, or oval headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications to provide corrosion protection in accordance with CAN-S16.
- .5 Welding is to conform to CSA W59 and the fabricator certified to CSA W47.1. Include for welding inspection in the Contract.
- .6 File or grind all exposed welds smooth and flush. Repair or fill all pits, cracks and holes. Grind and polish all handrails to a smooth, even surface. Smooth all inside corners, returns.
- .7 Insulate when necessary to prevent electrolysis due to metal to metal contact or metal to masonry or concrete contact. Use bituminous paint or other approved method.
- .8 Provide fastenings, including anchor bolts, bolts, lag screws, expansion bolts, straps, brackets, etc. required for the fabrication and erection of work of this Section.

2.3 FINISHES

- .1 Prior to priming steel, prepare all surfaces in conformance with SSPC SP-3 – Power Tool Cleaning for non-exposed locations and SSPC SP-5 – White-metal Blast Cleaning for exposed architectural finished locations. Adjust blast grit to suit primer coat thickness specified in Section 09 91 99 – Painting for Minor Works.
- .2 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A153, minimum zinc coating of 600 g/m². (Severe, unprotected exposures)
- .3 Electrolytic galvanizing: galvanize steel, where indicated, to ASTM A591, minimum zinc coating of 180 g/m². (Non-severe, unprotected exposures)
- .4 Wipe coat galvanizing: galvanize steel, where indicated to CSA G189, minimum zinc coating of 75 g/m². (Non-severe, protected exposures)
- .5 Shop Primers: Provide primers that are compatible with paint systems specified.
- .6 Touch up galvanized surfaces with zinc rich coating, to ASTM A780: DOD-P-21035 zinc rich paint, minimum DFT 8 mils.

- .7 Zinc Rich Paint: Conforming to DOD-P-21035 zinc rich paint.
 - .1 Clean metal to equivalent of commercial sand blast SSPC-SP6, remove sandblast in residue.
 - .2 Apply one coat of zinc rich paint to surfaces exposed after assembly to minimum dry film thickness of 60 μm (2.5 mil). Apply coating immediately after cleaning.
- .8 Isolation Coating: Apply an isolation coating to contact surfaces in contact with cementitious materials, wood materials and dissimilar metals except stainless steel.
- .9 Paint: Prepare the Work and paint in accordance with CAN/CSA-S16, primed ready for site finish as specified in Section 09 91 99 – Painting for Minor Works. Leave surfaces to be welded unpainted.

2.4 ROUGH HARDWARE

- .1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.

2.5 MISCELLANEOUS FABRICATIONS

- .1 Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated that are not a part of structural steel framework, as required to complete work.
- .2 Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitred joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- .3 Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
- .4 Miscellaneous Steel Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination for assembly and installation with other work.

2.6 GUTTERS AND DOWNSPOUTS

- .1 4 mm thick hot dipped galvanized steel components as indicated on drawings. Provide continuous welds for length of each joint.

2.7 PIPE BOLLARDS

- .1 Fabricate pipe bollards from Schedule 40 steel pipe and concrete as detailed on Drawings.
- .2 Concrete Fill: comply with requirements of Section 03 30 00.

- .3 Bollard Cover: high density polyethylene (HDPE) construction and as follows:
 - .1 Thickness: 3.2 mm thick
 - .2 Colour: selected by Departmental Representative from manufacturer's standard

2.8 MESH UTILITY CAGE

- .1 Exterior Mesh Utility Cage: all-steel construction with 8 gauge galvanized welded wire mesh or expanded metal mesh panels on 14 gauge galvanized steel frame.
 - .1 Provide hinged door access with padlock hasp.
 - .2 Mount with secure fasteners located within the enclosure.
 - .3 Size: 750 mm x 750 mm x 450 mm
 - .4 Provide 15 mm grid/vents
 - .5 Finish: powder coated

2.9 PASS-THRU BOX

- .1 Refer to details on Drawings for construction of pass-thru box. Provide accessories including, but not limited to, latches, fasteners, slide mechanism and addition accessories required for a complete and finished installation.

Part 3 Execution

3.1 ERECTION

- .1 Install Work in accordance with manufacturer's/fabricator's written instructions and Contract Documents.
- .2 Do welding work in accordance with CSA W59 unless specified otherwise.
- .3 Supply finished items to be built-in to those trades along with instructions for proper installation.
- .4 Apply architectural metal work using hidden mechanical fasteners. Installation shall be by skilled Architectural metal workers experienced in highest quality work.
- .5 Fasteners to draw adjoining sections together in proper, true alignment, and are capable of field adjustment.
- .6 All fasteners, mountings to be non-loosening and installed so that they will be hidden at completion.
- .7 Install all Work to true, straight lines, accurate to profile, all properly aligned.
- .8 Isolate dissimilar metals in a manner approved by the Departmental Representative to prevent electrolytic action or corrosion.
- .9 Install finish hardware supplied under other Sections required for completion of components of this Section.
- .10 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

- .11 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .12 Make field connections with high tensile bolts to CSA-S16.1 and weld to prevent loosening.
- .13 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .14 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .15 Repair galvanized areas damaged by welding, flame cutting or during handling, transport or erection in accordance with ASTM A780. Touch-up with organic zinc-rich paint to DOD-P-21035 zinc rich paint, minimum DFT 8 mils.

3.2 PIPE BOLLARDS

- .1 Anchor bollards in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.
- .2 Fill bollards solidly with concrete, mounding top surface.
- .3 Install bollard covers in accordance with manufacture's instructions.

3.3 MISCELLANEOUS ITEMS

- .1 Provide steel angle frame, hanging rods and bracing for supporting bulkheads and shelving.
- .2 Provide bracket backing supports millwork items where required.
- .3 Gutter:
 - .1 Slope eaves troughs to downspouts.
 - .2 Weld joints watertight.
 - .3 Install downpipes and provide goosenecks back to wall as indicated on Drawings.
- .4 Utility Cage: mounted cages at exterior gas meters and other locations indicated on drawings using secure fasteners located on inside of cage.
- .5 Supply and install miscellaneous metal items as indicated or specified, or as otherwise required for a complete job, in accordance with the design intent of the project.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 40 00 – Architectural Woodwork
- .3 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .4 Section 07 61 00 – Sheet Metal Roofing
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim
- .6 Section 08 14 16 – Flush Wood Doors
- .7 Section 09 21 16 – Gypsum Board Assemblies
- .8 Section 09 22 16 – Non-Structural Metal Framing
- .9 Section 09 91 99 – Painting for Minor Works
- .10 Section 10 28 10 – Toilet and Bath Accessories

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - .2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - .3 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
 - .4 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
 - .5 ASTM D5456-14a, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .6 ASTM E1333-10, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
 - .7 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 American Wood Preservers Association (AWPA):
 - .1 AWPA Book of Standards, 2012
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 Canadian Standards Association (CSA International)

- .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA O80 Series-08, Wood Preservation
 - .4 CSA O112 Series-M1977 (R2006), CSA Standards for Wood Adhesives.
 - .5 CSA O121-08, Douglas Fir Plywood.
 - .6 CSA O141-05 (R2009), Softwood Lumber.
 - .7 CSA O151-09, Canadian Softwood Plywood.
 - .8 CSA O153-M1980(R2008), Poplar Plywood.
 - .9 CAN/CSA-O325-07, Construction Sheathing.
- .5 National Lumber Grading Association (NLGA):
- .1 NLGA SPS2-2010, Special Products Standards on Machine Stress-Rated Lumber.
 - .2 Standard Grading Rules for Canadian Lumber 2010.
- .6 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
- .1 SCAQMD Rule 1113-04, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Submit MSDS sheets or official manufacturer literature stating no urea-formaldehyde was used in the manufacturing of composite wood.

1.4 QUALITY ASSURANCE

- .1 Lumber shall be graded and stamped by an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver wood products bundled or crated to provide adequate protection during transit. Inspect wood products for damage upon delivery and remove and replace damaged materials.

- .2 Store materials a minimum of 150 mm off the ground on blocking. Keep materials under cover and dry. Provide for air circulation within and around stacks and under temporary coverings.
- .3 Protect sheet materials to prevent breaking of corners and damage to surfaces.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

Part 2 Products

2.1 PANEL MATERIALS

- .1 Sheathing for diaphragms:
 - .1 Plywood: Douglas Fir (DFP) or Canadian Softwood (CSP), Sheathing Grade, to CSA O121 or O151, thickness as indicated on drawings.
 - .2 Other sheathing:
 - .1 Fire Rated Plywood Panels to CSA O325, Class A fire retardant produced under Performance Standard PS-1, certified by the American Plywood Association.
 - .1 Physical Properties:
 - .1 Modulus of Rupture: 32.8 N/mm²
 - .2 Modulus of Elasticity: 3998 N/mm²
 - .3 Hardness: 2222 N
 - .4 Screw Hold (Face): 1645 N
 - .5 Density: 540 kg/m³
 - .2 Plywood panels to CSA O325, thickness as indicated on drawings.
 - .3 Interior sheathing shall be ULC labelled fire resistant, provide grade stamp or certification as noted for fire retardant pressure treated lumber.

2.2 MISCELLANEOUS LUMBER

- .1 Provide lumber for support or attachment of other construction, including furring, blocking, nailing strips, ground, rough bucks, cants, curbs, fascia, backing sleepers, and similar members.
- .2 Fabricate miscellaneous lumber from dimension lumber of sizes indicated, and into shapes shown on drawings.
- .3 Moisture Content: 19% maximum for lumber items not specified to receive wood preservative treatment.
- .4 Grade: for dimension lumber sizes provide No. 2 or Standard grade lumber per NLGA. For board-sized lumber, provide sheathing grade, S2S.

2.3 WOOD PRESERVATIVE

- .1 Where lumber or plywood is indicated as preservative treated or is specified to be treated, treated in accordance with CAN/CSA O80.9M and AWPA.
- .2 Wood preservatives containing arsenic or chromium are not permitted.
- .3 Pressure treat above ground items with waterborne preservatives to minimum retention of 4.0 kg/m³. After treatment, kiln-dry lumber and plywood to maximum moisture content of 19% and 15% respectively. Treat indicated items and the following:
 - .1 Wood cants, nailing strips, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapour barriers, and waterproofing.
 - .2 Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry and concrete.
 - .3 Wood framing members less than 460 mm above grade.
 - .4 Wood floor plates installed over concrete slabs directly in contact with earth.
- .4 Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to minimum of 6.4kg/m³
- .5 Fire-Retardant Treatment: to CAN/SCA O80.9M, CAN/CSA O80.20M and CAN/CSA O80.27M, pressure impregnated, and as follows:
 - .1 Flame Spread Classification: FSC 25 maximum.
 - .2 Smoke developed of not more than: 75.
- .6 Complete fabrication of treated items before treatment where possible. If cut after treatment apply field treatment to cut surfaces.
- .7 Wood Preservatives: Maximum allowable VOC limit 350 g/L in accordance with SCAQMD Rule #1113 - Architectural Coatings.

2.4 ACCESSORIES

- .1 Air seal: closed cell polyurethane or polyethylene.
- .2 Sealants: in accordance with Section 07 92 00 – Sealants.
 - .1 Maximum allowable VOC limit 250 g/L in accordance with SCAQMD Rule 1168.
- .3 General purpose adhesive: to CSA O112 Series.
 - .1 Maximum allowable VOC limit 70 g/L in accordance with SCAQMD Rule 1168.
- .4 Nails, spikes and staples: to ASTM F1667, hot dipped galvanized for exterior work and pressure preservative and fire retardant treated materials.
- .5 Surface Applied Wood Preservative:
 - .1 Containing minimum 5% clear pentachlorophenol in accordance with CAN/CSA-O80 Series-M89.

- .2 Apply minimum of 2 coats applied in accordance with manufacturers written instructions.
- .6 Rough Hardware (bolts, nuts, washers, etc.): Hot dip galvanized in conformity to CSA G164 or Grade A low carbon steel, conforming to ASTM A307.
- .7 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .8 Expanding foam sealant: general purpose type, semi-rigid single-component polyurethane sealant to CAN/ULC S710.1 and as follows:
 - .1 Thermal Resistance (ASTM C518): RSI 0.73 per 25 mm thickness.
 - .2 Core Density: 16.02 – 24.03 kg/m³
 - .3 Fire Resistance (ASTM E84): flame spread 15; smoke developed 20.
 - .4 Cure Time: approximately one hour.

2.5 FASTENER FINISHES

- .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, pressure-preservative, fire-retardant, and treated lumber.
- .2 Bolts, lag screws, split rings and shear plates: No. 304 (18-8) stainless steel.

Part 3 Execution

3.1 INSTALLATION

- .1 Comply with requirements of National Building Code (NBC) supplemented by following paragraphs.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.
- .5 Select exposed framing for appearance. Install materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .6 Install blocking at locations indicated to support washroom accessories.
- .7 Install roof sheathing in accordance with requirements of NBC.
- .8 Install furring and blocking as required to space-out and support cabinets, wall and ceiling finishes, facings, fascia, soffit, door stops, electrical equipment mounting boards, and other work as required.
- .9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .10 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .11 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.2 ERECTION

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.
- .3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.3 POWER, TELECOMMUNICATIONS AND DATA PANEL BOARDS

- .1 Install 19 mm fire rated fir plywood boards on all walls in telephone and data rooms receiving wiring and equipment; minimum 1220 mm x 2440 mm panels on periphery walls over 300 mm wide, mounted 150 mm off of finished floor.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 The work of this section includes the supply installation of shop manufactured architectural woodwork.
- .2 Cabinet hardware to be supplied by this section.

1.2 RELATED SECTIONS

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 08 14 16 – Wood Doors
- .3 Section 09 21 16 – Gypsum Board Assemblies
- .4 Section 09 65 00 – Resilient Flooring
- .5 Section 09 91 99 – Painting for Minor Works
- .6 Section 10 28 13 – Washroom Accessories
- .7 Division 22 Mechanical: Sinks in countertops
- .8 Division 26 Electrical

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/NPA A208.1-2009, Particleboard.
 - .2 ANSI A208.2-2009, Medium Density Fiberboard (MDF) for Interior Applications.
 - .3 ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D2555 - 06(2011), Standard Practice for Establishing Clear Wood Strength Values.
 - .2 ASTM D2559 - 12a, Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
 - .3 ASTM D2832-92(R2011), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .4 ASTM D3930 – 08, Standard Specification for Adhesives for Wood-Based Materials for Construction of Manufactured Homes.
 - .5 ASTM D4300 - 01(2013), Standard Test Methods for Ability of Adhesive Films to Support or Resist the Growth of Fungi.
 - .6 ASTM D5116-10, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
 - .7 ASTM E1333-10, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.

- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
 - .1 AWMAC Architectural Woodwork Standards, Current Edition.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure), Includes Update No. 1 (2011).
 - .3 CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure), Includes Update No. 1 (2010), Update No. 2 (2010).
 - .4 CSA O121-08 (R2013), Douglas Fir Plywood, Includes Update No. 1 (2013).
 - .5 CSA O141-05 (R2009), Softwood Lumber.
 - .6 CSA O151-09, Canadian Softwood Plywood.
 - .7 CSA O153-13, Poplar Plywood.
- .6 International Organization for Standardization (ISO)
 - .1 ISO 14040:2006, Environmental Management-Life Cycle Assessment - Principles and Framework.
 - .2 ISO 14041:1998, Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.
- .7 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL),.
- .8 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2010.
- .9 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
 - .1 SCAQMD Rule 1113-11, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Show location of each item, dimensioned plans and elevations, large scale details, attachment devices, and other components.
 - .2 Show details of construction, profiles, jointing, fastening and other related details.
 - .3 Show materials, thicknesses, finishes and hardware.
 - .4 Show locations and sizes of cut-outs and holes for plumbing fixtures and other items installed in architectural woodwork.

- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit two (2) finished samples, 610 mm x 610 mm of each finish to be applied at the factory, to the Departmental Representative for approval. Where materials are being matched, verify that specified materials match existing prior to submitting samples.
 - .2 Alternative cabinet hardware from that specified shall be submitted to the Departmental Representative for approval.
 - .3 Reviewed samples shall become the standard for the work.
- .3 Closeout Submittals:
 - .1 Project Record Sheet: Submit to the Departmental Representative two (2) copies of the project record sheet identifying the project title and address, Departmental Representative, Consultant, and Architectural Woodwork Subcontractor. Indicate also materials and finishes used for architectural woodwork and whether shop finished or site finished and by whom. Include type and source of all cabinet hardware and any special items used under architectural woodwork.
 - .2 Submit in accordance with Section 01 01 50 – General Instructions, Operations and Maintenance Manuals.

1.5 **QUALITY ASSURANCE**

- .1 Architectural Woodwork Standards (AWS) and Errata shall be used to establish the minimum level of quality for this project.
- .2 Execute the work of this Section by a member of AWMAC with five years' experience in work of comparable complexity and scope.
- .3 Any reference to Custom or Premium grade in this specification shall be as defined in the AWS.
- .4 Any item not given a specific quality grade shall be Premium grade as defined in the AWS.
- .5 A copy of the AWS shall be made readily available for reference purposes on the job site.
- .6 References in this specification to part and item numbers mean those parts and items contained within the AWS.
- .7 Perform the Work in accordance with the definition of 'Good Workmanship' as defined in the AWS.
- .8 Remove and replace finish carpentry Work which does not conform to the AWS.
- .9 Guarantee and Inspection Service (GIS)
 - .1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and shall be subject to an inspection at the factory and/or site by an appointed AWMAC Certified Inspector. All inspection costs shall be included in the tender price for this project. (Contact your local AWMAC Chapter for details of inspection costs). Shop drawings shall be submitted to the AWMAC

Chapter office for review before work commences. Work that does not meet the AWMAC Architectural Woodwork Standards, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC, at no additional cost to the Departmental Representative.

- .2 If the woodwork contractor is an AWMAC Manufacturer member in good standing, a two (2) year AWMAC Guarantee Certificate will be issued. The AWMAC Guarantee shall cover replacing, reworking and/or refinishing deficient architectural woodwork due to faulty workmanship or defective materials supplied and/or installed by the woodwork contractor, which may appear during a two (2) year period following the date of issuance.
 - .3 If the woodwork contractor is not an AWMAC Manufacturer member they shall provide the Departmental Representative with a two (2) year maintenance bond, in lieu of the AWMAC Guarantee Certificate, to the full value of the architectural woodwork contract.
 - .4 For more information about AWMAC and the GIS Program visit our website at www.awmac.com and contact your local AWMAC Chapter office
- .10 Materials and installation shall be in metric measurements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with the AWS. Control the temperature and humidity in accordance with AWS recommendations, before, during, and after delivery, during storage, and during and after installation as required.
- .2 Provide protective coverings of suitable material for plastic laminate items, taking special precautions to protect corners.
- .3 Do not permit delivery of millwork to the site until the area is sufficiently dry so that woodwork shall not be damaged by excessive changes in ambient humidity

1.7 PROJECT CONDITIONS

- .1 Comply with the AWS requirements for care and storage for optimum temperature and humidity conditions. Maintain a minimum 430 lx (40 f.c.) illumination on surfaces and areas where work is being installed.
- .2 Where work is indicated to be fitted to other construction, check dimensions of other construction by field measurement before fabrication; show recorded field measurements on final Shop Drawings. Coordinate fabrication schedule with construction schedule and progress to avoid delay of Work.
- .3 Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.9 WARRANTY

- .1 Provide 2 year AWMAC GIS Guarantee.

Part 2 Products

2.1 MATERIALS

- .1 Use clean stock only and comply with AWS for quality grades specified.
- .2 Panel Materials: Provide panel materials meeting requirements for moisture content and grades in accordance with AWS requirements and as specified below. Panel products must be manufactured with no added urea-formaldehyde.
- .3 Softwood Plywood: Meeting CSA O121 or CSA O151, cross-banded, sanded G2S, thickness as indicated.
- .4 Poplar plywood: to CSA O153, utility interior moisture resistant type.
- .5 Medium Density Fibreboard (MDF): Meeting ASTM D1037 and ANSI A208.2, Premium Grade for interior use, minimum 750 kg/m³ density; formaldehyde emissions shall be 0.30 ppm or less per 0.424m²/m³ of room value.
 - .1 Urea-formaldehyde free.
- .6 Particleboard: to ANSI A208.1, Grade M-2 or better for interior use, minimum 720 kg/m³ density and Grade M-3, minimum 750 kg/m³ particleboard for countertops and shelves; clearly mark panels with grade mark in visible location; extruded particleboard having loose cores with voids will not be permitted; having no added urea formaldehyde.
- .7 Lumber:
 - .1 Softwood: to CAN/CSA O141, kiln dried to maximum moisture content of 12%, dressed 4 sides.
 - .2 Hardwood: to Canadian Hardwood Lumber Association, selected to meet AWS premium grade, species and finish as indicated on Drawings.
- .8 High Pressure Decorative Laminate: to ANSI/NEMA LD3; Grades and application in accordance with applicable AWS requirements and as follows:
 - .1 Constructed of multiple layers of phenolic resin-saturated kraft paper in combination with a layer of decorative melamine-saturated paper, all fused together under heat and pressure.
 - .2 Horizontal General Purpose Grade (HGS): thickness of 1.2 mm ±0.12 mm, used on the following:
 - .1 Horizontal surfaces, unless specified otherwise.
 - .3 Vertical General Purpose Grade (VGS): thickness of 0.7 mm ±0.10 mm, used on the following:
 - .1 Vertical surfaces, unless specified otherwise.

- .2 Exposed portions of case bodies, including ends, divisions and bottoms.
- .3 Exposed shelves.
- .4 Casework Doors: exposed and semi-exposed surfaces.
- .5 Drawer Faces: exposed and semi-exposed surfaces.
- .4 Liner Grade (CLS): thickness of 0.5 mm \pm 0.10 mm, used on the following:
 - .1 Semi-exposed shelves.
 - .2 Interior portions of case bodies.
 - .3 All surfaces of drawer boxes.
- .5 Laminate backer grade (BKL): thickness of 0.5 mm \pm 0.10 mm, used on the following:
 - .1 Concealed surface of casework backs.
 - .2 Concealed surfaces, unless specified otherwise.
- .6 Colour and Finish: to be selected by Departmental Representative after Contract Award.
- .9 Low Pressure Decorative Laminate: to ANSI/NEMA LD3, in accordance with applicable AWS requirements, and as follows:
 - .1 Melamine impregnated papers thermally fused under pressure.
 - .2 Thickness: 0.5 mm minimum.
 - .3 Wear Resistance: 400 cycles minimum.
 - .4 Colours: to be selected by Departmental Representative after Contract Award.
- .10 Stainless Steel Countertops: Stainless steel 1.6 mm nominal thickness, type 304 stainless steel laminated to marine grade plywood core and as follows:
 - .1 Finish: confirm with Departmental Representative
 - .2 Edge type: as indicated on Drawings or as directed by Departmental Representative.
 - .3 Form edges of exposed tops into a 25 mm thick channel shape with wood inserts on all four edges of underside of top to facilitate anchoring to base units.
 - .4 Backsplash and curbs formed from the same sheet as the top; top edges of curbs and backsplash formed into a channel shape.
 - .5 Welds shall be made without discoloration and shall be ground, polished, and passivated to blend harmoniously with the work surface finish.
 - .6 Protect surfaces of the tops with strippable plastic coating to protect the tops during shipment and installation.
- .11 Edging:
 - .1 All edges of door and drawer panels shall be finished the same as face and back (6 sides finished).
 - .2 Edge type shall conform to AWS requirements.
 - .3 High Pressure Decorative Laminate Edging:

- .1 Horizontal General Purpose Grade (HGS): thickness of 1.2 mm \pm 0.12 mm, colour and finish to match surface finish.
- .2 Post-forming (VGP): maximum thickness of 1mm, colour and finish to match surface finish.
- .12 Adhesive:
 - .1 Decorative laminate: polyvinyl acetate or aliphatic resin in accordance with manufacturer's recommendation for curing under pressure for bonding to wood cores, water resistant type.
- .13 Sealant: in accordance with Section 07 92 00 – Sealants.

2.2 CABINET WORK

- .1 Work shall conform to applicable AWS requirements.
- .2 HPDL edge banding shall be applied to all four edges.
- .3 Door and Drawer Bumpers: Self-adhesive type approximately 6 mm diameter clear silicone bumpers for all cabinet work doors and drawer faces, two per door and drawer, placed at door top and bottom and drawer top.

2.3 CABINET FABRICATION

- .1 General
 - .1 Flush overlay cabinet doors and drawer fronts as detailed.
 - .2 Fabricate gables and edges meeting walls oversize to allow for scribing to fit on site.
 - .3 Use non-telegraphing grain plywood when laminate is the specified finish.
 - .4 Assemble Work with flush butt hairline corners and joints. Cut-outs for services to be done on site during installation. No hairline cracks will be allowed in the face area of cabinet work modules unless approved in writing by Departmental Representative.
 - .5 Carefully fit, cope or mitre and well glue-up Joints. There shall be no end wood visible on finished surfaces.
 - .6 Set nail heads in finished surfaces. Countersink screws and bolts, except those detailed to be exposed, and fill holes with edge grain wood plugs to match colour and grain.
 - .7 Ensure adjacent part of continuous work match in colour and pattern.
- .2 Construction
 - .1 Minimum core thicknesses as follows:
 - .1 Drawer bottoms, particleboard, 12 mm;
 - .2 Drawer sides and backs, particleboard, 12 mm;
 - .3 Drawer fronts, particleboard, 19 mm;
 - .4 Doors, particleboard, 19 mm;
 - .5 Lower case backs against walls, particleboard, 10 mm;
 - .6 Upper case backs against walls, particleboard, 10 mm;
 - .7 Shelves, fixed and adjustable, particleboard, 19 mm;

- .8 Counter top cores, Plywood with non-telegraphing grain, 19 mm with 38 mm edge, for wet areas, use marine grade plywood and ensure that all cut-outs are sealed prior to installation of sinks, primer is not considered to be an appropriate sealer;
- .9 Backsplashes at all locations: Poplar Veneer Plywood, 19 mm; use marine grade plywood at wet areas,
- .10 All other work Poplar Veneer Plywood, 19 mm.
- .2 Glue, dowel, mortise, lock joint or dado all cabinet work and cabinet work. Do not use staples. Nailing and screws are acceptable. Do not surface nail or screw through countertops.
- .3 Blocking, framing, web frames to be solid lumber.
- .4 Provide solid wood edge strips in all doors and cases to receive hardware. Rebate and pressure glue to core.
- .5 Cut and adapt all Work to receive hardware.
 - .1 Drill and prepare end gables for insert type shelf standards on gables.
 - .2 Install all finishing hardware and fittings in shop.
 - .3 Fittings which may be susceptible to damage during shipping and installation may be installed after millwork installed on site.

2.4 CABINET HARDWARE

- .1 Provide the following cabinet hardware, in quantity required, complete with all screws, bolts, washers for complete installation.
- .2 Non-Exposed Fasteners: fabricators choice consistent with quality level specified.
- .3 Exposed Fasteners: Architectural appearance, material, finish and fastener tool type as selected by Departmental Representative; coordinate sample submittals before ordering materials.
- .4 Draw Bolt Fasteners: Mitre butt joint fastener, adjustable and requiring no special tools for installation and as follows:
 - .1 Material: Steel
 - .2 Finish: zinc
 - .3 Length: 100 mm
- .5 Spacers: Rigid PVC to size and profile indicated.
- .6 Access Panel Connectors: assembly bolt screwed with #5 hexagonal key and as follows:
 - .1 Material: steel with nickel finish
 - .2 Diameter: 6.35 mm
- .7 Grommets for electrical cords through counter tops: 50 mm diameter, plastic liner and cap.
 - .1 Colour: to be selected by Departmental Representative.
- .8 Pulls: Typical drawers and doors: steel wire handle pulls as follows:

- .1 Depth: 35 mm
- .2 Height: 10 mm
- .3 Width: 100 mm
- .4 Finish: to be selected by Departmental Representative
- .9 Drawer Slides: to ANSI-A156.9, B85051, side mount, steel construction, ball bearing operation, rail disconnect system, bright zinc finish, length as required, and as follows:
 - .1 Light duty drawer slides: 34 kg capacity, $\frac{3}{4}$ extension
 - .2 Medium duty drawer slides for drawers deeper than 150 mm but less than 406 mm wide: 41 kg capacity, full extension.
 - .3 Heavy duty drawer slides: 68 kg capacity, full extension.
 - .4 Lateral file drawers, 91 kg capacity, over-travel extension, 50 000 cycle test.
- .10 Hinges:
 - .1 Typical Cabinet Doors: to ANSI-A156.9, B01612 – concealed hinge, euro-style hinge with cover caps; fully adjustable for overlay, depth, height and closing force; opening angle of 110°; self-closing feature; nickel plated steel construction; overlay and half overlay mounting, size and profile to suit cabinet construction.
- .11 Locks:
 - .1 Typical lockable doors and drawers: Nickel finished, master keyed, keyed alike in groups, cam lock with plate, adjust keying group to suit requirements.
 - .2 Gang lockable drawers: Nickel finished, master keyed, keyed alike in groups, gang lock for groups of 3 drawers or more.
 - .3 Secure lock for Narcotics: Nickel finished, Master Keyed, with strike plate.
 - .1 Location: Room G187B Dispensary and as otherwise indicated on Drawings.
- .12 Shelf Rests:
 - .1 Flush mounted pilaster with shelf rests sized for shelf depth, nickel finish.
- .13 Waste Chute: circular waste chute of type 300 stainless steel with 152 mm inside diameter x 152 mm deep, self rimming, and with satin finish on exposed surfaces.
- .14 Additional hardware as indicated on Drawings.

2.5 FACTORY FINISHING – CABINET WORK

- .1 Cabinet work for High Pressure Decorative Laminate Finish:
 - .1 AWS Quality Grade Premium.
 - .2 Construction: Cabinet work shall conform to applicable sections of the AWS.
 - .3 Exposed Parts: High pressure decorative laminate, plywood with non-telegraphing grain as indicated.

- .4 Semi-Exposed Parts: High pressure decorative laminate, plywood with non-telegraphing grain as specified above.
- .5 Concealed parts: Low pressure decorative laminate backer to balance face materials.
- .2 Laminate Countertops and Backsplashes
 - .1 Countertops shall be self edge type to applicable AWS requirements.
 - .2 Backsplash shall conform to Section 6 of the AWS.
 - .3 Custom counter shall be seamless.

Part 3 Execution

3.1 JOB CONDITIONS

- .1 Job Conditions for installation of architectural woodwork shall be in accordance with applicable AWS requirements.

3.2 INSPECTION

- .1 Verify condition and dimensions of previously installed work upon which this Section depends. Report defects to Departmental Representative. Commencement of Work means acceptance of existing conditions.

3.3 PREPARATION

- .1 Obtain measurements from site.
- .2 Check access to ensure large pieces of work can be safely handled to their place of final installation.
- .3 Protect finished surfaces and materials of other trades from damage.
- .4 Ensure services and roughing-in which affect or are connected to or through this work are complete and acceptable.
- .5 Back prime cabinet work immediately after delivery to site.

3.4 INSTALLATION

- .1 Install work to applicable AWS and Quality Assurance requirements.
- .2 Install cabinet work in its indicated locations, plumb, level, and true.
- .3 Anchor to floor, walls or ceiling using fastening devices and hardware consistent with the building materials encountered. Do not use wood plugs. Do not use plastic plugs for ceilings or walls. Provide wall strapping as required.
- .4 Anchor cabinet work and millwork to building structure. Shim level and set square in relation to adjoining surfaces. Scribe to adjacent Work. Provide allowance for finish flooring installation to base.
- .5 Cabinet work:
 - .1 Fasten to framing using zinc-coated bolts, countersunk and plugged with matching wood plugs.

- .2 Set cabinetwork in place, on base, anchoring securely to building structure and to adjoining cabinetwork. Use approved connector type fasteners between items of cabinetwork to hold adjoining pieces tightly together.
 - .3 Scribe to smooth snug fit with adjoining surfaces and materials to align work. Mitre corners.
 - .4 Perform cutting, fitting, repairing in woodwork as required by other trades where their work is connected to or part of this work.
 - .5 Cut out openings for mechanical, electrical, and communications fittings and fixtures. Coordinate and cooperate in the connection and installation of mechanical, electrical, and communications work.
 - .6 Apply sealant between countertops and adjoining walls and cabinetwork. Seal edges of cut-out core material before fixtures installed.
 - .7 Install finishing hardware shipped loose.
- .6 Supply and install hardware required for the completion of architectural woodwork, including, without limitations, adjustable shelf supports and cabinet hinges, catches, pulls, drawer accessories, bumpers, drawer slides and closet hanger bars, and similar items. Install millwork hardware in the shop wherever possible. Install millwork hardware secure, plumb, level, true to line, and in accordance with the hardware manufacturers' printed instructions. Cut and fit to millwork for proper installation and operation. Provide smoothly operating units free from binding. Clean and adjust hardware for proper operation.

3.5 ADJUSTING AND CLEANING

- .1 During and after installation adjust all hardware and operating parts as necessary to ensure smooth and proper operation.
- .2 Clean all cabinet, countertops, shelves and fixtures.
- .3 Repair any marks, scratches or marring.
- .4 Remove and replace damaged, marked, or stained finish carpentry.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 07 21 13 – Board Insulation
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 27 19 – Underslab Vapour Barrier
- .5 Section 07 92 00 – Sealants

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E96/E96M-13, Standard Test Method for Water Vapor Transmission of Materials.
 - .2 ASTM E154/E154M-08a(2013)e1, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .3 ASTM D41/D41M-11, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 - .4 ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .5 ASTM D448-12, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 - .6 ASTM D449/D449M-03(2014)e1, Standard Specification for Asphalt Used in Dampproofing and Waterproofing.
 - .7 ASTM D5147/D5147M-14, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
 - .8 ASTM C1325-08b, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
 - .9 ASTM D2178/D2178M-13a, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
 - .10 ASTM D6162-00a(2008), Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
 - .11 ASTM D6163-00(2008), Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
 - .12 ASTM D6164/D6164M-11, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- .2 Underwriters Laboratories' of Canada (ULC)
 - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with waterproofing contractor's representative, Departmental Representative, and Contractor in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Co-ordination with other building subtrades.
 - .3 Review installation procedures, including:
 - .1 Substrate requirements for Project acceptance (curing of concrete surface, for release agents, temperature).
 - .2 Waterproofing installation.
 - .3 Phasing and sequencing requirements.
 - .4 Termination, flashing, expansion joint, and penetration requirements.
 - .5 Review inspection, testing, and quality control procedures.
 - .6 Manufacturer's warranty requirements.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Provide two copies of most recent technical waterproofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit membrane manufacturer's standard details that will be utilized for this project, indicate changes that must be made to make the details project specific for review by the Departmental Representative.
 - .3 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada and indicate VOC content for:
 - .1 Primers.
 - .2 Asphalt.
 - .3 Sealers.
- .2 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .3 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .4 Manufacturer's field report: in accordance with Section 01 01 50 – General Instructions, Quality Control.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: Engage experienced installer acceptable to the membrane manufacturer with a minimum of 3 years experience who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance.

- .2 Obtain primary waterproofing materials from single manufacturer and/or ensure materials ordered and supplied are compatible with one another. Ensure waterproofing materials are compatible with air and vapour retarder.
- .3 Coordination between all installers of each component of membrane is essential to ensure continuity of system and that junctions between the various components are effectively sealed.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store rolls of felt and membrane in upright position.
 - .1 Store membrane rolls with salvage edge up.
- .3 Remove only in quantities required for same day use.
- .4 Place plywood runways over completed Work to enable movement of material and other traffic.
- .5 Store sealants at +5 degrees C minimum.
- .6 Store insulation protected from daylight, weather and deleterious materials.
- .7 Handle waterproofing materials in accordance with manufacturer's written directives, to prevent damage or loss of performance.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 FIELD CONDITIONS

- .1 Ambient Conditions
 - .1 Do not install waterproofing when temperature remains below manufacturers' recommendations.
 - .2 Minimum temperature for solvent-based adhesive is -5 degrees C.
- .2 Install waterproofing on substrate, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into waterproofing system.

1.9 WARRANTY

- .1 Waterproofing membrane manufacturer hereby warrants that the waterproofing membrane will remain in a watertight condition and will not leak as a result of faulty materials for a period of 5 years. Scope of warranty shall include labour and material required to return the membrane to a watertight condition.

Part 2 Products

2.1 PERFORMANCE CRITERIA

- .1 Waterproofing System: capable of resisting moisture/water and preventing moisture migration to interior.

- .2 Compatibility between components of waterproofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.

2.2 SELF-ADHESIVE WATERPROOFING SYSTEM MATERIALS

- .1 Primer: water based primer as recommended by membrane manufacturer and as follows:
 - .1 To CGSB 37-GP-9Ma, elastomeric bitumen, solvent primer with adhesive enhancing resins to enhance adhesion of self-adhesive membranes at temperatures above -10°C as recommended by membrane manufacturer.
- .2 Waterproofing Membrane: SBS modified bitumen self-adhering sheet membrane with cross-laminated polyethylene film, covered by pull-off release sheets and as follows:
 - .1 Minimum total thickness: 1.5 mm
 - .2 Tensile strength (membrane): 4.07 MPa to ASTM D412
 - .3 Tensile strength (film): 40.71 MPa to ASTM D412
 - .4 Ultimate elongation: 455% to ASTM D412
 - .5 Flexibility at cold temperature: minimum -30°C
 - .6 Water vapour permeability: <0.019 perms to ASTM E96
 - .7 Puncture Resistance: 2.98 kN to ASTM E154

2.3 ACCESSORIES

- .1 Waterproofing Mastic: single component sealing compound to seal exterior, vertical and horizontal terminations as recommended by manufacturer.
- .2 Adhesive for overlay board and insulation: Water-based rubberised liquid coating as recommended by manufacturer.
- .3 Insulation: as specified in Section 07 21 13.
- .4 Drainage board: high-strength drainage panel consisting of polypropylene core and fabric for installation over waterproof membranes with the following characteristics:
 - .1 Thickness: 10 mm
 - .2 Compressive strength: 550 kPa
 - .3 Flow rate: 223 l/min/m.
- .5 Protection Board (for all horizontal underslab installations): premanufactured protection board as recommended by the membrane manufacturer for installation under slabs.
- .6 Protection Board (for all vertical applications): 25 mm thick expanded polystyrene foam board or other premanufactured protection board as recommended by the membrane manufacturer.
- .7 Protection board adhesive: fast drying, rubber based cement, as recommended by the membrane manufacturer. Note: protection board adhesive is to be compatible with protection board and with membrane.

- .8 Termination Bar: high strength plastic composite, ultraviolet resistant as recommended by membrane manufacturer.
- .9 Provide drainage board accessories as required for complete installation as recommended by drainage board manufacture.

Part 3 Execution

3.1 EXAMINATION AND PREPARATION OF SURFACES

- .1 Do not proceed with work until conditions are in accordance with manufacturers instructions.
- .2 Ensure surfaces are smooth, dry, clean and free of ice and debris as per manufacturer's recommendations.
- .3 Do not install materials in conditions of snow or rain.
- .4 Cure concrete a minimum of fourteen (14) days, adhesion test is recommended before membrane application.
- .5 Verify the compatibility of membrane components with curing compounds, coatings, or other materials which are already installed on the surfaces to be treated.
- .6 Report cracks over 3 mm wide to Departmental Representative. Fill crack with waterproofing mastic. Apply 150 mm wide strip of membrane centered over crack.

3.2 METHOD OF EXECUTION

- .1 Perform Work on a continuous basis as surface and weather conditions allow.
- .2 Protect adjoining surfaces against damage that could result from the waterproofing installation.

3.3 PRIMER APPLICATION

- .1 Apply primer coating as recommended by manufacturers printed instructions. If not covered the same day, primed surfaces must be re-primed.

3.4 SELF-ADHESIVE WATERPROOFING MEMBRANE INSTALLATION

- .1 Select waterproofing membrane according to temperatures during application. For membrane applications at temperature below -10°C, contact membrane manufacturer.
- .2 Apply pre-stripped membrane and seal with waterproofing mastic to all protrusions through waterproofing membrane.
- .3 Align the first roll of membrane to a previously drawn chalk line.
- .4 Pre-strip edges with a 150 mm wide strip of membrane centered on the corner. Membrane to be installed in direct contact with the substrate not leaving any voids under the membrane strip.
- .5 Install membrane onto primed surface by peeling back the paper backing on the underside and adhering the membrane to the surface.

- .6 Install subsequent rolls in the same manner and aligned with the preceding roll with a side lap of at least 75 mm. End laps must be overlapped at least 150 mm.
- .7 Holes and tears in the membrane must be repaired with the appropriate membrane material. The repair must exceed the affected surface area by at least 75 mm. The membrane piece applied for the repair must be sealed around its edges with mastic.
- .8 Use a roller approved by manufacturer to apply pressure over the entire surface of the membrane to ensure perfect adhesion.
- .9 Contractor to verify meticulously the membrane installation at the end of each day of work and before application of membrane protection system and backfilling.
- .10 Seal all inside corner overlaps with a bead of mastic after membrane installation.
- .11 Uppermost edge of membrane is to be mechanically fastened to the concrete substrate using applicable fasteners and termination bars.
- .12 Apply mastic on the top edge of membrane to prevent water infiltration.
- .13 Any waterproofing membrane left exposed after backfilling shall be protected from ultra violet and mechanical damages.

3.5 INSULATION, PROTECTION AND DRAINAGE BOARD INSTALLATION

- .1 Apply adhesive with spots 75 mm in diameter, every 300 mm. Bottom panel should be supported or mechanically fixed. On the top row of insulation, apply a continuous bead of adhesive 25 mm wide to the top leading edge of the panels to be glued. This bead will protect the adhesive spots during initial cure by limiting the flow of moisture behind the insulation in case of rain.
- .2 Drape the drainage board and secure without fastening through the waterproofing membrane or tape to the waterproofing membrane.
 - .1 Unroll drainage board with flat core side against the wall or waterproofing membrane.
 - .2 Adhere drainage board with mastic without fastening through the waterproofing membrane.
 - .3 Overlap flat side core lip with second sheet of the drainage board to provide a continuous drainage layer. Ensure excess filter fabric is overlapped with the next sheet.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 04 22 00 – Concrete Unit Masonry
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 27 19 – Underslab Vapour Barrier
- .5 Section 07 46 19 – Steel Siding
- .6 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .7 Section 07 61 00 – Sheet Metal Roofing

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-15e1, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM C1126-15, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .3 ASTM D1621-16, Standard Test Methods for Compressive Properties of Rigid Cellular Plastics.
 - .4 ASTM D2842-12, Standard Test Methods for Water Absorption of Rigid Cellular Plastics.
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CGA-B149.1-10, Natural Gas and Propane Installation Code, Includes Update No.1 (2010).
 - .2 CAN/CGA-B149.2-10, Propane Storage and Handling Code.
- .3 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-S114-05, Test for Determination of Non-Combustibility in Building Materials.
 - .3 CAN/ULC-S604-M91, Standard for Factory-Built Type A Chimneys.
 - .4 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 PRE-INSTALLATION MEETINGS

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative, Departmental Representative, and Consultant in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
 - .2 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Health and Safety Requirements: in accordance with Section 01 35 33 – Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Handling Requirements:
 - .1 Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
 - .2 Protect plastic insulation as follows:
 - .1 Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - .2 Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - .3 Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

.4 Care for insulation in accordance with PIMA technical bulletin 109.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

Part 2 Products

2.1 INSULATION MATERIALS

- .1 Wall Insulation: Expanded polystyrene (EPS) to CAN/ULC S701 and as follows:
- .1 Type: 3
 - .2 Thermal Resistance: RSI 0.81/25 mm minimum.
 - .3 Edges: square.
 - .4 Size: 1220 mm x 2440 mm or 610 mm x 1220 mm as appropriate to application x thickness required to achieve insulation value indicated on Drawings.
 - .5 Compressive Strength: minimum compressive strength 140 kPa at 10% deformation in accordance with ASTM D1621.
 - .6 Water Absorption: maximum 4% (% by volume) in conformance with ASTM C272.
- .2 Foundation Wall Insulation: Extruded polystyrene (XPS) to CAN/ULC S701 and as follows:
- .1 Type: 4
 - .2 Thermal Resistance: RSI 0.87/25 mm minimum.
 - .3 Edges: square.
 - .4 Size: 610 mm x 2440 mm x thickness as indicated on Drawings.
 - .5 Compressive Strength: minimum 200 kPa at 10% deformation in accordance with ASTM D1621.
 - .6 Water Absorption: maximum 0.7% (% by volume) in conformance with ASTM D2842.
- .3 Load Bearing Insulation: Extruded Polystyrene (XPS), high density extruded type in accordance with CAN/ULC S701 and as follows:
- .1 Type: 4
 - .2 Thermal Resistance: RSI 0.87/25 mm minimum.
 - .3 Edges: square.
 - .4 Size: 610 mm x 2440 mm x thickness as indicated on Drawings.
 - .5 Compressive Strength: minimum 410 kPa at 5% deformation in accordance with ASTM D1621.
 - .6 Water Absorption: maximum 1% (% by volume) in conformance with ASTM D2842.
- .4 For MBM roof insulation refer to Section 07 52 00 – Modified Bituminous Membrane Roofing.

2.2 ACCESSORIES

- .1 Adhesive (for polystyrene): trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation to CGSB 71-GP-24 Type II; suitable for application in temperature down to -12°C.
 - .1 Solids by Weight: approximately 73%
 - .2 Drying Time (on porous base substrate at 20°C):
 - .1 Initial Set: up to 30 minutes
 - .2 Set Through: 24 hours
 - .3 Water Vapour Permeance (ASTM E96): 1.7 ng/Pa.m².s
- .2 Insulation Fasteners
 - .1 Mechanical Fasteners: High quality, impact resistant plastic fastener system specifically designed for installation of board insulation materials; 38 mm diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate.
- .3 Perimeter Insulation Flashings: Coordinate supply of end closures and flashings for perimeter insulation system with Section 07 62 00.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Examine substrates and immediately inform Departmental Representative in writing of defects.
- .2 Prior to commencement of work ensure:
 - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 WORKMANSHIP

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.
- .5 Use only insulation boards free from chipped or broken edges that is dry, and unsoiled and that has not been left exposed at any time to ice and snow.

- .6 Use largest possible dimensions to reduce number of joints.
- .7 Offset both vertical and horizontal joints in multiple layer applications.
- .8 Do not enclose insulation until it has been reviewed by Departmental Representative.

3.4 INSTALLATION: GENERAL

- .1 Install rigid insulation to maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements.
- .2 Saw-cut and trim insulation neatly to fit spaces. Butt edges and ends tight. Fit insulation tight against mechanical, electrical and other items protruding plane of insulation. Fill voids with foamed-in-place insulation compatible with installed insulation; refer to Section 07 21 19.
- .3 Follow the instructions for use of materials of insulation and accessory manufacturers.
- .4 Install insulation horizontally. Offset vertical joints minimum 300 mm.
- .5 Leave insulation joints unbonded over line of expansion and control joints; bond a continuous 150 mm wide strip of primary vapour membrane over expansion and control joints using compatible adhesive.

3.5 INSTALLATION: PERIMETER INSULATION

- .1 Install board insulation to vertical surfaces with adhesive applied in accordance with manufacturer's written instructions, and as follows:
 - .1 Exterior Application: Extend boards as indicated on Drawings, installed on perimeter foundation wall.
 - .2 Apply adhesive to the substrate by the "dab" method not less than 10 mm x 20 mm size at 150 mm centres; bed the insulation in the adhesive before the adhesive loses its tack or skins over.
 - .3 Protect below grade insulation on vertical surfaces from damage during backfilling; set in adhesive according to insulation manufacturer's written instructions.

3.6 INSTALLATION: UNDERSLAB INSULATION

- .1 Extend boards as indicated on Drawings, and as follows:
 - .1 Lay boards on level compacted fill.
 - .2 Protect top surface of horizontal insulation from damage during concrete work by applying protection board.

3.7 INSTALLATION: CAVITY WALL INSULATION

- .1 Cavity Wall Insulation: Fit courses of insulation between wall ties and other confining obstructions in cavity; butt edges tightly in vertical and horizontal directions and as follows:
 - .1 Install cavity insulation with a tight fit to substrate materials, provide adhesive and additional fasteners where uneven substrates cause air spaces behind insulation; apply adhesive to substrate in a continuous film

not less than 3 mm thick when wet and bed the insulation into adhesive before adhesive loses its tack or skins-over.

- .2 Apply insulation fasteners using a minimum of six (6) fasteners in two rows located near the centre of the board along the narrow dimension and near the third points along the long dimension; secure boards with two clips at the centre where both dimensions are less than 600 mm.
- .3 Apply sheet membrane vapour retarder behind Z-bars prior to installation of insulation between Z-bars supporting preformed metal cladding.
- .4 Install insulation clips to walls before sheet membrane vapour retarders are applied.

3.8 CLEANING AND PROTECTION

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- .3 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation

END OF SECTION

Part 1 General

1.1 INTENT

- .1 Foam-in-place insulation to exterior hollow steel door frames, aluminum door frames and window frames.
- .2 Foam-in-place insulation around protrusions through the exterior wall envelope and juncture of different cladding materials.

1.2 RELATED SECTIONS

- .1 Section 07 21 13 – Board Insulation
- .2 Section 07 26 00 – Vapour Retarders
- .3 Section 07 92 00 – Sealants
- .4 Section 08 11 00 – Metal Doors and Frames
- .5 Section 08 11 16 – Aluminum Doors and Frames
- .6 Section 08 50 00 – Aluminum Windows

1.3 REFERENCES

- .1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .2 Green Seal Environmental Standards
 - .1 Standard GC-03-97, Anti-Corrosive Paints.
 - .2 Standard GS-11-10, Paints and Coatings.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State SCAQMD Rule 1113-06, Architectural Coatings.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .3 CAN/ULC-S705.1-01-AM3, Amendment 3 to Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density,- Material –Specification, Includes Amendments 1,2.
 - .4 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:

- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions, Quality Control.
 - .1 Test reports: submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers: Use companies that are members and licensed CUFCA having trained and certified installers in accordance with CAN/ULC S705.2 and CUFCA requirements.
 - .2 Manufacturer: Obtain air and vapour seal materials from a single manufacturer regularly engaged in manufacturing the products specified in this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other sections.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 SITE CONDITIONS

- .1 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .2 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

- .3 Ensure temperature is maintained throughout the curing period.

Part 2 Products

2.1 MATERIALS

- .1 Insulation: Closed cell, two pound density, one component rigid urethane foam.
 - .1 Flame Spread/Smoke Developed (ASTM E84): 25/400
 - .2 Thermal Resistance: minimum 1.36 RSI/25 mm
 - .3 Compressive Strength (ASTM D1621): 118.6 kPa
 - .4 Tensile Strength (ASTM D1623): 220 kPa
 - .5 Water Vapor Permeance (ASTM E96)
 - .1 Perm at 25 mm thick: 6.4
 - .2 Perm at 50 mm thick: 3.2
 - .6 Water Absorption (% by volume) 3.2 to ASTM D2842.
 - .7 Air Leakage (ASTM E2178, L/s/m² at 75 Pa): 0
- .2 Thermal Barrier: spray applied fire retardant overcoat meeting applicable requirements of the National Building Code for thermal barrier of foamed plastic.
 - .1 Fire Test Performance: test to CAN/ULC S101 and ASTM E119
 - .2 Flame Spread/Smoke Developed (ASTM E84): 0/0
 - .3 Thermal Performance (0.043 W/mK at 24°C): 0.59 RSI/25 mm
 - .4 Density (ASTM E605): 256 kg/m³
 - .5 Cohesion/Adhesion (ASTM E736): 18.0 kPa
 - .6 Compressive Strength (ASTM E761): 114 kPa
 - .7 Air Erosion (ASTM E859): 0.0 g/m²
 - .8 Fungal Resistance (ASTM G21): no growth after 28 days.
 - .9 Corrosion Resistance: does not promote corrosion

Part 3 Execution

3.1 SURFACE PREPARATION/EXISTING CONDITIONS

- .1 Clean spaces that are to receive insulation, of dirt, dust, grease, loose material or other foreign matter that may inhibit adhesion.
- .2 Provide sufficient ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24 hour period after application.
- .3 Protect adjacent surfaces from overspray and dusting.
- .4 Prior to application, slightly moisten surfaces to which foam in place insulation is being applied, to accelerate curing.
- .5 Temporarily brace frames as may be required to prevent possible bowing of frames due to over expansion of the foam-in-place insulation.

**3.2 INSTALLATION/AIR SEAL AROUND EXTERIOR WINDOW AND DOOR
FRAMES**

- .1 Fill exterior hollow steel door frames 75% full with foam-in-place insulation prior to installation of frames. Fill the remainder of the frame after installation, through the gap between the frame and the wall construction.
- .2 Install foam-in-place insulation around all exterior window frames to maintain continuity of the thermal barrier, after air barrier has been installed and sealed to windows.
- .3 Ensure that foam completely fills spaces, without voids, and that foam is continuous at corners.

3.3 INSTALLATION/AROUND PROTRUSIONS THROUGH AIR SEAL

- .1 Install foam-in-place insulation around all protrusions through the exterior building envelope to achieve and maintain continuity of air/vapour seal.

3.4 CLEANING

- .1 Cut back excess foam-in-place insulation once cured, flush with surrounding surfaces, or recess back for application of sealant as specified in Section 07 92 00.
- .2 Upon completion of foam-in-place insulation work, clean adjacent surfaces of overspray and dusting to the satisfaction of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete
- .2 Section 04 22 00 – Concrete Unit Masonry
- .3 Section 07 21 13 – Board Insulation
- .4 Section 07 21 19 – Foam-In-Place Insulation
- .5 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .6 Section 07 61 00 – Sheet Metal Roofing
- .7 Section 07 92 00 – Sealants

1.2 REFERENCES

- .1 American Society for Testing of Materials (ASTM)
 - .1 ASTM D93-16, Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.
 - .2 ASTM D146/D146M-04 (2012) e1, Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.
 - .3 ASTM D412- 15a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
 - .4 ASTM D1970/D1970M-15a, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .6 ASTM E283-04 (2012), Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .7 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.
 - .8 ASTM E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Select products to be compatible with adjoining membranes previously installed under related Sections
 - .2 Select products from a single manufacturer, or products which are compatible from different manufacturers.

- .3 Coordination between all installers of each component of vapour and air retarder system is essential to ensure continuity of system and that junctions between the various components are effectively sealed.
- .4 Verify with manufacturers and all tradesmen involved with installation procedures of building products incorporated into air barrier elements including, but not limited to, various membranes, coating and sealants as well as continuity with roofing membrane.
- .2 Pre-installation Meeting:
 - .1 Convene one (1) week before commencing Work of this Section.
 - .2 Arrange for manufacturer's factory-trained agent to be on site at beginning of installation to provide training and supervision of personnel who will install membrane. Agent shall also provide frequent inspection visits thereafter to assure quality and competence of membrane installations.
- .3 Sequencing:
 - .1 Sequence work in accordance with Construction Progress Schedule.
 - .2 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data.
 - .3 Submit statement from manufacturer(s), indicating products supplied under this Section are compatible with one another and with products previously installed under the work of related Sections.
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Provide duplicate 200 mm x 200 mm samples of membrane adhered to all project substrates, including adjoining membranes specified in other Sections.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 01 50 – General Instructions, Quality Control.
 - .1 Existing Substrate Condition: report deviations, as described in PART 3 - EXAMINATION in writing to Departmental Representative.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.5 QUALITY ASSURANCE

- .1 Applicator: company specializing in performing work of this section with minimum 3 years documented experience with installation of air/vapour barrier systems.
 - .1 Completed installation must be approved by the material manufacturer.
- .2 Applicator: company:
 - .1 Currently licensed by National Air Barrier Association certifying organization.
 - .2 Must maintain their license throughout the duration of the project.

1.6 MOCK-UP

- .1 Construct mock-up in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .2 Construct typical exterior wall panel, 3 m long by 4 m wide, incorporating window and frame and sill, insulation, building corner condition, and junction with roof system; illustrating materials interface and seals.
- .3 Locate where directed.
- .4 Mock-up may remain as part of finished work.
- .5 Allow review of mock-up by Departmental Representative before proceeding with air/vapour barrier Work. Accepted mock-up will demonstrate minimum standard of quality required for this project.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.9 AMBIENT CONDITIONS

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 01 50 – General Instructions, Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.
- .4 Apply air/vapour barrier membrane to cast-in-place concrete, precast concrete, masonry (strike masonry joints flush) which are smooth, clean, dry, and in good condition. Moisture, grease, machine oil or other foreign material must be removed. Concrete must be cured, minimum 7 days, and dry before application, and when temperature is 5 degrees C or higher.

1.10 WARRANTY

- .1 Manufacturer's Warranty: issue and written and signed warranty in the name of the Departmental Representative, certifying the product will meet the physical characteristics published by the manufacturer for a period of 5 years starting from the completion date of installation of membranes.
- .2 Installer's Warranty: Submit installers warranty stating that air and vapour membranes and accessories are installed in accordance with manufacturer's recommendation and that membrane, transitions and through-wall flashing membranes, primers, mastics, adhesives and sealants are sourced from one manufacturer.

Part 2 Products

2.1 SELF-ADHESIVE AIR AND VAPOUR BARRIER SYSTEM MATERIALS

- .1 Primer: SBS synthetic rubbers, adhesive resins and solvents used to prime porous substrates to enhance adhesion of self-adhesive membranes at temperatures above -10°C.
 - .1 Specific gravity at 20°C (kg/l): 0.79 to 1.0 kg/l
 - .2 Solids by weight: 24% to 53%
 - .3 Flash point: -30°C to ASTM D93
- .2 Air/Vapour Barrier Membrane: to CAN/CGSB 37.56 or ASTM D1970; SBS modified bitumen, self-adhering sheet membrane with polyethylene facer, for application temperatures between -10°C and 10°C and as follows:
 - .1 Thickness: 1 mm to 1.5 mm
 - .2 Tensile strength: 11.3 kN/m to 15.4 kN/m to ASTM D5147.
 - .3 Ultimate elongation: 25% to 40%
 - .4 Flexibility at cold temperature: minimum -30°C
 - .5 Air permeability: <0.0003 L/sec. m²
 - .6 Water vapour permeability: <0.05 perm
 - .7 Static puncture: minimum 178 N
 - .8 Tear resistance: 375 to 400 N
 - .9 Lap adhesion: 800 N/m
- .3 Air/Vapour Barrier Membrane: to CAN/CGSB 37.56 or ASTM D1970; SBS modified bitumen, self-adhering sheet membrane with polyethylene facer, for application temperature above 5°C, and as follows:
 - .1 Thickness: 1 mm to 1.5 mm
 - .2 Tensile strength: minimum 6 kN/m
 - .3 Ultimate elongation: 25% to 40%
 - .4 Flexibility at cold temperature: minimum -17°C
 - .5 Air permeability: <0.0003 L/sec. m²
 - .6 Water vapour permeability: <0.05 perm
 - .7 Static puncture: 400 N

- .8 Tear resistance: 375 to 400 N
- .9 Lap adhesion: minimum 1750 N/m
- .4 For roof air and vapour barrier refer to Section 07 52 00 – Modified Bituminous Membrane Roofing.

2.2 MASTICS AND ADHESIVES

- .1 Waterproofing Mastic: solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers, used to seal around penetrations and extrusions.
 - .1 Compatibility: With air/vapour barrier membrane, substrate and insulation.
 - .2 Specific gravity at 20°C: 1.0 kg/l to 1.12 kg/l
 - .3 Application Temperature: -10°C to +35°C
 - .4 Solids by Weight: 70% to 83 %

2.3 ACCESSORIES

- .1 Thinner and cleaner for Butyl and Neoprene Sheet: as recommended by sheet material manufacturer.
- .2 Attachments: galvanized steel bars and anchors.
- .3 Roof-to-Wall Transition Membranes: Manufacturer's recommended reinforced self adhesive, compatible with roofing air and vapour membranes and wall materials specified in this Section.
- .4 Through Wall Membranes: Manufacturer's recommended reinforced self adhesive, compatible with air and vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.
 - .1 Thickness: 1 mm
 - .2 Tensile Strength (Membrane): 3400 kPa to ASTM D412 Die C
 - .3 Tensile Strength (Film): 39500 kPa to ASTM D882
 - .4 Puncture Resistance (Membrane): 180 N to ASTM E154
 - .5 Elongation: 200% to ASTM D412 Die C
 - .6 Watertightness: pass CGSB 37.58
 - .7 Water Vapour Permeance: 1.6 ng/Pa.s.m² to ASTM E96 Method B
 - .8 Tear Resistance Initial: 200N MD to ASTM D1004
 - .9 Propagation: 75N MD to ASTM D1938
 - .10 Lap Peel Strength at -4°C: 8.75 N/cm to ASTM D1876
 - .11 Adhesion to Concrete 8.75 N/cm to ASTM D903
 - .12 Moisture Absorption: 0.1% max to ASTM D570

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 ENVIRONMENTAL REQUIREMENTS

- .1 All membrane shall be installed at surface and ambient temperature of 5°C or above, in dry weather conditions.
- .2 For applications below 5°C consult membrane manufacturer's technical representative for instructions and, obtain Departmental Representative's approval before proceeding with Work.

3.3 EXAMINATION AND PREPARATION

- .1 Verify that surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Remove loose or foreign matter, which might impair adhesion of materials.
- .4 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions
- .5 Do not install materials during rain or snowfall.
- .6 Report unsatisfactory conditions to Departmental Representative in writing.
- .7 Do not start work until deficiencies have been corrected.
 - .1 Beginning of Work implies acceptance of conditions.

3.4 INSTALLATION: SELF ADHERING SYSTEM

- .1 Apply primer to substrates in accordance with manufacturer's written instructions.
- .2 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 150 mm overlap at all end and side laps.
- .3 Corner details: Double cover outside and inside corners, use 300 mm wide initial strip of membrane centred on axis of corner. Follow with full width of sheet membrane to cover initial strip completely.
- .4 Construction and control joints: Install membrane in double thickness over properly sealed joints, use 300 mm wide initial strip of membrane centred over joint. Follow with full width of sheet membrane. Assure that joints are properly sealed; joint filler and a compatible sealant are installed
- .5 Tie-in to window frames, aluminium screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials as indicated in drawings.
- .6 Roll laps and membrane with a counter top roller to effect seal.
- .7 Small protrusions (pipes, etc.) through the waterproofing membrane, should be pre-stripped with a membrane and sealed with mastic
- .8 Inspect membrane installation meticulously and immediately. Holes and tears in the membrane must be repaired with air / vapour barrier membrane material. The repair must exceed the affected surface area by a minimum of 150 mm. The membrane piece applied for the repair must be sealed around its edges with mastic.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 The Departmental Representative shall review installed membrane for continuity of air barrier prior to placement of insulation.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.7 PROTECTION OF WORK

- .1 Protect finished work from penetrations.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished work is protected from climatic conditions.
- .4 Repair to manufacturers written instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 07 21 13 – Board Insulation
- .3 Section 07 26 00 – Vapour Retarders

1.2 REFERENCES

- .1 American Concrete Institute International (ACI):
 - .1 ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .2 ASTM E154-08a(2013)e1, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .3 ASTM E1643-11, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - .4 ASTM E1745-11, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - .5 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.
 - .6 ASTM F1249-13, Standard Test Method for Water Vapour Transmission Rate through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-51.34-M86 , Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.
 - .2 Submit manufacturer's installation instructions including joint treatment recommendations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.

- .2 Store materials in clean, dry area in accordance with manufacturer's instructions.
- .3 Protect materials during handling and application to prevent damage.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

Part 2 Products

2.1 VAPOUR BARRIER SHEET MATERIALS

- .1 Plastic Sheet Vapour Retarder (Underslab): High density, puncture resistant polyethylene sheet in accordance with ASTM E1745 and CAN/CGSB-51.34, and as follows:
 - .1 Thickness: 0.25 mm
 - .2 Vapour Permeance: Nominal ≤ 0.02 Perms maximum
 - .3 Tensile Strength and Puncture Resistance: ASTM E1745 Class B minimum

2.2 ACCESSORIES

- .1 Accessory Materials: Provide manufacturer's required seam tape, pipe boots and vapour proofing mastic forming a complete system in accordance with CAN/CSA A23.1 and ASTM E1643
- .2 Seam Tape: High density, air resistant polyethylene tape with pressure sensitive adhesive. Type as recommended by vapour retarder manufacturer. Minimum 100 mm for lap joints and perimeter seals, 50 mm wide elsewhere.
- .3 Sealant: Asbestos free non-hardening sealant, compatible with vapour retarder materials, recommended by vapour retarder manufacturer in accordance with Section 07 92 00.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Examine surfaces to receive membrane. Notify Departmental Representative if surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.3 INSTALLATION: UNDERSLAB SHEET VAPOUR BARRIER

- .1 Install vapour barrier in accordance with manufacturer's written instructions and ASTM E1643, and generally as follows:

- .1 Unroll vapour barrier with the longest dimension parallel to direction of concrete placement.
 - .2 Lap vapour barrier onto face of grade beams.
 - .3 Overlap joints 200 mm and seal with manufacturer's required tape.
 - .4 Seal penetrations including pipe and conduit risers in accordance with manufacturer's written instructions.
 - .5 Make no additional penetrations except as required for placing of reinforcing steel and permanent utilities.
- .2 Repair damaged areas by cutting patches of vapour barrier membrane; sized to overlap damaged area a minimum of 150 mm to each side of puncture; and tape all sides using manufacturer's required tape.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 07 21 13 – Board Insulation
- .4 Section 07 26 00 – Vapour Retarders
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim
- .6 Section 07 92 00 – Sealants

1.2 REFERENCES

- .1 Aluminum Association, Inc. (AA)
 - .1 DAF-45-03, Designation System for Aluminum Finishes.
- .2 American Aluminum Manufacturers Association (AAMA):
 - .1 AAMA 605.2, Voluntary Specification for High Performance Coatings on Architectural Panels and Extrusions.
 - .2 AAMA 620-96, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A240/A240M-14, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .2 ASTM A755/A755M-11, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - .3 ASTM B209-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .4 ASTM C297/C297M-04(2010), Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions.
 - .5 ASTM A480/A480M-14a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - .6 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .7 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .8 ASTM D1781-98(2012), Standard Test Method for Climbing Drum Peel for Adhesives.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 20M-08, Standard for Sheet Steel Cladding for Architectural, Industrial and Commercial Building Applications.

- .2 CSSBI S8-08, Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.
- .5 Canadian Standards Association (CSA)
 - .1 CAN3 S157/S157.1-05 (R2010), Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.
 - .2 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2014).
 - .3 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum, Includes Update No. 1 (2011), Update No. 2 (2012).
 - .4 CSA HA Series-M1980, CSA Standards for Aluminum and Aluminum Alloys.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 PRE-INSTALLATION MEETINGS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Department Representative, installer, manufacturer's representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Manufacturer's representative shall also provide frequent inspection visits during the course of work of this Section to assure quality and competence of panel installation.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate layout, profiles and product components including anchorage, accessories, finish colours and textures.
 - .2 Include details showing thickness and dimensions of the various system parts, fastening and anchoring methods, locations of joints and gaskets and location and configuration of movement joints.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:

- .1 Submit duplicate 300 x 300 mm samples of composite panel in thickness specified from representative materials, finishes and colours. Include clips, anchors, supports, fasteners, closures, and other panel accessories for assembly approval.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
- .5 Manufacturers' Field Reports: Submit copies of manufacturers field reports.
- .6 Submit quality assurance submittals in accordance with Section 01 01 50 – General Instructions, Quality Control.
 - .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that composite wall panels comply with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: Engage experienced installer with a minimum of 5 years experience who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance and is approved by manufacturer.
- .2 Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Document requirements including, but not limited to, the following:
 - .1 Seal and signature to shop drawings and design submittals requiring structural engineering.
 - .2 Site review and certification of installed components.
 - .3 Completion of Letters or Commitment and Supervision specified in Section 01 35 00 – Delegated Design Submittals.
 - .4 Manufacturer's Engineering Recommendations: Perform composite wall panel work in accordance with written recommendations from panel manufacturer.
 - .5 Verify panel thickness based on maximum deflections provided in this Section and to suit building location and configuration.

1.6 MOCK-UPS

- .1 Mock-ups: construct mock-ups in accordance with Section 01 01 50 – General Instructions, Quality Control and to requirements supplemented as follows:
 - .1 Provide mock-up for evaluation of surface finishes and workmanship.
 - .2 Construct mock-up indicating relationship between wall panels, air spaces, air/vapour retarder membrane, windows, and doors.
 - .3 Co-ordinate type and location of mock-ups with project requirements.

- .4 Accepted units will be used as standard for acceptance of production units.
- .5 Remove and replace units which are not accepted.
- .6 Do not proceed with remaining work until workmanship, colour, and finish are reviewed by Departmental Representative.
- .7 Refinish mock-up area as required to produce acceptable work.
- .8 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
 - .1 Reviewed mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and protect material in accordance with panel manufacturer's recommendations.
- .2 Do not expose panels with strippable film to direct sunlight or extreme heat.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.9 WARRANTY

- .1 Special warranties specified in this Article shall not deprive the Departmental Representative of other rights the Departmental Representative may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- .2 Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, colour fade, chalking, cracking, peeling, and loss of film integrity for a period of 20 years from date of Substantial Performance.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Maximum deflection not to exceed L/180 under system's own weight plus wind load (positive and negative) loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:30 years.
- .2 Calculate live load deflections in accordance with CSSBI 20M, as modified by the requirements of this Section.
- .3 Provide for movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasonal temperature range from -40°C (-40°F) to +50°C (120°F), and wind loads noted above.

- .4 Include expansion joints to accommodate movement in wall system and between wall system and building structure, where these movements are caused by deflection of building structure, and accommodate these movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .5 Provide for positive drainage to the exterior of all water entering or condensation occurring within the system.
- .6 Final review and acceptance of work completed by this Section shall be carried out by the manufacturer's representative, Departmental Representative, Contractor and the Subcontractor.

2.2 COMPOSITE METAL PANEL MATERIALS

- .1 Composite aluminum panel: Aluminum sheets thermally bonded in continuous process, under tension, to thermoplastic core with no glues or adhesives between dissimilar materials, and as follows:
 - .1 Total Composite Thickness: 4 mm
 - .2 Aluminum Face Sheets:
 - .1 Alloy: AA3000 Series.
 - .2 Thickness: 0.51 mm.
 - .3 Factory Finish: coil coated with fluoropolymer paint to AAMA 620
 - .4 Colours: as indicated on Drawing A201.
 - .3 Core: non-combustible.
 - .4 Bond Integrity: tested for resistance to delamination as follows:
 - .1 Bond Strength: 10.3 MPa minimum to ASTM C297.
 - .2 Peel Strength: 100 N mm/mm minimum to ASTM D1781.
 - .3 No degradation in bond performance after 8 hours of submersion in boiling water and after 21 days of immersion in water at 21 degrees C.
- .2 Aluminum extrusions:
 - .1 Alloy: AA-6063-T5.
 - .2 Colour: Mill finish where non-exposed.
- .3 Stiffeners:
 - .1 Alloy: AA-6063-T5
 - .2 Colour: Mill finish.

2.3 SYSTEM BACK-UP MATERIALS

- .1 Girts: Fabricated from minimum 1.27 mm thickness galvanized steel to ASTM A653, Grade 230 with Z275 coating. Material visible after assembly of wall panel shall be finished to match aluminum panels.
- .2 Sub-girts: Structural quality steel to ASTM A653, with Z275 zinc coating to ASTM A792, adjustable double-angle profile as indicated to accept panel with structural attachment to building frame.

- .3 Isolation Tape: Manufacturers standard material for separating dissimilar metals from direct contact.
- .4 Stiffeners, as required: Minimum 25 mm x 25 mm aluminum, bonded to the full length of face sheet using double sided high bond isolating tape to prevent weather staining and frost lines to the face of the panel. Bonding tape to be protected with continuous bead of caulking on both sides of stiffeners, type as recommended by manufacturer.
- .5 Insulation Fastenings: Corrosion resistant, galvanized bugle head screws with 38 mm diameter washer, 25 mm minimum penetration into framing.
- .6 Insulation: as specified in Section 07 21 13.
- .7 Air/Vapour Retarder: Self-adhering membrane as specified in Section 07 26 00.

2.4 ACCESSORIES

- .1 Panel Stiffeners: structurally fastened or restrained at ends, secured to rear face of composite panel with silicone or double sided high bond isolating tape to prevent weather staining and frost lines to the face of the panel as recommended by panel manufacturer, size stiffeners to maintain panel flatness to specified tolerances, material as recommended by manufacturer.
- .2 System Sealants: Sealants within the panel system, as recommended by manufacturer, colour to be selected by Departmental Representative.
- .3 Gaskets: Santoprene or EPDM as recommended by manufacturer.
- .4 Flashings: Fabricate flashing from 1.57 mm minimum thickness aluminum sheet. Where exposed to view, finish to match adjacent panels. Provide lap strip under flashing at abutted conditions; with lapped surfaces sealed with a full-bed of non-hardening sealant.
- .5 Fasteners:
 - .1 Attachment of the panel system to the primary panel structural supports shall be made using manufacturer's recommended fasteners.
 - .2 Typical joinery shall be attached with concealed, non-corrosive fasteners. When exposed fasteners are required in isolated conditions, the fastener shall be obscured in the panel joinery, exposed fasteners shall be stainless steel.

2.5 FABRICATION

- .1 Aluminum wall panels and components shall comply with details as indicated on drawings and as indicated in shop drawings.
- .2 All components shall be factory fabricated ready for field installation. All components shall match quality and installation of accepted mock-up specified above.
- .3 Tolerances:
 - .1 Panel bow shall not exceed 0.8% of panel overall dimension in width or length.
 - .2 Panel dimensions shall allow for field adjustment and thermal movement.

- .3 Panel lines, breaks and curves shall be sharp, smooth and free of warps or buckles.
- .4 Panel shall be visually flat.
- .5 Panel surfaces shall be free of scratches or marks caused during fabrication.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Obtain all dimensions from job site.
- .2 Ensure all structural support is aligned and condition is acceptable.
- .3 Building surfaces shall be smooth, clean and dry, and free from defects detrimental to the installation of the system. Notify Contractor of conditions not acceptable for installation of system.
- .4 Inspect wall system and components before installation and verify that there is no shipping damage.
- .5 Do not install damaged panels; repair or replace as required for smooth and consistent finished appearance.

3.3 INSTALLATION

- .1 Install composite panels in accordance with manufacturer's written instructions and shop drawings.
 - .1 Allow for thermal movement.
- .2 Install air/vapour retarder membrane in accordance with Section 07 26 00 and the manufacturer's instructions.
- .3 Install both layers of girts as indicated on drawings and to ensure no air gap between girts and insulation boards.
- .4 Install girts attached to structural support or wall framing, using recommended fasteners.
- .5 Install insulation between girts forming tight to following applied girt to maintain continuous thermal barrier.
- .6 Erect panels plumb, level and true.
- .7 Do not install component parts that are observed to be defective, including warped, bowed, dented, scraped and broken members.
- .8 Install exterior metal cladding to structural support by hidden mechanical fasteners.

- .9 All fasteners shall penetrate wall framing. Where fastener does not penetrate framing, DO NOT remove fastener. Removal of fastener will damage integrity of air/vapour membrane. Realign fastener location and install new fastener in close proximity to original fastener.
- .10 Install pre-formed corners and end enclosures, sealed to arrest direct weather penetration.
- .11 Ensure panels aligned vertically and horizontally.
- .12 Assemble and secure wall system so stresses on sealants are within manufacturers' recommended limits.
- .13 Separate dissimilar metals; use appropriate gasket and fasteners to minimize corrosive or electrolytic action between metals.
- .14 Install flashings to divert all moisture and condensation to exterior. Trim and flash around doors, louvers, and windows. Use only membrane flashing supported by insulation per architectural details.

3.4 FIELD QUALITY CONTROL

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

3.5 CLEANING

- .1 Remove strippable film coating (if used) as soon as possible after surrounding material has been installed.
- .2 Remove all excess materials, debris and equipment at completion.
- .3 Clean all panels clean and free of all grime and dirt.
- .4 Touch-up damaged finishes with manufacturer's recommended touch-up paint.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 07 21 13 – Board Insulation
- .3 Section 07 49 90 – Metal Soffit Panels
- .4 Section 07 62 00 – Sheet Metal Flashing and Trim
- .5 Section 07 92 00 – Sealants

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .2 American National Standards Institute (ANSI)
 - .1 ANSI/ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-15e1, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .3 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .4 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - .5 ASTM D2369-10 (2015) e1, Standard Test Method for Volatile Content of Coatings.
 - .6 ASTM D2832-92(R2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .7 ASTM F1667-15, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members, Includes Update No. 1 (2014) Update No. 2 (2015) Update No. 3 (2015).
 - .2 CSA S136.1-12, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.
- .6 Environmental Choice Program (ECP)
 - .1 CCD-045, Sealants and Caulking Compounds.
 - .2 CCD-046, Adhesives.

1.3 PRE-INSTALLATION MEETINGS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Departmental Representative, Consultant, installer, manufacturer's representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Manufacturer's representative shall also provide frequent inspection visits during the course of work of this Section to assure quality and competence of membrane installation and panel alignment.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's:
 - .1 Caulking and sealant materials during application and curing.
 - .2 Finishing materials.
 - .3 Insulation adhesives.
 - .4 Paints.
 - .5 Isolation coatings.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate arrangement of cladding system including dimensions, wall openings, location of joints, profiles of inner and outer skin, types and locations of supports, fasteners, flashing, closures, compliance with design criteria and requirements of related work.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit duplicate 300 x 300 mm samples of wall system, representative of materials, finishes and colours.
 - .2 Prior to ordering materials, provide to Departmental Representative the following for verification purposes: three samples of colour of finish specified.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: Submit copies of manufacturers field reports.

1.5 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Installer Qualifications: Engage experienced installer, with a minimum of 5 years experience, who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance.

1.6 MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .2 Construct a portion of one exterior wall to establish a standard of construction, workmanship, and appearance.
- .3 Construct mock-up indicating relationship between wall panels, air spaces, air/vapour retarder membrane, windows, and doors.
- .4 Do not continue with work of this Section until Departmental Representative has reviewed mock-up.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store materials in accordance with manufacturer's instructions.
- .2 Protect panels during transportation, unloading, storing, and erecting to prevent bending, warping, twisting, and surface damage.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.
- .2 Divert used metal cut-offs from landfill by disposal into the on-site metals recycling bin and removed for disposal at the nearest metal recycling facility.
- .3 Divert reusable materials for reuse at nearest used building materials facility.
- .4 Divert unused caulking, sealants, and adhesive materials from landfill through disposal at hazardous material depot.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Design metal panel wall system in accordance with CSA S136.
- .2 Design metal panel wall to provide for thermal movement of component materials caused by ambient temperature range of 60 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .3 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without

permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

- .4 Design members to withstand dead load and wind loads calculated in accordance with National Building Code and applicable local regulations, to maximum allowable deflection of 1/180th of span.
- .5 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".
- .6 Provide minimum thermal resistance of RSI 2.1 W/m²K.
- .7 Permeance through wall system not to exceed 1 ng/(Pa.s.m²).
- .8 Design wall system to accommodate specified erection tolerances of structure.
- .9 Design wall system to allow for movement of air between exterior and interior side of metal cladding.
- .10 Provide an effective air barrier, to prevent infiltration and/or exfiltration of air through wall assembly.

2.2 STEEL CLADDING MATERIALS

- .1 Galvanized sheet steel cladding: Z275 galvanized sheet steel applied to both sides, commercial steel (CS), type A, grade 230 to ASTM A653/A653M and as follows:
 - .1 Nominal Core Thickness: 0.76 mm or thicker to meet design loads.
 - .2 Profile: Varies as follows:
 - .1 300 mm wide without stiffening ribs with female/male interlocking edges for concealed fastening.
 - .2 305 mm wide x 38 mm deep with female/male interlocking edges for concealed fastening.
 - .3 Corrugated profile having nominal 880 mm panel c/c with 22 mm deep profile at 68 mm c/c.
 - .4 Profile having nominal 910 mm panel with 44 mm deep profile, overlap of 22 mm, underlap of 23 mm, 130 mm c/c.
 - .3 Finish: prefinished as specified below.

2.3 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Class: F1S.
 - .2 Colour: to be selected by Departmental Representative after Contract Award.
 - .3 Specular gloss: 30 units +/-5 to ASTM D523.
 - .4 Coating thickness: not less than 22 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .1 Outdoor exposure period 2500 hours.
 - .2 Humidity resistance exposure period 5000 hours.

2.4 ACCESSORIES

- .1 Sub-girts: minimum 1.21 mm base metal thickness, galvanized steel to ASTM A653/A653M, grade 230 with Z275 zinc coating; profiled to accept liner and exterior sheet with structural attachment to building frame. Exposed materials of wall assembly to match panels.
- .2 Panel Fastenings: Manufacturer's standard to suit design loads and application. Provide self tapping screws, bolts, nuts, self locking rivets and bolts, end welded studs, and other suitable fasteners designed to withstand design loads, and as follows:
 - .1 Concealed type.
 - .2 Use stainless steel fasteners for exterior applications and galvanized steel fasteners for interior applications.
- .3 Sealant: as indicated in Section 07 92 00 and as recommended by manufacturer. Colour of exposed sealant to match adjacent panel.
- .4 Isolation coating: bituminous paint.
- .5 Exterior corners: of same profile, material and finish as adjacent cladding material, shop cut and brake formed to required angle, concealed corner brace, pop rivet connections with painted head to match cladding.
- .6 Exposed joint (perpendicular to profile): ends of cladding sheet shop cut clean and square, backed with tight fitting filler lapping back of joint, exposed components colour matched to cladding.
- .7 Accessories: cap flashings, drip flashings, internal corner flashings, copings and closures for head, jamb, sill and corners, of same material, thickness and finish as exterior cladding, brake formed to shape.
- .8 Expansion joints: as recommended by Manufacturers Instructions.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 PREPARATION

- .1 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.
- .2 Touch up building framing members with primer as required.

3.3 INSTALLATION

- .1 Install cladding in accordance with manufacturer's written instructions
- .2 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.

- .3 Install outside corners, fillers and closure strips with carefully formed and profiled work.
- .4 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .5 Attach components in manner not restricting thermal movement.
- .6 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Sealants.

3.4 CONTROL/EXPANSION JOINTS

- .1 Construct control and expansion joints as indicated.
- .2 Use cover sheets, of brake formed profile, of same material and finish as adjacent material.
- .3 Use mechanical fasteners to secure sheet materials.
- .4 Assemble and secure wall system to structural frame so stresses on sealants are within manufacturers' recommended limits.

3.5 CONSTRUCTION

- .1 Installation Tolerances: Shim and align panels and cladding system within installed tolerance of 6 mm in 6100 mm on level, plumb, and location lines as indicated, and within 3 mm offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's field services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .4 Submit reports to Departmental Representative within three days of review and submit.

3.7 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Wash down exposed interior and exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Wipe interior surfaces clean as part of final clean-up.

- .3 Remove excess sealant with recommended solvent.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 07 46 19 – Steel Siding
- .3 Section 07 62 00 – Sheet Metal Flashing and Trim
- .4 Section 07 92 00 – Sealants

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D146/D164M-04(2012)e1, Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
 - .3 ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit samples of soffit panel, in the selected colour on actual metal base.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit shop drawings showing assembly and installation details, method of sealing and flashing, building connection attachments, provision for thermal movement, fabrication details and static release loads and static release forces.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Cover pre-finished components to protect surface finishes from damage and deterioration.
- .2 Store components off the ground to prevent twisting, bending or delamination. Slope to shed moisture.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Design and construct soffit system so that completed installation is air, vapour and moisture resisting from interior and exterior.
- .2 Maximum deflection not to exceed L/180 under system own weight plus wind and suction loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:30 years.
- .3 Provide movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasonal temperature range, from -40°C to 50°C, and preceding noted wind and suction loads.
- .4 Include expansion joints to accommodate movement in soffit system and between soffit system and building structure, where these movements are caused by deflection of building structure. Accommodate these movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .5 Provide for positive drainage to the exterior of all water entering or condensation occurring within the system.

2.2 MATERIALS

- .1 Metal Sheet Soffit: Prefinished, preformed galvanized sheet steel, minimum 0.48 mm (26 ga.) metal core thickness, and as follows:
 - .1 Profile: flat panel, 254 mm long with female/male interlocking edges for concealed fastening, and 29 mm deep.
 - .2 Colour: As selected by Departmental Representative from Stelco/Dofasco 8000 Series standard colour range.
 - .3 Acceptable Fabricators:
 - .1 Custom Metal Contracting Ltd.
 - .2 Thermal Systems KWC Ltd.
 - .3 VicWest Steel Inc.
- .2 Erection girts: As recommended by cladding manufacturer.
- .3 Flashing, Trim and Closures: core thickness and finish to match metal soffit and as required for complete installation
- .4 Fastenings: Manufacturer's standard or custom to suit design loads and application. Finish all exposed fasteners to match soffit panels.
- .5 Sealant: In accordance with Section 07 92 00, type as recommended by manufacturer for specific end use, colour to match soffit panels.
- .6 Insect Screen: 1.6 mm aluminum wire mesh.

- .7 Z Bars: 1.27 mm minimum thickness, galvanized steel with a zinc coating of not less than 275 g/m².

Part 3 Execution

3.1 PREPARATION

- .1 Obtain all dimensions from job site.
- .2 Ensure all structural support is aligned and condition is acceptable.
- .3 Provide additional structural framing as may be required to conform with Performance Requirements.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's written instructions and Contract Documents, plumb, true, level, and rigid.
- .2 Install soffit panels to structural support by hidden mechanical fasteners.
- .3 Install support girts, as required, to structural support. Interlock and seal side and end joints.
- .4 Install flashings to divert all moisture and condensation to exterior.
- .5 Install soffit panels to structural support by hidden mechanical fasteners.
- .6 Install pre-formed corners and end enclosures, caulked and sealed to arrest direct weather penetration.
- .7 Ensure panels aligned horizontally.

3.3 ADJUSTING AND CLEANING

- .1 Remove all excess materials, debris and equipment at completion.
- .2 Clean all panels clean and free of all grime and dirt.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 31 00 – Steel Decking
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 07 21 13 – Board Insulation
- .4 Section 07 26 00 – Vapour Retarders
- .5 Section 07 61 00 – Sheet Metal Roofing
- .6 Section 07 62 00 – Sheet Metal Flashing and Trim
- .7 Section 07 92 00 – Sealants
- .8 Division 22 – Plumbing: Coordination of pipes and pipe fittings and other materials penetrating roof membranes.
- .9 Division 23 – Heating, Ventilation and Air Conditioning: Coordination of ductwork and other materials penetrating roof membranes.
- .10 Division 26 – Electrical: Coordination conduit, wiring, communications cabling, cable trays and other materials penetrating roof membranes.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM E96/E96M-13, Standard Test Methods for Water Vapor Transmission of Materials.
 - .2 ASTM D41/D41M-11, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 - .3 ASTM D312-00(2006), Standard Specification for Asphalt Used in Roofing.
 - .4 ASTM D448-12 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 - .5 ASTM D2178/D2178M-13a, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
 - .6 ASTM D6162-00a (2008), Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.
 - .7 ASTM D6163-00 (2008), Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.
 - .8 ASTM D6164/D6164M-11, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
 - .9 ASTM D6222/D622M-11, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcement.
 - .10 ASTM D6223-02 (2009)e1, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement.

- .11 ASTM D6509/D6509M-09, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcement.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
 - .2 CGSB 37-GP-56M AMEND, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
 - .3 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 CRCA Roofing Specifications Manual.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA A123.21-10, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems, Includes Update No. 1 (2010).
 - .2 CSA-A123.3-05 (R2010), Asphalt Saturated Organic Roofing Felt (Reaffirmed 2010).
 - .3 CAN/CSA-A123.4-04 (R2013), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
 - .4 CSA O121-08(R2013), Douglas Fir Plywood, Includes Update No. 1 (2013).
 - .5 CSA O151-09, Canadian Softwood Plywood.
- .5 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Roofing Contractor's Association of British Columbia (RCABC)
 - .1 Roofing Practices Manual
 - .2 Roofing Contractors Association of B.C. Guarantee Corp. Guarantee Program.
- .8 Underwriters Laboratories' of Canada (ULC)
 - .1 CAN/ULC S107-10, Methods of Fire Tests of Roof Coverings.
 - .2 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Departmental Representative, installer, manufacturer's representative in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.

- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements. Ensure system meets RCABC warranty requirements as indicated below.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Provide copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide copies of WHMIS MSDS and indicate VOC content for:
 - .1 Primers
 - .2 Vapour retarder membrane
 - .3 Sealers
 - .4 Insulation
 - .5 Base and cap sheet
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate flashing, control joints, tapered insulation details.
 - .2 Provide layout for tapered insulation.
- .3 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .4 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens, roofing felts, and membrane with specification requirements.
- .5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .6 Manufacturer's field report: in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .7 Reports: indicate procedures followed, ambient temperatures and wind velocity during application.

1.5 QUALITY ASSURANCE

- .1 Obtain roofing membrane materials through one source from a single manufacturer.
- .2 Installer Qualifications: company or person specializing in application of modified bituminous roofing systems with 5 years documented experience approved by manufacturer.
- .3 Roofing and sheet metal work shall be performed in conformance with roofing manufacturer's written recommendations using materials in accordance with CAN/ULC S107.

- .4 Perform Work to RCABC/RGC practice Manual and manufacturers written instructions.
- .5 Provide only materials listed by RCABC/RGC.

1.6 FIRE PROTECTION

- .1 Comply with safety measures described in manufacturer's written installation requirements, requirements of insurance companies and other requirements of the Authorities Having Jurisdiction.
- .2 Fire Extinguishers, located within six (6) meters of each roofing torch, ULC labelled for ABC protection.
- .3 At the end of each workday, use a heat detector gun to spot any smouldering or concealed hot spots. Job planning must be organized to ensure workers are still on location at least one hour after torch application.
- .4 Do not apply torch directly to dry or unprotected wood surfaces.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 01 50 – General Instructions, Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
 - .2 Provide and maintain dry, off-ground weatherproof storage.
 - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with selvage edge up.
 - .4 Remove only in quantities required for same day use.
 - .5 Place plywood runways over completed Work to enable movement of material and other traffic.
 - .6 Store sealants at +5 degrees C minimum.
 - .7 Store insulation protected from weather, daylight and deleterious materials.
 - .8 Do not store materials on roof in concentrations that exceed design live load.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not perform roofing work when air temperature, including wind chill, falls below the membrane manufacturer's recommended limit.
- .2 Do not apply roofing materials to a damp, frozen or unsuitable surface.

- .3 Do not expose roofing materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.

1.10 WARRANTY

- .1 Roofing Membrane Manufacturer: Provide manufacturer's warranty stating that they will repair or replace defective roofing (including labour) and base flashing materials that do not remain watertight, that splits, tears, or separates at the seams or from the substrate within the specified warranty period and as follows:
 - .1 Warranty Period: 15 years Platinum Warranty, starting from Substantial Performance for the Project.
 - .2 Name of Warrantee: Warrantor shall issue a written and signed warranty identifying the Departmental Representative's name as the warrantee, and stating that executed work will remain in place and be free of any defects in materials and workmanship for the stated warranty period.
- .2 Special Warranty: In addition, provide a ten (10) year RCABC Warranty starting from the date of Substantial Performance. All related fees are to be included in the bid price including, but not limited to, administrative and re-inspection costs and the construction inspection costs.

Part 2 Products

2.1 PERFORMANCE CRITERIA

- .1 Provide system with products to achieve 10 year RCABC warranty certificate.
- .2 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.
- .3 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 DECK SHEATHING

- .1 Glass Mat Faced Roof Boards: to ASTM C1177/C1177M for manufacturing and ASTM D3272 for mould resistance, standard, mould resistant, thickness as indicated.
 - .1 Surface Burning Characteristics: In accordance with CAN/ULC S102.
 - .1 Flame Spread: 0
 - .2 Smoke Developed: 0
 - .2 Long Edges: Square.

2.3 PRIMER

- .1 Primer comprised of elastomeric bitumen, volatile solvents and adhesive enhancing additives as recommended by membrane roofing manufacturer to suit substrate and installation conditions.

2.4 VAPOUR RETARDER

- .1 Premanufactured Self Adhesive Air/Vapour Barrier: Self-adhesive vapour barrier membrane composed of SBS modified bitumen with thermoplastic polymers and high density polyethylene film and as follows:
 - .1 Thickness: Minimum 0.8 mm.
 - .2 Cold Bending: -35°C
 - .3 Static Puncture: 400 N.
 - .4 Membrane Breaking Strength (MPa): MD=75, XD=98.
 - .5 Water Vapour Permeance: 0.92 ng/Pa•s•m² to ASTM E96.
- .2 Vapour retarder continuity strip: SBS membrane with non-woven polyester reinforcement, glass grid and elastomeric bitumen. Sanded upper surface; underside self-adhesive, compatible with wall and roof air/vapour retarder membranes as recommended by accepted membrane manufacturers below.

2.5 INSULATION

- .1 Primary Flat and Sloped Insulation: Closed-cell polyisocyanurate foam core laminated to heavy non-asphaltic glass fibre reinforced facers; 25 mm thickness of largest panels practical, having square edges, minimum LTTR RSI 1.04/25 mm; conforming to ULC S704, Type 3, Class 2, to a tolerance not exceeding 3 mm from nominal size in any dimension.
- .2 Sloped insulation: sloped as indicated on Drawings.

2.6 MEMBRANE

- .1 Composite Cover Board: Asphaltic-support board and factory applied base sheet:
 - .1 Description: SBS modified base sheet membrane and polyester reinforcement, factory applied to a semi-rigid asphaltic board. The top surface is covered with sane. The membrane side lap is 60% self-adhesive and 40% covered with a poly film that is heat sealed.
 - .1 Board size: 910 mm x 2440 mm x thickness as indicated on Drawings (minimum 5 mm).
 - .2 In conformance with: CGSB 37.56-M
 - .3 Properties:

	MD	XD
.1 Strain Energy (kJ/m)	9	7
.2 Breaking Strength (N/50 mm)	17	12.5
.3 Ultimate Elongation (%)	60	65
.4 Tear Resistance (N)	60	
.5 Static Puncture Resistance (N)	400	
.6 Dimensional Stability (%)	-0.4	0.3
.7 Plastic Flow (°C)	≥ 115	
.8 Cold Bending (at -30°C)	No Cracking	
.9 Lap Joint Strength (kJ/m)	Pass > 4kJ/m	
 - .2 Membrane base sheet flashing (stripping):

- .1 Primer: Manufacturer's recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of self-adhesive membranes suitable for application temperatures.
- .2 Roofing membrane with non-woven polyester reinforcement and glass grid and elastomeric bitumen. Top face covered with thermofusible plastic film, underside self-adhesive and protected by silicone release paper in accordance with CGSB 37-GP-56M type 2, class C, grade 1.
- .3 Components:
 - .1 Reinforcement: Non-woven polyester and glass grid.
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
 - .3 Mark top face with lines to ensure proper roll alignment.
- .4 Characteristics:
 - .1 Cold bending at minimum -25°C: No cracking
 - .2 Softening point: $\geq 110^{\circ}\text{C}$
 - .3 Reinforcing weight: minimum 160 g/m²
 - .4 Membrane Thickness: minimum 2.5 mm
- .3 Roofing cap sheet membrane for field surfaces and flashings and parapets:
 - .1 Description: Roofing membrane composed of SBS modified bitumen with a composite reinforcement and elastomeric bitumen. The surface is protected with coloured granules. The underface is covered with a thermos-fusible surface for torch application.
 - .1 Coloured Granules: to be selected by Departmental Representative.
 - .2 In conformance with: ASTM D6162
 - .3 Properties:

	MD	XD
.1 Strain Energy (kN/m)	7.8	7.2
.2 Breaking Strength (N/50 mm)	15	13.5
.3 Ultimate Elongation (%)	60	65
.4 Tear Resistance (N)	125	
.5 Static Puncture Resistance (N)	560	
.6 Dimensional Stability (%)	0.2	0
.7 Plastic Flow (°C)	≥ 110	
.8 Cold Bending (at -30°C)	No Cracking	
.9 Lap Joint Strength (kN/m)	Pass > 4kN/m	

2.7 ADHESIVE

- .1 Insulation Adhesive: Manufacturers standard adhesives specifically formulated for installation of plastic insulation to roofing materials.
- .2 Sheathing Board Adhesive: Manufacturers standard adhesives specifically formulated for installation of sheathing to metal deck.

2.8 ACCESSORIES

- .1 Perimeter Fire Seal: SBS modified bitumen, minimum 60 gm/m² glass fleece reinforced, self adhering membrane having sanded top face, cut into strips minimum 150 mm wide x nominal 1.5 mm thick.
- .2 Flashing and sheet metal in accordance with Section 07 62 00 – Sheet Metal Flashing and Trim.
- .3 Waterproofing Mastic: Black, solvent based mastic containing SBS modified bitumen, fibres and mineral fillers.
- .4 Torches: Use only torches designed for torching roofing material and acceptable to manufacturer.

2.9 PIPE SUPPORTS

- .1 Roof drain pans, vent stack covers and other roof penetration flashings: pre-manufactured, stainless steel construction, purpose-made to suit application and location, designed to tie-in to SBS modified membrane roofing systems.
- .2 Premanufactured Pipe Supports: fabricated from 100% recycled content, with 2.7 mm thickness galvanized steel frame, 150 mm wide x 100 mm tall x length to suit installation; including fasteners, bridge components, and angled supports as required for a complete installation and having the following accessories:
 - .1 Pipe and Conduit Support: Galvanized pipe clamp sized to suit gas pipe in accordance with manufacturers instruction's.
 - .2 Multi-Pipe and Conduit Support: Galvanized pipe support system size and number to suit pipes being supported in accordance with manufacturer's instructions.
 - .3 Extendable Height Support: Galvanized steel pipe extensions to suit installation in accordance with manufacturer's instructions.

Part 3 Execution

3.1 QUALITY OF WORK

- .1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and RCABC Roofing Manual.
- .2 Do priming in accordance with manufacturers written recommendations.
- .3 The interface of the walls and roof assemblies will be fitted with durable rigid material sheet metal and plywood providing connection point for continuity of air barrier.
- .4 Assembly, component and material connections will be made in consideration of appropriate design loads.

3.2 EXAMINATION OF ROOF DECKS

- .1 Verification of Conditions:
 - .1 Inspect with Departmental Representative deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation

outlets to determine readiness to proceed. The start of roofing work will mean roofing conditions are acceptable for work completion.

.2 Evaluation and Assessment:

.1 Prior to beginning of work ensure:

- .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
- .2 Curbs have been built.
- .3 Roof drains have been installed at proper elevations relative to finished roof surface.
- .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

.4 Provide fire protection during installation.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks, sloped roofs and adjacent work where materials hoisted or used. Roofing Contractor shall assume full responsibility for damage.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking shall be treated with rust proofing or galvanization.

3.4 DECK SHEATHING

.1 Adhere sheathing with adhesive per manufacturer's written instructions.

.2 Place with long axis of each sheet transverse to trusses, with end joints staggered and fully supported.

3.5 PRIMING DECK

.1 Apply deck primer to deck substrate at the rate recommended by manufacturer.

.2 Surfaces to be primed must be free of rust, dust or any residue that may hinder adherence.

.3 Cover primed surfaces with roofing membrane within time limits recommended by roofing membrane system manufacturer.

3.6 VAPOUR RETARDER INSTALLATION

- .1 Install self adhering air/vapour barrier membrane by unrolling air/vapour barrier membrane onto substrate aligned with substrate materials starting at bottom of slope without removing silicone release sheet, and as follows:
 - .1 Align roll parallel to steel deck flutes supporting membrane overlaps on top of flute along entire length.
 - .2 Peel back one end of silicone release sheet and adhere membrane to substrate; peel remaining release sheet at a 45° angle to avoid wrinkles in membrane.
 - .3 Cut roll and start again where membrane is not properly aligned to deck flutes; re-align membrane and overlap end of misaligned piece by 150 mm.
 - .4 Overlap adjacent membranes by 75 mm; overlap end laps by 150 mm; stagger end laps by 300 mm; place thin sheet of metal under end lap of membrane to provide structural support to lapped membranes.
- .2 Overlap roof air/vapour barrier to wall air/vapour barrier using compatible continuity strip to provide continuity of building envelope.

3.7 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

- .1 Insulation: fully adhered, adhesive application:
 - .1 Adhere insulation to vapour barrier using manufacturer's recommended adhesive applied at a rate recommended by the manufacturer
 - .2 Place boards in parallel rows with ends staggered, and in firm contact with one another.
 - .3 Cut end pieces to suit.
 - .4 Apply adhesive in accordance with CSA A123.21.
 - .5 Separate the membrane and insulation with a drainage layer or slipsheet.
- .2 Tapered insulation application:
 - .1 Adhere insulation using manufacturer's recommended adhesive applied at rate recommended by manufacturer; adhere insulation at locations where roof deck will be visible in final installation.
 - .2 Install tapered insulation in accordance with shop drawings. Stagger joints between layers 150 mm minimum.
- .3 Installation of Composite Cover Board and Factory Laminated Base Sheet:
 - .1 Adhere base sheet board using adhesive applied in continuous strips spaced as required and based on manufacturer's instructions and the CSA A123.21 Wind Uplift Roof System Analysis Report.
 - .2 Heat seal side laps of the cover board with an industrial hot air welder as recommended by manufacturer.
 - .3 Line up end laps of the cover boards (not staggered) and apply primer as per manufacturer's recommendations and allow to "flash off" in preparation for the application of the self-adhesive cover strip membrane.

- .4 Self-adhesive cover strip membrane shall be applied over each primed end lap of the cover board, rolled into place and a hot air welder is required to heat seal the side and end laps.
- .5 Avoid the formation of wrinkles, swellings or fishmouths.
- .4 Perimeter Fire Seal Application
 - .1 Apply perimeter fire seal to roof perimeter and curb substrates prior to applying base sheet materials. Apply fire seal to vertical joints in parapet or curb sheathing, and at vertical corners.
 - .2 Extend fire seal minimum 50 mm up parapet faces and extend fire seal minimum 75 mm onto adjacent substrates. Ensure air bubbles and fish mouths are removed.
 - .3 Install perimeter fire seal to act as temporary moisture seal until installation of flashing materials.
- .5 Reinforced gusset installation:
 - .1 Install gussets at every angle, and on inside and outside corners.
 - .2 Install self adhesive gussets before installing self adhesive base sheet flashing membranes.
- .6 Base sheet flashing installation:
 - .1 Apply base sheet flashing when primer coat is dry and in accordance with manufacturer's written instructions.
 - .2 Position pre-cut membrane pieces; peel back 100 mm to 150 mm of silicone release paper to hold the membrane in place at the top of the parapet, then gradually peel back remaining silicone release paper, pressing down on the membrane with aluminium applicator to provide good adhesion and to provide smooth transition between up-stand and field surface; smooth entire membrane surface with a roller for full adhesion.
 - .3 Cut off corners at end laps being covered by next roll.
 - .4 Install a reinforcing gusset in all inside and outside corners.
 - .5 Seal overlaps at the end of each workday.
- .7 Cap sheet application – torched:
 - .1 Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
 - .2 Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge).
 - .3 Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
 - .4 Avoid overheating. Take care to avoid excessive bitumen bleed-out at joints during installation.
 - .5 Unless overlap widths differ between cap and base sheets, make sure joints between the two layers are staggered by at least 300 mm.

- .6 Overlap cap sheet side laps by 75 mm and end laps by 150 mm. Cut off corners at end laps to be covered by next roll. Overlap surfaces must be granule-free or degranulated.
 - .7 Complete welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam.
 - .8 Once cap sheet is installed, carefully check overlapped joints. Leave bleed-out at joints ungranulated until inspected and accepted by the roofing inspector. Apply coloured granules to bleed-out area by priming with self-adhesive primer, and while still tacky shake granules onto surface and press into place.
- .8 Cap Sheet Flashings Application:
- .1 Install cap sheet flashing in 1 m widths. Overlap side by 100 mm. Stagger base and cap sheet overlaps by minimum 100 mm. Make overlaps 150 mm wide.
 - .2 Draw parallel chalk line 150 mm from parapet or upstand bases. Sink surface granules into bed of hot bitumen with torch from chalk line to parapet or upstand.
 - .3 Adhere cap sheet to base sheet membrane starting from bottom and working to top using trowel grade adhesive applied with 5 mm notched steel trowel at a rate recommended by membrane manufacturer; use roller to apply even pressure over entire surface to provide uniform adhesion across entire surface.
- .9 Roof penetrations:
- .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.8 FIELD QUALITY CONTROL

- .1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Departmental Representative.
- .2 All inspection fees will be paid by the Contractor, in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .3 Manufacturers' Field Services:
 - .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
 - .2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.

- .3 Upon completion of Work, after cleaning is carried out.
- .4 Obtain reports within three days of review and submit.

3.9 CLEANING

- .1 Remove bituminous markings from finished surfaces.
- .2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .3 Repair or replace defaced or disfigured finishes caused by work of this section.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 07 21 13 – Board Insulation
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 46 19 – Steel Siding
- .5 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .6 Section 07 62 00 – Sheet Metal Flashing and Trim
- .7 Section 07 92 00 – Sealants

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A755/A755M-11, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - .3 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
 - .4 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .5 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32- M77, Sheathing, Membrane, Breather Type.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2014).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
 - .1 CCMC-2002, Registry of Product Evaluations.
- .6 Roofing Contractor's Association of British Columbia (RCABC)
 - .1 Roofing Practices Manual
 - .2 Roofing Contractors Association of B.C. Guarantee Corp. Guarantee Program.
- .7 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

- .1 Architectural Sheet Metal Manual, 7th Edition, 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section with Contractor, Consultant, Departmental Representative, installer, and manufacturer's representative to:
 - .1 Review methods and procedures related to metal roofing system installation, including manufacturer's written instructions.
 - .2 Examine deck substrate sheathing conditions for compliance with requirements, including flatness and attachment to structural members.
 - .3 Review structural loading limitations of deck sheathing during and after roofing.
 - .4 Review flashings, special roof details, roof drainage, roof penetrations, and condition of other construction that will affect metal roofing system.
 - .5 Review temporary protection requirements for metal roofing system during and after installation.
 - .6 Review roof observation and repair procedures after metal roofing system installation.
 - .7 Review manufacturer's installation instructions and warranty requirements. Ensure system meets RCABC warranty requirements as indicated below.
- .2 Coordination:
 - .1 Coordinate installation of roof curbs, equipment supports, and roof penetrations.
 - .2 Coordinate metal roofing system with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak proof, secure, and non-corrosive installation.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit product data including; but not limited to, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roofing system and accessory.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit duplicate 300 x 300mm samples of each sheet metal material.
- .4 Submit proof of manufacturer's CCMC Listing and listing number to Departmental Representative.

- .5 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: Engage experienced installer with a minimum of 5 years experience who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance. Installer to be a member of the Roofing Contractors Association of British Columbia.
- .2 Obtain each type of metal roofing system through one source from a single manufacturer.
- .3 Roofing and sheet metal work shall be performed in conformance with roofing manufacturer's written recommendations using materials in accordance with CAN/ULC S107.
- .4 Perform Work to RCABC/RGC practice Manual and manufacturers written instructions.
- .5 Provide only materials listed by RCABC/RGC.

1.6 MOCK-UPS

- .1 Submit mock-ups in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .2 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .3 Locate where directed.
- .4 Allow for review of mock-up by Departmental Representative before proceeding with sheet metal flashing work.
- .5 Reviewed mock-up will demonstrate minimum standard of quality required for this Work and may remain as part of finished Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store materials in accordance with manufacturer's instructions.
- .2 Protect panels during transportation, unloading, storing, and erecting to prevent bending, warping, twisting, and surface damage.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.9 WARRANTY

- .1 Provide twenty (20) year roofing manufacturer's warranty covering labour and materials. Upon successful completion of the work to roofing manufacturer's satisfaction and receipt of final payment, the roofing manufacturer's System

- Warranty shall be issued. Applicator to submit required information and documents in compliance with roofing manufacturer's requirements.
- .2 The Applicator to provide the Departmental Representative with a separate workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Departmental Representative. The Applicator's warranty obligation shall run directly to the Departmental Representative, and a copy shall be sent to the roofing manufacturer.
 - .3 Special Warranty: In addition, provide a ten (10) year RCABC Warranty starting from the date of Substantial Performance. All related fees are to be included in the bid price including, but not limited to, administrative and re-inspection costs and the construction inspection costs.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 General: The complete roof cladding system shall meet the following performance/design criteria and maintain its intended appearance, remain wind and watertight, allow for expansion and contraction of metal components and transmit loads to the supporting structural back-up.
- .2 Provide system with products to achieve 10 year RCABC warranty certificate.
- .3 The design, and erection of a complete metal roof system is the responsibility of this subcontractor and are based on the performance criteria specified. The method assembly, reinforcing and anchorage is schematic and shows general intent only. Location and methods of providing same shall be this subcontractor's responsibility who shall design the assembly, reinforcing and anchorage to suit specific conditions in an acceptable manner complying with the requirements specified herein.
- .4 Provide flashing as shown and required to make the system wind and watertight, and still allow for thermal movement.
- .5 All fastenings shall be concealed where possible. Where exposed in finished surfaces, screw heads shall be neat and symmetrical, made completely watertight and capable of allowing expansion and contraction of metal roof cladding. Exposed fasteners shall be color-matched to finished metal cladding or stainless steel and as scheduled.
- .6 Design and install panel system and all connections to withstand earthquake forces and wind loads in accordance with the requirements of the National Building Code
- .7 Thermal Movements and Wind Loads: The metal wall and associated flashing systems shall be so designed and constructed as to provide for such expansion and contraction of component materials as will be caused by an ambient temperature range of -40°C to +60°C without causing harmful buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

- .8 Provide and/or make allowances for free noiseless vertical and horizontal thermal and wind loading movement, due to the contraction and expansion of any and all component parts.
- .9 Assembly and erection procedures shall take into account the ambient temperature range and wind pressure at the time of installation.
- .10 The system shall provide clear internal paths of drainage in order to drain any trapped moisture to the exterior, discharging moisture in a manner avoiding staining of architectural finishes, collecting in puddles, formation of unsafe icicles and dripping onto pedestrians.
- .11 Fasten panel assembly to building structure in a manner, which transmits all loads to the main structure without exceeding the capacity of any fastener.

2.2 ROOF SHEATHING

- .1 Glass Mat Faced Roof Boards: to ASTM C1177/C1177M for manufacturing and ASTM D3272 for mould resistance, standard, mould resistant, thickness as indicated.
 - .1 Surface Burning Characteristics: In accordance with CAN/ULC S102.
 - .1 Flame Spread: 0
 - .2 Smoke Developed: 0
 - .2 Long Edges: Square.

2.3 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: to ASTM A653/A653M, commercial quality (CS), with Z275 galvanized coating and as follows:
 - .1 Base Metal Thickness: 24 gauge as indicated on Drawings.
 - .2 Finish: prefinished as specified below.
 - .3 Profile: double lock standing seam as indicated on Drawings.
- .2 Miscellaneous Metal Framing: Cold rolled steel framing in accordance with CSA S136, and as follows:
 - .1 Steel Sheet Components: Fabricated from 1.2 mm nominal base metal thickness galvanized steel to ASTM A653M, with Z180 zinc coating.
 - .2 Hat Shaped, Rigid Furring Channels: Fabricated from 0.72 mm nominal base metal thickness galvanized steel, depth as indicated.
 - .3 Cold Rolled Furring Channels: 1.5 mm nominal bare steel thickness, with minimum 13 mm wide flange, depth as indicated.
 - .4 Furring Brackets: Adjustable, corrugated edge type, steel sheet with minimum 0.72 mm nominal bare steel thickness.
 - .5 Z-Bars: Slotted or non-slotted web, face flange 32 mm wide; wall attachment flange 22 mm wide x depth to suit insulation thickness, minimum 0.43 mm nominal bare metal thickness.
- .3 Metal Framing Fasteners: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates as recommended by manufacturer. NOTE: Secure construction requirements applies to all roofs, see drawings.

2.4 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied silicone modified polyester.
 - .1 Class: F1S.
 - .2 Colour: as indicated on Drawings.
 - .3 Specular gloss: 30 units +/-5 to ASTM D523.
 - .4 Specular gloss: 30 units +/-5 to ASTM D523.
 - .5 Coating thickness: not less than 20 micrometres.
 - .6 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .1 Outdoor exposure period 500 hours.
 - .2 Humidity resistance exposure period 500 hours.

2.5 INSULATION

- .1 Roof Insulation: to CAN/ULC-S704, Type 1, Class 3, closed-cell polyisocyanurate foam manufactured using HCFC-free blowing agents, and with glass scrim both sides.
 - .1 Compressive Strength (ASTM D1621): 138 kPa
 - .2 Board Size: 1220 mm x 1220 mm
 - .3 Thickness: as indicated on Drawings.
 - .4 Long Term Thermal Resistance (LTTR): RSI 1.00/25 mm minimum.
 - .5 Density (ASTM D1622): 32 kg/m³
 - .6 Flame Spread Index (ASTM E84): 50
 - .7 Smoke Development (ASTM E84): 160 – 180

2.6 INSULATION OVERLAY BOARD

- .1 Insulation overlay board: same as Roof Sheathing.

2.7 VAPOUR BARRIER MEMBRANE

- .1 Air and Vapour Barrier and Primer: adhered SBS-modified bituminous membrane for high temperature applications; rubberized asphalt will not flow up to temperatures as high as 116°C.
 - .1 Primer: as recommended by manufacturer
 - .2 Thickness: 1.0 mm
 - .3 Breaking Strength (ASTM D1970): MD = 11.3 kN/M; XD = 15.4 kN/m
 - .4 Elongation at Break (ASTM D1970): MD = 52%; XD = 24%
 - .5 Tear Resistance (ASTM D1970): MD = 375 N; XD = 400 N
 - .6 Static Puncture Resistance (ASTM D5602): 400 N
 - .7 Water Vapour Permeance (ASTM E96): 1.25 ng/PA.s.m²

2.8 ACCESSORIES

- .1 Provide components required for complete metal roofing system assembly including trim, copings, fasciae, corner units, ridge cap, ridge closures, clips,

- flashings, sealants, gaskets, fillers, closure strips, and similar items; match material and finish of metal roofing system.
- .2 Isolation coating: alkali resistant bituminous paint.
 - .3 Plastic cement: to CAN/CGSB-37.5.
 - .4 Underlay: No.15 perforated asphalt felt to CSA A123.3.
 - .5 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.
 - .6 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer and in accordance with Section 07 92 00.
 - .7 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
 - .8 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
 - .9 Fasteners: concealed.
 - .10 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
 - .11 Flashing, Roof Curbs, and Trim: Prefinished flashing materials to match roofing materials in accordance with Section 07 62 00
 - .12 Gutters and Downspouts: in accordance with Section 05 50 00 – Metal Fabrications.
 - .13 Touch-up paint: as recommended by sheet metal roofing manufacturer.
 - .14 Snow Guards: continuous type, fabricated of non-corrosive prefinished metal as directed by Departmental Representative. Installed without penetrating metal roofing system, and complete with predrilled holes, clamps, or hooks for anchoring.

2.9 FABRICATION

- .1 Fabricate and finish metal roofing system and accessories at the factory to greatest extent possible, using manufacturer's standard procedures and processes to obtain the indicated profiles and meeting dimensional and structural requirements for the Project.
- .2 Provide roof sheet and all accessories in longest practicable length to minimize field lapping of joints.
- .3 Fabricate flashing and trim in accordance with SMACNA recommendations that apply to the design, dimensions, metal, and other characteristics of item indicated.

Part 3 Execution

3.1 COMPLIANCE

- .1 Comply with Warranty requirements, and RCABC Roofing Application Standards Manual guidelines, requirements and recommendations.

3.2 EXAMINATION

- .1 Examine substrates to ensure proper attachment to framing.
- .2 Examine roof deck to verify deck is clean and smooth, free of depressions, waves or projections and within flatness tolerances required by metal roofing system manufacturer
- .3 Verify roof opening, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- .4 Verify deck is dry and free of snow or ice.

3.3 ROOF SHEATHING

- .1 Mechanically fastened with screws spaced 400 mm on centre each way.
- .2 Place with long axis of each sheet transverse to deck, with end joints staggered and fully supported by roof structure.

3.4 INSTALLATION AIR AND VAPOUR MEMBRANE

- .1 Install self adhering membrane, wrinkle free, on roof sheathing under metal roofing system.
- .2 Apply primer if required by manufacturer and install in accordance with temperature restrictions of manufacturer.
- .3 Apply over entire roof in shingle fashion to shed water, with end laps of not less than 150 mm staggered 600 mm between courses and as follows:
 - .1 Overlap side edges not less than 90 mm.
 - .2 Extend into gutter trough.
 - .3 Roll laps with roller.
 - .4 Cover within 14 days.
- .4 Install flashings to cover membrane in accordance with requirements specified in Section 07 62 00.

3.5 INSTALLATION: INSULATION

- .1 Extend insulation in thickness indicated to cover entire roof in accordance with installation requirements in Section 07 21 13.
- .2 Install insulation horizontally and held in place with furring members as detailed on Drawings.

3.6 INSTALLATION

- .1 Install metal roofing system in accordance with manufacturer's written instruction.
- .2 Use concealed fastenings except where approved by Departmental Representative before installation.
- .3 Provide underlay under sheet metal roofing. Secure in place and lap joints 100 mm minimum.

- .4 Apply slip sheet over asphalt felt underlay to prevent bonding between sheet metal and felt. Secure with minimum anchorage and lap joints 50 mm minimum in direction of waterflow.
- .5 Install sheet metal roof panels using cleats spaced at 300 mm on centre.
- .6 Secure cleats with two fasteners each and cover with cleat tabs.
- .7 Stagger transverse seams in adjacent panels.
- .8 Flash roof penetrations with material matching roof panels, and make watertight.
- .9 Form seams in direction of water-flow and make watertight.

3.7 STANDING SEAM ROOFING

- .1 Fold lower end of each pan under 20 mm.
 - .1 Slit fold 25 mm away from corner to form tab where pan turns up to make standing seam.
 - .2 Fold upper end of each pan over 50 mm.
 - .3 Hook 20 mm fold on lower end of upper pan into 50 mm fold on upper end of underlying pan.
- .2 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.
- .3 Finish standing seams 25 mm high on flat surfaces. Bend up one side edge 40 mm and other 45 mm.
 - .1 Make first fold 6 mm wide single fold and second fold 12 mm wide, providing locked portion of standing seam with 5 plies in thickness.
 - .2 Fold lower ends of seams at eaves over at 45 degrees angle.
 - .3 Terminate standing seams at ridge and hips by turning down in tapered fold.
- .4 Form valleys of sheets not exceeding 3 m in length. Lap joints 150 mm in direction of flow.
 - .1 Extend valley sheet minimum 150 mm under roofing sheets.
 - .2 At valley line, double fold valley and roofing sheets and secure with cleats spaced 450 mm on centre.

3.8 BUILT-IN GUTTERS

- .1 Refer to Section 05 50 00 – Metal Fabrications.

3.9 CLEANING

- .1 Remove temporary protective coverings and strippable films, if any, as metal roofing system are installed, unless otherwise indicated in manufacturer's written installation instructions.
- .2 Clean finished surfaces as recommended by metal roofing system manufacturer upon completion of metal roofing system installation; maintain in a clean condition during remainder of construction.

- .3 Replace metal roofing system components that become damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.
- .4 Remove all excess materials, debris and equipment at completion.
- .5 Clean all panels clean and free of all grime and dirt.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 42 43 – Composite Metal Panels
- .5 Section 07 46 19 – Steel Siding
- .6 Section 07 46 90 – Metal Soffit Panels
- .7 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .8 Section 07 61 00 – Sheet Metal Roofing
- .9 Section 07 92 00 – Sealants
- .10 Section 08 11 00 – Metal Doors and Frames
- .11 Section 08 11 16 – Aluminum Doors and Frames
- .12 Section 08 50 00 – Aluminum Windows

1.2 REFERENCES

- .1 The Aluminum Association Inc. (AA)
 - .1 Specifications for Aluminum Sheet Metal Work in Building Construction.
 - .2 DAF45-03, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A606/A606M-09a, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .4 ASTM B32-08, Standard Specification for Solder Metal.
 - .5 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .6 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - .7 ASTM D4586-07(2012) e1, Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 - .1 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual

- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-05 (R2010), Asphalt Saturated Organic Roofing Felt.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2009, Standard/Specification for Windows, Doors, and Skylights, Includes Update No. 1 (2013).
 - .3 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
- .6 Green Seal Environmental Standards
 - .1 Standard GS-03-97, Anti-Corrosive Paints.
 - .2 Standard GS-11-10, Paints and Coatings.
 - .3 Standard GS-36-00, Commercial Adhesives.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .8 Roofing Contractors Association of British Columbia (RCABC):
 - .1 Roofing Practices Manual
 - .2 Roofing Contractors Association of B.C. Guarantee Corp. Guarantee Program.
- .9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
Architectural Sheet Metal Manual, 5th Edition, 1993
- .10 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule #1113-04, Architectural Coatings.
 - .2 SCAQMD Rule #1168-05, Adhesives and Sealants.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate work of this Section with interfacing and adjoining Work for proper sequencing of each installation and to provide positive weather resistance, durability of the work, and protection of materials and finishes.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 QUALITY CONTROL

- .1 Installer: Engage an experienced installer having a minimum of three years experience who has completed projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- .2 Construct and install roof metal flashings in accordance with RCABC Manual details and in accordance with the RCABC Manual. If requirements conflict, this specification takes precedence over the manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Stack pre-formed and pre-finished material in manner to prevent twisting bending and rubbing.
- .2 Provide protection for galvanized surfaces.
- .3 Prevent contact of dissimilar metals during storage and protect from acids, flux, and other corrosive materials and elements
- .4 Protect prefinished surfaces from scratches and from rust staining.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.8 WARRANTY

- .1 The same warranty provisions apply to flashings associated with roofing as to the roofing.
- .2 Provide Warranty for sheet metal flashing and trim to include in maintenance manuals as specified in Section 01 01 50 – General Instructions, Operations and Maintenance Data Manuals.

Part 2 Products

2.1 METAL FLASHINGS

- .1 Zinc coated galvanized steel sheet (pre-finished): Type A commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
 - .1 Class: F1S-Finished one side.
 - .2 Thickness: minimum 0.45 mm base metal thickness or as otherwise indicated
 - .3 Factory Finish: manufacturer's standard silicone modified polyester
 - .4 Colour: to be selected by Departmental Representative after Contract Award.
- .2 Formed aluminum flashings: Tension levelled, aluminum sheet in accordance with ASTM B209 and ANSI H35.1 alloy designation 3003-H14 and as follows:
 - .1 Thickness: minimum 1.00 mm.
 - .2 Colour and Finish: prefinished; to be selected by Departmental Representative after Contract Award.
- .3 Form flashings, copings and fascias to profiles indicated. Roofing fascia metal coil to be a minimum for 22 gauge (0.7 mm) to prevent oil canning.

2.2 METAL GUTTERS

- .1 Refer to Section 05 50 00 – Metal Fabrications and Section 07 61 00 – Sheet Metal Roofing.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Roofing Cement: to ASTM D4586, asphalt based, asbestos free.
- .3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.
- .4 Sealants: as indicated in Section 07 92 00 - Sealants.
 - .1 Mastic Sealant: CAN/CGSB 37.29 polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
 - .2 Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00.
- .5 Fasteners: of same material as sheet metal, to CSA B111, as recommended by sheet metal manufacturer; non-corrosive. Finish of exposed parts to match material being fastened.
- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .7 Solder: to ASTM B32, alloy composition Sn.
 - .1 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered
- .8 Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet metal.
- .9 Metal Accessories: Provide non-corrosive sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work. Accessories shall match or be compatible with material being installed; size and thickness as required.
- .10 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

- .1 Fabricate sheet metal building flashings and trim in accordance with the recommendations of SMACNA's Architectural Sheet Metal Manual that apply to the design, dimensions, metal, and other characteristics as required.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .3 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .4 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .5 Make flashings of prefinished metal for all cap flashings, for all flashings adjacent to roofing at roof edges and area dividers and where exposed to view from ground. Make flashings for other locations, of plain galvanized metal as follows:

- .1 Use 0.45 mm metal core thickness except where otherwise indicated.
- .2 Use 0.62 mm metal core thickness wherever a flat length exceeding 305 mm wide occurs.
- .3 Use 0.80 mm metal core thickness for concealed fastening strips.
- .6 All straight run joints shall be S-Lock in roof flashings.
- .7 Make joints to allow for thermal movement, space S-Lock joints at 1500 mm maximum centers.
- .8 Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant in accordance with SMACNA standards.
- .9 Make flashings for building into masonry and concrete so that joints can be lapped 100 mm or more.
- .10 Strengthen free edges of metal flashings by folding to form a 13 mm hem.
- .11 Make flashings to curbs, walls and parapets a minimum of 200 mm high, where possible.
- .12 Where curb-mounted roof penetrations are not required, provide flashing sleeves and collars for all pipes and conduit extending through the roof. Sleeves shall be soldered to a piece of sheet metal extending at least 150 mm onto the surrounding roof.
- .13 Make joints for corners and intersections with standing seams except where exposed of pre-finished metal when seams shall be flat locked.
- .14 All bends machine made; form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .15 Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, non-corrosive metal recommended by sheet metal manufacturer, and as follows:
 - .1 Size as recommended by SMACNA manual or sheet metal manufacturer for application but not less than thickness of metal being secured.
- .16 Back paint metal flashings in contact with dissimilar metals or materials with bituminous paint that would result in electrolytic action or corrosion.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSPECTION

- .1 Check mounting and counterflashing of mechanical items and report any defect to the Departmental Representative.

- .2 Verify that solid wood blocking or sheathing provided to back-up all flashings and that all nails, screws set and wood provides a smooth flat plane.
- .3 Verify that all reglets, provided under other Sections or built-in by other trades, properly and securely located, true and level in line.

3.3 INSTALLATION: METAL FLASHING

- .1 Apply metal roof flashing to RCABC recommended requirements as a minimum.
- .2 Install sheet metal flashing and trim in accordance with performance requirements, manufacturer's installation instructions, and SMACNA's Architectural Sheet Metal Manual.
- .3 Do not install metal flashings over flexible roof flashing until the flexible roof flashing has been inspected and approved by the Roofing Inspector. This includes curbs for roof mounted items.
- .4 Fasten metal base flashing to walls or upstands along top of flashing. Do not secure to cant strip. Form lapped corner joints. Extend rolled edge of base flashing approximately 25 mm on to roof from toe of cant, and rest on top of roof surface.
- .5 Do not use exposed fastening unless indicated, or concealed fastening is not possible. Locations and methods shall be approved by Departmental Representative.
- .6 Provide underlay under sheet metal.
 - .1 Secure in place and lap joints 100 mm.
- .7 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
 - .1 Flash joints using S-lock or standing seams forming tight fit over hook strips, as detailed.
- .8 Lock end joints and caulk with sealant.
- .9 Insert metal flashing to form weather tight junction.
- .10 Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
- .11 Underlayment: Install a slip sheet of red rosin paper and a course of polyethylene underlayment where installing stainless steel or aluminum directly on cementitious or wood substrates.
- .12 Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
- .13 Caulk flashing at cap flashing with sealant.
- .14 Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the Item manufacturer, to drain roof in the most efficient manner.
- .15 Coordinate roof drain flashing installation with roof drainage system installation.

- .16 All exposed and pre-finished flashings to provide a smooth flat surface free of indentations, bumps, oil-canning, or twists, all edges, bends hard, sharp and true to line.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- .4 Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Performance.
- .5 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 This Section includes through penetration firestopping and smoke seal systems for penetrations through the following fire resistance rated assemblies, including both empty openings and openings containing penetrating items:
 - .1 Wall and partitions.
 - .2 Smoke barriers.
 - .3 Construction enclosing compartmentalized areas.
- .2 This Section includes fire resistive joint systems for the following:
 - .1 Floor-to-wall joints.
 - .2 Head-of-wall joints.
 - .3 Wall-to-wall joints.
 - .4 Joints between perimeter edge of fire resistance rated floor assemblies and back of curtainwall system.
- .3 This specification section provides requirements for Rated Systems or systems requiring Engineered Judgements:
 - .1 Use of materials that have not been tested in a system or that are not capable of obtaining an engineered judgement will not be acceptable for use on this Project.
 - .2 Materials having only a ULC label will not be acceptable for use on this Project, unless supporting documentation is provided indicating its use in a listed assembly.

1.2 RELATED SECTIONS

- .1 Section 01 35 00 – Delegated Design
- .2 Section 03 30 00 – Cast-In-Place Concrete
- .3 Section 04 22 00 – Concrete Unit Masonry
- .4 Section 05 12 00 – Structural Steel
- .5 Section 09 21 16 – Gypsum Board Assemblies
- .6 Division 23 Mechanical
- .7 Division 26 Electrical

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM E119-16, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

- .3 ASTM E814-13a, Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .4 ASTM A1008/A1008M-15, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- .5 ASTM E1966-15, Standard Test Method for Fire-Resistive Joint Systems.
- .6 ASTM E2174-14b, Standard Practice for On-Site Inspection of Installed Fire Stops.
- .7 ASTM E2307-15b, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.
- .8 ASTM E2393-10a(2015), Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Fire Protection Agency (NFPA)
 - .1 NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 Edition.
- .4 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC Guide No. 40 U19-1998, Firestop Systems.
 - .2 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .3 CAN/ULC S102-11, Standard Method of Tests for Surface Burning Characteristics of Building Materials and Assemblies.
 - .4 CAN4 S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
 - .5 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.
 - .6 CAN/ULC S702-09-AM1, Standard for Thermal Insulation Mineral Fibre for Buildings, Includes Amendment 1(January 2012).
 - .7 ULC S702.2-10, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.
 - .8 List of Equipment and Materials.
- .5 Underwriters Laboratories Inc. (UL)
 - .1 ANSI/UL 1479, Standard for Fire Test of Through-Penetration Firestops.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative, Departmental Representative, and Consultant in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.

- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 – General Instructions, Submittal.
 - .1 Not later than 30 working days following Award of Contract, submit a schedule listing surfaces or components to which firestopping and smoke seals is to be applied, and indicating the firestopping and smoke seals system and materials required and detailing installation.
 - .2 Where possible determine thickness to be applied from tests of assemblies identical to the assembly to be protected, conducted in accordance with ULC S-101, ASTM E119, ULI 1479, NFPA 251, and ASTM E814.
 - .3 Determine system from available engineering studies, or correspondence with the labelling agency indicating the effect of the differences on the fire separation of the assembly. Confirm acceptance of system by authorities having jurisdiction in writing.
 - .4 Where the assembly includes conditions that do not correspond to those included in any previously tested assembly and for which no relevant engineering information is available use the same system and material as would be required for a tested assembly with similar conditions.
- .2 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .3 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions, Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

- .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in fire stopping installations and approved by manufacturer with 5 years documented experience.
- .2 Use materials and methods of determining required thickness of application that have the full acceptance of authority having jurisdiction.
- .3 Use materials tested to CAN/ULC-S115. Assemblies containing the materials shall be in accordance with assemblies tested and approved by agencies acceptable to authority having jurisdiction.
- .4 Source Responsibility: Obtain through penetration firestop and joint systems, for each kind of penetration and construction condition indicated, from a single source of installation responsibility.
- .5 Delegated Design Professional: Use a professional engineer, registered in the province of the Work and familiar with installations of similar scope and complexity to design firestopping and smoke seals.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
 - .3 Use stock before its expiration date.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.9 PROJECT CONDITIONS

- .1 Install firestopping and smoke seals materials only when the areas in which they are scheduled are closed-in and protected from dampness.

- .2 Environmental Limitations: Install firestopping and smoke seals systems when ambient or substrate temperatures are within temperature and moisture limits permitted by firestopping and smoke seals system manufacturers or when substrates are not wet due to rain, frost, condensation, or other causes.
- .3 Ventilate firestopping and smoke seals systems in accordance with manufacturer's written instructions by natural means or forced air circulation where natural means are not adequate.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Delegated Design Requirements: Design firestopping and smoke seals required by the Contract Documents to withstand fire ratings indicated and in accordance with requirements of the Building Code, and as described in Section 01 35 00.
- .2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the Building Code, Underwriters Laboratories Canada, and authorities having jurisdiction, and as follows:
 - .1 Provide through penetration firestop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated:
 - .1 Fire resistance rated load bearing walls, including partitions, with fire protection rated openings.
 - .2 Fire resistance rated non-load bearing walls, including partitions, with fire protection rated openings.
 - .3 Fire resistance rated floor assemblies.
 - .2 F-Rated Systems: Provide through penetration firestop systems with F-ratings indicated, as determined by ULC S115 or ASTM E814, but not less than that equalling or exceeding fire resistance rating of constructions penetrated.
 - .3 T-Rated Systems: For the following conditions, provide through penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per by ULC S115 or ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials:
 - .1 Penetrations located outside wall cavities.
 - .2 Penetrations located outside fire resistive shaft enclosures.
 - .3 Penetrations located in construction containing fire protection rated openings.
 - .4 Penetrating items larger than 100 mm diameter nominal pipe or 100 cm² in overall cross sectional area.
 - .4 Firestopping and Smoke seals Systems Exposed To View: Systems exposed to view, traffic, moisture, and physical damage; provide products that after curing do not deteriorate when exposed to these conditions both during and after construction, and as follows:

- .1 Provide moisture resistant through penetration firestop systems for piping penetrations for plumbing and wet pipe sprinkler systems.
- .2 Provide firestopping and smoke seals systems capable of supporting floor loads involved either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic.
- .3 Provide firestopping and smoke seals systems not requiring removal of insulation for penetrations involving insulated piping.
- .4 Provide products with flame spread ratings of less than 25 and smoke developed ratings of less than 50 for firestopping and smoke seals and joint systems exposed to view.
- .5 Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equalling or exceeding fire resistance rating of constructions in which joints are located.

2.2 FIRESTOPPING AND SMOKESEALS: GENERAL

- .1 Compatibility: Provide firestopping and smoke seals systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping and smoke seals systems, under conditions of service and application, as demonstrated by firestopping and smoke seals system manufacturer based on testing and field experience, and as follows:
 - .1 Service penetration assemblies: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.
 - .2 Service penetration firestopping and smoke seals components: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.13, under the Label Service of ULC.
 - .3 Fire resistance rating of installed firestopping and smoke seals assembly not less than the fire resistance rating of surrounding floor and wall assembly.
 - .4 Firestopping and Smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
 - .5 Firestopping and Smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations. Exemption to fire dampers.
- .2 Accessories: Provide components for each firestopping and smoke seals systems that are needed to install fill materials. Use only components specified by firestopping and smoke seals system manufacturer and approved by the qualified testing and inspecting agency for firestopping and smoke seals systems indicated. Accessories include, but are not limited to, the following items:
 - .1 Permanent forming, damming and backing materials, including the following:

- .1 Slag or rock wool fibre insulation.
- .2 Sealants used in combination with other forming, damming or backing materials to prevent leakage of fill materials in liquid state.
- .3 Fire-rated form board.
- .4 Fillers for sealants.
- .2 Temporary forming materials.
- .3 Substrate primers.
- .4 Collars.
- .5 Steel sleeves.
- .6 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .7 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .8 Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.912 mm.
- .9 Steel Deck Moulded Flute Inserts: One piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire rated wall assemblies.
- .10 Labels: Peel-and-stick labels printed with the following information:
 - .1 ATTENTION: FIRE RATED ASSEMBLY. DO NOT MODIFY
 - .2 Name of firestopping manufacturer
 - .3 Names of products used
 - .4 Hour Rating of Assembly
 - .5 Manufacturers standard detail number, or Engineered Judgement identifier; ULC or cUL_{US} Number
 - .6 Date of installation
 - .7 Name of installing Subcontractor
 - .8 Contact telephone number for repair or replacement of firestopping materials.

2.3 **FILL MATERIALS**

- .1 General:
 - .1 Provide firestopping and smoke seals systems containing the types of fill materials indicated in the Firestopping and Smoke seals System Schedule below by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
 - .2 Firestopping and smoke seal systems shall be tested in accordance with ULC S115, and be comprised of asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases, and not to exceed opening sizes for which they are intended for the ratings as indicated on drawings.
- .2 Cast-in-Place Firestopping and Smoke seals Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic

- sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- .3 Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
 - .4 Firestopping and Smoke seals Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
 - .5 Cable Penetration Devices: Premanufactured intumescent blocks, consisting of a system of inserts and adjustable cores; or premanufactured fire rated cable pathway systems.
 - .6 Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
 - .7 Intumescent Putties: Non-hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.
 - .8 Intumescent Spray Foam: Expanding spray-in-place intumescent foam sealant.
 - .9 Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
 - .10 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
 - .11 Pillows/Bags: Reusable, heat expanding pillows/bags consisting of glass fibre cloth cases filled with a combination of mineral fibre, water insoluble expansion agents and fire retardant additives.
 - .12 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
 - .13 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
 - .1 Grade for Horizontal Surfaces: Pourable (self levelling) formulation for openings in floors and other horizontal surfaces.
 - .2 Grade for Vertical Surfaces: non-sag formulation for openings in vertical and other surfaces.

2.4 ACCESSORIES

- .1 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .2 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .3 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .4 Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.95 mm (20 ga.).

2.5 MIXING

- .1 For those products requiring mixing before application, comply with firestopping and smoke seals system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Examine surfaces, components, materials to receive firestopping and smoke seals material; report any conditions which would detrimentally affect the application of the material or the proper firestopping and smoke seals of the system.
- .2 Commence Work when conditions of surfaces and the working conditions are suitable.
- .3 Where penetration sealants or caulking are required, ensure all service lines are in place, tested and approved.
- .4 Verify all proper blocking, framing (using non-combustible materials) are properly installed and prepared to receive firestopping and smoke seals. Notify Departmental Representative in writing of any deficiencies affecting the proper performance of the firestopping and smoke seals, do not proceed until deficiencies are corrected.

3.3 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Prime surfaces as required.
- .5 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.4 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Apply firestopping and smoke seals materials/systems to maintain the fire separations in the project as indicated on drawings.
- .3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .5 Tool or trowel exposed surfaces to neat finish.
- .6 Remove excess compound promptly as work progresses and upon completion.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
 - .1 Cut tests may be made at random by the Departmental Representative. Frequency of cut tests shall be determined by the Departmental Representative, but will not be more than 1% of total length of firestopping and smoke seals.
 - .2 Make all necessary repairs and correct all deficiencies noted after completion of cut tests.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, twice during progress of Work at 25% and 60% complete.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Design and provide through penetration firestopping and smoke seals as follows for:
 - .1 Systems with No Penetrating Items: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Silicone sealant.
 - .3 Intumescent putty.
 - .4 Intumescent foam blocks or boards.
 - .5 Intumescent spray foam.
 - .2 Systems for Metallic Pipes, Conduit, or Tubing: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Silicone sealant.
 - .3 Intumescent putty.
 - .4 Intumescent foam blocks or boards.
 - .5 Intumescent spray foam.
 - .3 Systems for Non-metallic Pipe, Conduit, or Tubing: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Silicone sealant.
 - .3 Intumescent putty.
 - .4 Intumescent wrap strips.
 - .5 Firestopping and Smoke seals device.
 - .6 Intumescent spray foam.
 - .4 Re-enterable and Cable Managed Systems for Electrical, and Data and Communications Cables.
 - .5 Systems for Electrical, and Data and Communications Cables: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Silicone sealant.
 - .3 Intumescent putty.
 - .4 Silicone foam.
 - .5 Intumescent foam blocks or boards.
 - .6 Intumescent spray foam.
 - .6 Systems for Cable Trays: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Intumescent putty.
 - .3 Silicone foam.
 - .4 Pillows/bags.

- .5 Intumescent foam blocks or boards.
- .7 Systems for Insulated Pipes: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Intumescent putty.
 - .3 Silicone foam.
 - .4 Intumescent wrap strips.
 - .5 Intumescent foam blocks or boards.
 - .6 Intumescent spray foam.
- .8 Systems for Miscellaneous Electrical Penetrations: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Intumescent putty.
 - .3 Intumescent foam blocks or boards.
 - .4 Intumescent spray foam.
- .9 Systems for Miscellaneous Mechanical Penetrations: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Intumescent foam blocks or boards.
 - .3 Intumescent spray foam.
- .10 Systems for Groupings of Penetrations: Select one or more of the following fill materials:
 - .1 Latex sealant.
 - .2 Intumescent wrap strips.
 - .3 Firestopping and Smoke seals device.
 - .4 Intumescent composite sheet.
 - .5 Intumescent foam blocks or boards.
 - .6 Intumescent spray foam.
- .2 Design and provide joint firestopping and smoke seals as follows for:
 - .1 Floor-to-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - .1 Assembly Rating: As indicated.
 - .2 Nominal Joint Width: As indicated.
 - .3 Movement Capabilities: To be confirmed, compression, extension, or horizontal shear.
 - .2 Head-of-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - .1 Assembly Rating: As indicated.
 - .2 Nominal Joint Width: As indicated.
 - .3 Movement Capabilities: Compression and extension.
 - .3 Wall-to-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:

- .1 Assembly Rating: As indicated.
 - .2 Nominal Joint Width: As indicated.
 - .3 Movement Capabilities: Compression and extension.
- .3 Design and provide perimeter fire containment firestopping and smoke seals as follows for:
- .1 Perimeter Fire Containment System: Provide materials to meet the following criteria:
 - .1 Integrity Rating: As indicated.
 - .2 Insulation Rating: As Indicated.
 - .3 Linear Opening Width: As indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete
- .2 Section 06 40 00 – Architectural Woodwork
- .3 Section 07 21 19 – Foamed-In-Place Insulation
- .4 Section 07 26 00 – Vapour Retarders
- .5 Section 07 27 19 – Underslab Vapour Barrier
- .6 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .7 Section 07 62 00 – Sheet Metal Flashing and Trim
- .8 Section 08 11 16 – Aluminum Doors and Frames
- .9 Section 08 50 00 – Aluminum Windows
- .10 Section 08 80 50 – Glazing
- .11 Section 09 21 16 – Gypsum Board Assemblies
- .12 Section 09 30 13 – Tiling
- .13 Division 23 – Mechanical
- .14 Other technical specification sections as indicated.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
 - .2 ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.
 - .3 ASTM D2240-05(2010), Standard Test Methods for Rubber Property, Durometer Hardness.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 19-GP-5M-84, Sealing Compound, One Component, Acrylic Base, Solvent Curing (incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
 - .4 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
 - .5 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .6 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 Department of Justice Canada (Jus)

- .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Caulking compound
 - .2 Primers
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .4 Manufacturers Sample Warranty
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for sealants. Indicate VOC content.
 - .3 Submit manufacturer's installation instructions for each product used.
 - .4 When required by Departmental Representative, submit test certificates from an approved Canadian materials testing laboratory indicating that sealants meet the requirements of the CGSB standards specified, and that the tests have been conducted in accordance with ASTM D2240.
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals Procedures.
 - .1 Provide colour samples of the actual sealants for approval; painted or printed colour charts are not acceptable.

1.4 QUALITY ASSURANCE

- .1 Caulking shall be performed by a caulking contractor with successful experience in Work of similar size and complexity.
- .2 Before performing Work of this Section, submit the names of proposed materials. If specified using CGSB Standards, indicate Qualification Number.

1.5 MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .2 Before performing caulking work do sample applications of each type of sealant for approval. Site locations for sample applications shall be designated by

Departmental Representative. Approved samples shall form standard for this project and no work of inferior quality will be allowed. Start no final work until approval of samples is given by the Departmental Representative.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.
- .2 Deliver containers labelled and sealed, complete with written application and maintenance instructions.
- .3 Store materials in a dry heated enclosure in accordance with manufacturer's instructions.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.
- .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 the CEPA, TDGA, Regional and Municipal regulations.
- .5 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.
- .6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .8 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.
- .2 Substrate must be clean, dry, and frost free.

1.9 WARRANTY

- .1 Contractor hereby warrants that caulking work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces in accordance with General Conditions, but for three (3) years.
- .2 Provide Warranty for sealants to include in maintenance manuals as specified in Section 01 01 50 – General Instructions, Operations and Maintenance Data Manuals.

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 Unless otherwise specified, VOC content limits of sealants shall be in accordance with SCAQMD Rule 1168 and as follows:
 - .1 Architectural Materials:
 - .1 Sealants: VOC content limit 250 g/L.
 - .2 Sealant Primers for Non-Porous Surfaces: VOC content limit 250 g/L.
 - .3 Sealant Primers for Porous Surfaces: VOC content limit 775 g/L.
 - .2 Roofing:
 - .1 Non-Membrane Related Sealants: VOC content limit 300 g/L.
 - .2 Single Ply Roofing Sealants: VOC content limit 450 g/L.
 - .3 SBS Membrane Sealant Primer: VOC content limit 500 g/L.
 - .3 All Other Applications:
 - .1 Sealants: VOC content limit 420 g/L.
 - .2 Sealant Primers: VOC content limit 750 g/L.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Type S-1: Acrylic Latex One Part, Shore A Hardness 20, to CAN/CGSB-19.17 and ASTM C834.
- .2 Type S-2: Silicone Sealant; mould and mildew resistant.
 - .1 To ASTM C920; type S; grade NS; class 25; use NT, G, and A.
- .3 Type S-3: Silicone Sealant; general construction and air-seal sealant.

- .1 To CAN/CGSB-19.13 and ASTM C920: type S; grade NS; class 25; use NT, M, G, A, O.
- .4 Type S-5: Acoustical Sealant; interior, non-skimming, non-hardening, simple component synthetic rubber sealant.
 - .1 To CAN/CGSB-19.21.
- .5 Type S-6: Multi-component polyurethane sealant; chemical curing, exterior wall sealant.
 - .1 To CAN/CGSB-19.24 and ASTM C920: type M; grade NS; class 50; use T, NT, M, A, O.
- .6 Type S-7: One-component polyurethane sealant; non-sag, for general constructions.
 - .1 To CAN/CGSB-19.13 and ASTM C920: type S; grade NS; class 25; use NT, M, A, O.
- .7 Type S-8: Horizontal joint sealant; two component, self-levelling.
 - .1 To CAN/CGSB-19.24 and ASTM C920: type M; grade P; class 25; use T, M, O.
- .8 Type S-9: One part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to ASTM C920, type S, grade P, class 50, use T, M, A,O and CAN/CGSB 19.13, MC-1-25-B-N.
- .9 Type S-10: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.
- .10 Type S-11: One-component polyurethane sealant; medium-modulus, non-sag, low-VOC, UV stable.
 - .1 To CAN/CGSB-19.13 and ASTM C920: type S; grade NS; class 50; use NT, T, M, A, O, I.
- .11 Type S-12: Two-part nonsag epoxy security (pickproof) sealant.
 - .1 High solids, high modulus, high strength epoxy resin compound
 - .2 Shore D hardness to ASTM C661
 - .3 Type I and III or IV, Grade 3, Class C to ASTM C881

2.3 ACCESSORIES

- .1 Preformed Compressible and Non-Compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing.
 - .1 Rod Type Sealant Backings:
 - .1 ASTM C1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi-cellular material with a surface skin).
 - .2 Use any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.

- .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- .4 Non-adhering to sealant, to maintain two sided adhesion across joint.
- .2 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.
 - .3 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.
- .2 Preformed Sealants
 - .1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates.
 - .1 Performance Properties
 - .1 Joint Movement Capability (ASTM C719): +200/-100%
 - .2 Ultimate Elongation: 500%
 - .3 Ultimate Tensile Strength: 5.52 MPa
 - .4 Hardness, Durometer (Type A): 33
 - .3 Primer: Non-staining type as recommended by sealant manufacturer.
 - .4 Joint Cleaner: Non-corrosive solvent type recommended by sealant manufacturer for applicable substrate materials.

2.4 COLOURS

- .1 Colours: To match adjacent materials, to be selected from manufacturer's standard colour range.

2.5 SEALANT SELECTION

- .1 Where no specified type of sealant is shown or specified, choose one of the sealants specified in this Section appropriate for its location.
- .2 Make sealant selections consistent with manufacturer's recommendations.
- .3 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.
- .4 Use mould & mildew resistant silicone sealant Type S-2 for non-moving joints in washrooms and kitchens. Do not use on floors.
- .5 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type specified.
- .6 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.

- .7 Use multi-component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.
- .8 Use multi-component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .9 Use polyurethane, semi-self levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.
- .10 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .11 Use sealant S-11 for sealing exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.
- .12 Use sealant S-12 at high security locations as indicated on drawings and as directed by Consultant.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 INSPECTION

- .1 Carefully inspect surfaces, materials to receive sealants and verify they are physically capable of retaining sealant bond.
- .2 Verify that fillers and backing provided under other Sections properly installed.

3.3 SURFACE PREPARATION

- .1 Prepare surfaces in accordance with manufacturer's instructions.
- .2 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .3 Maintain workmanship of highest quality in accordance with best trade practice.
- .4 Ensure that joint forming materials are compatible with sealant.
- .5 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work. Wire brush loose materials and other foreign matter which might impair adhesion of sealant.
- .6 Use air stream to blow out dirt and water from crevices.
- .7 Ensure joint surfaces are dry and frost free
- .8 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc).

- .9 Prime other joints when recommended by manufacturer. Use a brush that will reach all parts of the joints. Mask adjoining surfaces with tape prior to priming to prevent staining.

3.4 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.

3.5 BACKUP MATERIAL

- .1 Use backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.
- .3 Where depth of joint does not permit the use of backer rod apply paper masking tape to back of joint to act as bond breaker.
- .4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

3.6 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.7 APPLICATION

- .1 Apply sealant in strict accordance with manufacturer's recommendations.
- .2 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm
- .3 Use pressure gun fitted with suitable nozzle. Use sufficient pressure to fill voids and joints solid.
- .4 Form surface of sealant smooth, free from ridges, wrinkles, sags, or air pockets and imbedded impurities. Neatly tool surface to a slight concave appearance.
- .5 Tool sealants to achieve air tight joints. Use wet tools as required.
- .6 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.
- .7 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
- .8 Seal perimeters of hollow metal door frames on both sides.
- .9 Seal control joints in gypsum board and stucco, and junctures between interior partitions with exterior walls.

- .10 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained, as indicated on drawings.
- .11 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.
- .12 Seal at all locations where dissimilar material meet.
- .13 Curing
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.

3.8 CLEAN UP

- .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.
- .4 On porous surfaces allow sealant to cure overnight, and remove excess by light wire brushing.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 Section includes requirements for commercial doors and detention doors.

1.2 RELATED SECTIONS

- .1 Section 04 22 00 – Concrete Unit Masonry
- .2 Section 07 21 19 – Foamed-In-Place Insulation
- .3 Section 07 92 00 – Sealants
- .4 Section 08 11 10 – Detention Metal Doors and Frames
- .5 Section 08 14 16 – Flush Wood Doors
- .6 Section 08 71 00 – Door Hardware
- .7 Section 08 80 50 – Glazing
- .8 Section 09 91 99 – Painting for Minor Works
- .9 Section 13 49 00 – Radiation Protection

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-13, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A780/A780M-09, Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.
 - .3 ASTM A879/A879M-12, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 - .4 ASTM A924 / A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - .5 ASTM C578-14, Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - .6 ASTM C591-13, Specification for Un-Faced Pre-formed Rigid Cellular Polyisocyanurate Thermal Insulation
 - .7 ASTM C1289-14, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - .8 ASTM D1622-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - .9 ASTM D4726-09, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.
 - .10 ASTM D6386-10, Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

- .11 ASTM D7396-08, Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting.
- .12 ASTM F1450-12a, Standard Test Methods for Hollow Metal Swing Door Assemblies for Detention and Correctional Facilities.
- .13 ASTM F1577-05(2012), Standard Test Methods for Detention Locks for Swinging Doors.
- .14 ASTM F1592-12, Standard Test Methods for Detention Hollow Metal Vision Systems.
- .15 ASTM F1758-05(2012), Standard Test Methods for Detention Hinges Used on Detention-Grade Swinging Doors.
- .16 ASTM F1915-05(2012) Standard Test Methods for Glazing for Detention Facilities.
- .2 Builders Hardware Manufacturers Association (BHMA)
 - .1 BHMA A156.16-2013, Auxiliary Hardware.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN4-S106-M80(R1985), Standard Method for Fire Tests of Window and Glass Block Assemblies
 - .2 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
 - .3 CSA W47.1-09, Certification of companies for fusion welding of steel, Includes Update No. 3 (2011), Update No. 5 (2012), Update No. 6 (2013).
 - .4 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Guide Specification for Installation and Storage of Hollow Metal Doors and Frames, 2012.
 - .2 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
 - .3 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition.
 - .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2012 Edition.
- .6 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-11, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 The Society for Protective Coatings (SSPC)
 - .1 SSPC-PS 12.01, One Coat Zinc-Rich Painting System.
 - .2 SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems.
- .8 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

- .2 CAN/ULC S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.
- .3 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .4 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer’s printed product literature, specifications and data sheets for each type of door and frame specified.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate general construction of each type of door and frame, configurations, material, material thickness, jointing methods, mortises, reinforcements, anchors, arrangement of hardware, fire ratings, finish and special features.
 - .2 Reference door and frame types to Door Schedule. Indicate door numbers where applicable.

1.5 QUALITY ASSURANCE

- .1 Manufacturer/Fabricator: member in good standing of the Canadian Steel Door and Frame Manufacturer’s Association.
- .2 Installer: Use installers who are experienced with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.
- .3 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:
 - .1 List by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
 - .2 Fabricate all rated doors, frames and screens to labelling authority standard.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions Common Product Requirements and as follows:
 - .1 Receive and store materials as recommended by materials manufacturer.
 - .2 Adequately protect surfaces from damage during moving, handling and storage.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Perform work in accordance with CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, except as otherwise specified herein.
- .2 Steel fire rated doors and frames: Label and list fire rated doors and frames by an organization accredited by the Standards Council of Canada in conformance with CAN4-S104 and CAN4-S105 for ratings indicated on Drawings. Fire labels must be factory applied by the manufacturer.
- .3 Be responsible for securing approval from authorities having jurisdiction for materials, fabrication and installation of fire rated oversized door and frame assemblies

2.2 MATERIALS

- .1 Steel:
 - .1 Doors and Frames: Metallic coated steel sheets in accordance with ASTM A924/M924; coated to meet requirements of ASTM A653/A653M. Commercial Steel (CS), Type B, ZF120 galvanized; stretcher levelled standard of flatness where used for face sheets.
- .2 Nominal Base Metal Thickness Requirements:
 - .1 Frames: refer to frame fabrication requirements specified in this section.
 - .2 Doors: refer to door fabrication requirements specified in this section.
 - .3 Hardware Reinforcement for Doors and Frames: Carbon steel, welded in place, prime painted, to the following minimum nominal thicknesses:

Hardware Reinforcement	Door (mm)	Frame (mm)
Mortise Hinge:	3.51	3.51
Mortise or Bored Lock or Deadbolt:	1.98	1.98
Flush or Surface Bolt Front:	1.98	1.98
Surface or Concealed Closer:	2.74	2.74
Strike Reinforcements:	1.98	1.98
Hold Open Arm:	1.98	1.98
Electronic Hardware Reinforcements:	1.98	1.98
Pull Plates and Bars:	1.30	1.30
Mortar Box:	--	0.84
Surface Exit Devices:	1.98	1.98
Door Surface Hardware Reinforcements:	1.30	1.30
Frame surface hardware reinforcements:	2.74	2.74
Notes: Provide guard boxes to protect mortised cut-outs from spray applied insulation, fully sealed.		

- .3 Door Core Materials
 - .1 Honeycomb: Structural small cell 25 mm maximum. kraft paper honeycomb:
 - .1 Weight: 36.3 kg/ream minimum.
 - .2 Density: 16.5 kg/m³ minimum.
 - .3 Sanded to required thickness.
 - .2 Polystyrene: Rigid extruded, closed cell insulation, fire retardant treated meeting the requirements of ULC S701, Type 4, minimum thermal resistance RSI 0.8/25 mm thickness.
 - .3 Polyisocyanurate: Rigid, modified polyisocyanurate, closed cell board, Type 1, conforming to CAN/ULC-S704:
 - .1 Density: 32 kg/m³.
 - .2 Thermal Values: RSI 2.0.

2.3 ADHESIVES

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

2.4 PRIMER

- .1 Touch-up primer: to ASTM A780/A780M and SSPC-PS 12.01.
 - .1 Maximum VOC limit 50 g/L to GC-03.

2.5 PAINT

- .1 Prepare surfaces for field painting to ASTM D6386 and ASTM D7396.
- .2 Field paint steel doors and frames in accordance with Section 09 91 99 – Painting for Minor Works. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
 - .1 Maximum VOC emission level 50 g/L to GS-11 and to SCAQMD Rule 1113.

2.6 ACCESSORIES

- .1 Door silencers (bumpers): Black neoprene, to ANSI/BHMA A156.16 Type 6-180; three silencers on strike jambs of single door frames; two silencers on heads of double door frames; screw fastener applied. Stick on bumpers are not acceptable.
- .2 Floor anchors: 3.5 mm minimum adjustable floor clip angles with 2 holes for anchorage to floor.
- .3 Exterior top caps: steel.

- .4 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .5 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
 - .2 Design glazing stops to be tamperproof.
- .6 Metallic paste filler: to manufacturer's standard.
- .7 Fasteners: tamperproof type 304 stainless steel screws with countersunk flat head.
- .8 Labels for fire doors and door frame: brass plate, riveted to door and door frame.
- .9 Sealant: Section 07 92 00 – Joint Sealants.
 - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .10 Glazing: Section 08 80 50 – Glazing.

2.7 FABRICATION GENERAL

- .1 Welded construction: assemble units by welding in accordance with CSA W59 to produce a finished unit square, true and free of distortion. Welding shall be undertaken only by a fabricator fully approved by the Canadian Welding Bureau to the requirements of CSA W47.1.
- .2 Permit access by an approved inspection and testing company for the purpose of inspecting at random, doors being fabricated for this project.
- .3 Make provisions in doors and frames to suit requirements of trade or section providing electrically operated hardware or security devices. Provide removable plates or knock outs for electrical contacts. Provide junction boxes on security door frames as required for door strikes, mag locks and door contacts. Ensure frames arrive on site prepared for wiring.
- .4 Fabricate galvanized steel channels to reinforce frames and screens as required for size, and for fire protection rating requirements. Extend reinforcements from floor to structure above. Design top connection to accommodate structural deflection. Conceal reinforcements in frames and screens.

2.8 FRAMES AND SCREENS FABRICATION: GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Accurately form frames to profiles indicated. Construct frames straight and free from twist or warp.
- .3 Interior frames: 1.6 mm minimum for single doors; 1.98 mm for frames with opening width in excess of 1220 mm; welded type construction. 50 mm face standard frame profile, throat and frame width to suit wall construction.
- .4 Blank, drill, reinforce and tap frames to receive mortised, templated hardware, security and electrical devices, using templates provided by finish hardware

- supplier. Reinforce frames for installation of closers. Install stiffener plates or two angle spreaders where required to prevent bending of frame and to maintain alignment when setting. Weld reinforcement in place.
- .5 Provide removable portion of stop and frame where required for overhead concealed door closers, properly connected to frame, and prepare for attachment of closer prior to shipment.
 - .6 Protect mortised cutouts with steel guard boxes.
 - .7 Provide three resilient bumpers per single door at the strike jamb. Provide two resilient bumpers per door leaf at the head of double doors.
 - .8 Manufacturer's nameplates on frames and screens are not permitted.
 - .9 Conceal fastenings except where exposed fastenings are indicated.
 - .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
 - .11 Partition Screens:
 - .1 Fabricate metal screens to profiles indicated.
 - .2 Supply jamb and mullion extensions and anchors required to secure screens to structure or framing provided under other Sections. Fabricate anchorage to prevent transfer of load from support framing to the screens when deflection of structure occurs.
 - .3 Provide concealed reinforcement for screens to receive handrails.
 - .4 Provide closely fitted steel glass stops where required. Mitre corners. Drill and countersink fasteners symmetrically at 150 mm o.c. Screw stops in place.
 - .12 Provide fire labelled frames for those openings requiring fire protection ratings, as scheduled on Drawings.

2.9 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Where frames terminate at finished floor, supply floor plates for anchorage to slab. Check depth of extension of finished floor to structural slab and provide jamb extension anchorage as required. Provide 50 mm minimum adjustment
- .3 Locate wall anchors immediately above or below each hinge reinforcement on the hinge jamb, and directly opposite on the strike jamb. Provide three anchors per jamb for frames up to 2300 mm. Add one anchor per jamb for each additional 760 mm or fraction thereof in frame height.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.10 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Cut frame mitres accurately and weld on inside of frame profile. Fill frame corners, exposed surface depressions and butted joints with air drying paste filler. Sand to a smooth uniform finish. Touch up damaged galvanized finish with zinc rich primer.

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

2.11 DOOR FABRICATION GENERAL

- .1 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; 45 mm thickness of types and sizes indicated on drawing, and as follows:
 - .1 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .2 Form edges true and straight with minimum radius suitable for thickness of steel used.
 - .3 Bevel lock and hinge edges 3 mm in 50 mm; confirm requirement with builder's hardware or door swing that could dictate a different bevel.
 - .4 Top and bottom of doors shall be provided with inverted, recessed, nominal 1.60 mm steel end channels, welded to each face sheet at 150 mm O/C.
 - .5 Provide fire labelled doors for those openings requiring fire protection ratings as indicated on Drawings.
 - .6 Fabricate doors with the following clearances:
 - .1 Clearance between door and frame and between meeting edges of doors swinging in pairs shall not exceed 3 mm
 - .2 Clearance between the bottom of door and floor shall not exceed 19 mm or as required to accommodate specified hardware
 - .3 Clearance between bottom of door and a raised non-combustible sill in accordance with NFPA 80
 - .4 Clearance between bottom of door and nominal surface of combustible floor coverings in accordance with NFPA 80
- .2 Fabricate doors with longitudinal edges locked seam and spot welded. Seams: not visible, grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish. Bevel both stiles of single doors 1 in 16.
- .3 Interior Doors: Flush, lock seam construction, hollow steel doors fabricated in accordance with CSDMA Manufacturing Specifications for Doors and Frames, and as follows:
 - .1 Face sheets: Minimum 1.30 mm base steel sheet thickness.
 - .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.
- .4 Radiation Protection Doors:
 - .1 Refer to Section 13 49 00 – Radiation Protection
- .5 Detention Doors and Frames:

- .1 Refer to Section 08 11 10 - Detention Metal Doors and Frames

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify condition and dimensions of previously installed work upon which this Section depends. Report defects to Departmental Representative. Commencement of work means acceptance of existing conditions

3.3 INSTALLATION GENERAL

- .1 Install fire rated doors and frames in accordance with requirements of NFPA 80.
- .2 Install doors, frames and accessories in accordance with reviewed shop drawings, ANSI A250.11, CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames, manufacturer's data, and as specified in this Section.

3.4 FRAME INSTALLATION

- .1 Door Frames:
 - .1 Remove temporary spreaders before installing door frames, leaving exposed surfaces smooth and undamaged.
 - .2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm out of plumb measured on face of frame, maximum twist corner to corner of 3 mm; align horizontal lines in final assembly.
 - .3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 1200 mm and wider in accordance with ANSI A250.1; do not use temporary metal spreaders for bracing of frames 1.
 - .4 Place frames before construction of enclosing walls and ceilings , except for frames located in existing walls or partitions allowing for deflection of adjacent construction to ensure that structural loads are not transmitted to frames, and as follows:
 - .1 Check and correct opening width and height, squareness, alignment, twist and plumb as frames are installed in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.
 - .2 Metal Stud Partitions: Provide a minimum of three wall anchors per jamb for frames up to 2150 mm high and 1 additional anchor for each 600 mm over 2150 mm high; install adjacent to hinge

- location on hinge jamb and at corresponding heights on strike jamb; attach wall anchors to studs with screws.
- .3 Remove wooden braces after frames are securely fastened or attached to adjacent construction.
- .5 Install glazing materials and studded door silencers.
- .6 Do not site weld unless approved by Departmental Representative in writing for the specific screen.
- .7 For frames over 1220 mm in width, provide vertical support at the centre of head.
- .2 Window Frames:
 - .1 Installation of borrowed lights is same as for door frames.
 - .2 Site assemble large borrowed lights to provide true and even alignment with flush butt hairline jointing, all fasteners concealed.
 - .3 Site weld only when approved by Consultant in writing for the specific location.
 - .4 Align all horizontal rails in final assembly.
 - .5 Install sealant and back-up materials
- .3 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:
 - .1 Squareness: Maximum 1.6 mm measured across opening between hinge jam and strike jamb.
 - .2 Plumbness: Maximum 1.6 mm measured from bottom of frame to head level.
 - .3 Alignment: Maximum 1.6 mm measured offset between face of hinge jamb and strike jamb relative to wall construction.
 - .4 Twist: Maximum 1.6 mm measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.
- .4 Install door silencers.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

3.5 DOOR INSTALLATION

- .1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.
- .2 Install hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .3 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, non-combustible sill and thresholds: 6 mm; 13 mm at openings in non-fire rated separations where undercuts are indicated.
- .4 Adjust operable parts for correct clearances and function.

3.6 FINISH REPAIRS

- .1 Touch-up areas where galvanized coating has been removed or damaged with primer.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.7 GLAZING

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

3.8 ADJUSTING AND CLEANING

- .1 Adjust doors for smooth and balanced door movement.
- .2 Clean doors and frames.

3.9 FIELD PAINTING

- .1 Prepare surfaces for field painting, to ASTM D6386 and ASTM D7396.
- .2 Field painting: refer to Section 09 91 99 Painting for Minor Works. Protect weatherstrips from paint. Provide final finish, free of scratches or other blemishes.

END OF SECTION

Part 1 General

1.1 DOCUMENTS

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

1.2 COORDINATION

- .1 It is required that a single Detention Equipment Contractor (DEC) be responsible for the supply only of all Detention Doors and Frames and related components as specified here in. The Detention Equipment Contractor (DEC), must submit a combined bid for Section 08 11 10 Detention Metal Doors and Frames, and for the supply and installation of Section 08 71 10 Detention Hardware.

1.3 SECTION INCLUDES

- .1 Detention metal doors and frames as scheduled.

1.4 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry
- .2 Section 07 21 19 – Foamed-In-Place Insulation
- .3 Section 07 92 00 – Sealants
- .4 Section 08 11 00 –Metal Doors and Frames
- .5 Section 08 71 10 - Detention Hardware
- .6 Section 08 80 50 - Glazing
- .7 Section 09 91 99 – Painting for Minor Works

1.5 REFERENCES

- .1 ANSI/NAAMM 863-14 Guide Specifications for Detention Security Hollow Metal Doors and Frames, Fifth Edition.
- .2 ASTM F 1450 Detention Door and Frame Assembly Test Methodology including Impact, Static Load, Rack and Door Edge Crush Tests.
- .3 ASTM F 159-05 Standard Test Methods for Detention Hollow Metal Vision Systems.
- .4 ASTM A627 Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities
- .5 ASTM A653-97M-03 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .6 ASTM A924-M04 Standard Specification for General Requirements for Sheet Steel,
- .7 Metallic- Coated by the Hot-Dip Process.

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- .8 CAN/CSA-G40.21-04 Structural Quality Steel.
 - .9 CAN4-S104-M80 Fire Tests of Door Assemblies.
 - .10 CAN/ULC-S702-97 Type 1,
 - .11 CSA W59-03 Welded Steel Construction (Metal Arc Welding).
 - .12 ISO 9001:1994 Quality Systems – Model for Quality Assurance.
 - .13 NFPA-80, 1999 Fire Doors and Windows.
 - .14 10-ULC List of Equipment and Materials, Volume 2.
 - .15 11-WH Certification Listings.

1.6 PERFORMANCE REQUIREMENTS

- .1 Products covered by this specification shall be tested by an independent, nationally recognized agency in accordance with ASTM F 1450 and ASTM F 1592 test methodology with strict conformance to ANSI/NAAMM 863---14, Section 1.05. Products shall meet each of the following NAAMM 863-14 performance criteria:
 - .1 Static Load Test - Under 14,000 lb (62,272N) load, maximum mid-span deflection shall not exceed 0.58" (14.7mm) and after release of load, deformation shall not exceed 0.10" (2.5mm).
 - .2 Rack Test - Under 7,500 lb (33,360N) corner load, maximum deflection shall not exceed 3.5" (88.9mm) and there shall be no buckling or failure of welds.
 - .3 Impact Load Test - After 600 impacts of 200 ft-lbs (271.2J) each on the door face, within 6" (150mm) of the lock bolt and 150 impacts within 6" (150mm) of each hinge, the door shall remain closed and locked, the assembly shall not be damaged to the extent that forcible egress can be obtained, the door shall be capable of being unlocked with the key and the door shall be operated to provide egress.
 - .4 Removable Glazing Stop Test - After 600 impacts of 200 ft-lbs (271.2J) each, the removable glass stops and steel plate shall remain firmly in place so that removal of the plate cannot be accomplished without removing the glazing screws and there shall be no more than one (1) broken glazing screw in the assembly.
- .2 Fire labelled product shall be provided for those openings requiring fire protection ratings, as scheduled. Products shall be tested in strict conformance with CAN4-S104, listed by Underwriters Laboratories of Canada or Warnock Hersey under an active Factory Inspection Program and shall be constructed as detailed in Follow-Up Service Procedures issued to the manufacturer.
- .3 Should any door or frame scheduled to be fire rated, not qualify for labeling due to design, hardware, glazing or any other reason, the Departmental Representative shall be so advised before manufacturing commences.

1.7 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Install fire labeled detention security steel door and frame product in accordance with NFPA-80, current edition, unless specified otherwise.

1.8 SUBMITTALS

- .1 Submit test reports from an independent ULC testing agency certifying that door and frame assemblies meet the performance criteria of ANSI/NAAMM 863-14, Section 1.05. Test reports shall indicate the test laboratory, location of the test facility and include a complete description of the test procedures and results.
- .2 Submit test reports from an independent testing agency certifying that security inserts meet the cutting performance criteria of ASTM 627 - 03. Test reports shall indicate the test laboratory, location of the test facility and include a complete description of the test procedures and results.
- .3 Submit shop drawings and samples in accordance with Section 01 33 00.
- .4 Submit sample of doors showing corner detail, stiffeners, insulation, reinforcement for hardware and glazing details.
- .5 Submit a sample of door frame showing corner detail, reinforcements and cut outs for hardware.
- .6 Submit shop drawings indicating each door and frame in elevation complete with fabrication and installation details showing material types and thicknesses, reinforcement, anchors, hardware preparation, glazing preparation, access covers and doors, weld types and spacing, security fasteners and all special features. Reference doors and frames to door schedules and hardware groupings. Indicate provision for electrical service routing within door frames.
- .7 Submit documentation for incorporation into maintenance manuals specified under Section 01 78 00. Documentation to include full identification of hardware including part numbers, manufacturer and source of supply; recommended spare parts lists that Departmental Representative should stock for maintenance purposes; complete operational, adjustment, maintenance and repair procedures; name and address of subcontractor installing work.
- .8 Submit record drawings in accordance with Section 01 78 00. Include all controls and wiring diagrams. Record deviations from original design and shop drawings.

1.9 QUALITY ASSURANCE

- .1 Product shall be manufactured by a firm experienced in the design and production of detention security steel door and frame assemblies, the integration of security or electronic hardware and glazing materials and their impact on the scope of work.
- .2 Manufacturer shall be assessed and registered as meeting the requirements of Quality Systems under ISO 9001.
- .3 Product quality shall meet standards set by the National Association of Architectural Metal Manufacturers (NAAMM) and the Canadian Steel Door and Frame Manufacturer's Association, CSDFMA.
- .4 All work specified under this section shall be executed by a Subcontractor who will be held responsible for the supply and installation of all work specified under this section including the installation of Detention Hardware specified under Section 08 71 10 and coordination of all other work specified under Related Sections as required for the completion of the work. The cost of any change in lock supplier

involving changes in size of doors and frames is the responsibility of this section of the work.

- .5 Door and frame fabricator's and installers to have successfully completed a minimum of (3) previous installations similar to this project. Provide qualification documentation to the Departmental Representative when requested.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Store doors and frames in an upright position, protected from the elements and raised above the ground in a manner to prevent corrosion damage.
- .2 Damaged, sprung or twisted doors or frames, or doors with interior cores or frames telegraphing through will be rejected. Doors which exhibit rust or surface irregularities will be rejected. Rejected doors shall be replaced at no additional cost to the contract.
- .3 Remove wraps or covers from door and frame product upon delivery at building site.
- .4 All materials shall be thoroughly inspected upon receipt and all discrepancies, deficiencies and/or damages shall be immediately reported in writing to the supplier. All damages shall be noted on the carriers' Bill of Lading.
- .5 Contractor responsible for installation shall ensure all materials are properly stored on planks or dunnage in a dry location. Product shall be stored in a vertical position, spaced with blocking to permit air circulation between them. Materials shall be covered to protect them from damage from any cause.
- .6 Contractor shall notify the supplier in writing of any errors or deficiencies in the product before initiating and corrective work.

1.11 WARRANTY

- .1 Warrant in writing, doors and frames against failure of welds, fasteners and anchors for a period of three (3) years from the date of Substantial Performance of the Work.

Part 2 Products

2.1 MATERIALS

- .1 Steel: Detention security doors and frames and bar-less detention windows shall be fabricated from tension leveled steel to ASTM A924, galvanized to ASTM A653, Commercial Steel (CS), coating designation ZF120, known commercially as paintable Galvanneal.
- .2 Security Screws: In accordance with Section 01 01 50.
- .3 Insulation: 24 kg/m³, density glass fibre to CAN/ULC-S702 Type 1, full thickness of door for nonrated doors; for rated doors, use core approved by labelling authority.
- .4 Adhesive: Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive ULC/WH approved.

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- .5 Mutes: Glyn-Johnson G164 or approved substitution.
 - .6 Formed Components: Commercial grade sheet steel to ASTM A568.
 - .7 Structural steel and Steel Perforated Panels: Structural quality steel to CAN3-G40.21.
 - .8 Zinc-rich Primer: To CGSB 1-GP-181M.
 - .9 Iron Oxide Primer: To CGSB 1-GP-140M.
 - .10 Isolation Coating: Alkali resistant bituminous paint.
 - .11 Filler Compound: Plastic automotive body type.

2.2 DOOR CONSTRUCTION

- .1 General:
 - .1 Doors shall be flush swing, of the types and sizes indicated on the schedules or drawings.
 - .2 Doors shall be 50.8 mm thick.
 - .3 Exterior doors shall be fabricated from 2.0 mm thick steel, exclusive of coating.
 - .4 Interior doors shall be fabricated from 2.0 mm thick steel, exclusive of coating.
 - .5 Door faces shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .6 Formed edges shall be true and straight with a minimum radius for the thickness of steel used.
 - .7 Lock and hinge edges shall be bevelled 3mm in 50 mm unless security or builders' hardware dictate otherwise.
 - .8 Lock and hinge edges shall be continuously reinforced with 2.7 mm vertical formed steel stiffener, welded to the interior of both face sheets at 100 mm on center maximum.
 - .9 Door shall be internally reinforced with 2.7 mm continuous vertical top hat steel stiffeners spaced with interior webs no more than 100 mm apart, welded to each face sheet at 150 mm on center maximum. Top hat stiffeners shall be secured together with ULC approved adhesive, welded at top and bottom and continuously each side, b300 mm from each end.
 - .10 Voids between stiffeners shall be filled with 24kg/m³ density, loose batt type fiberglass material.
 - .11 Top and bottom of doors shall be reinforced with 2.7 mm continuous, inverted, steel end channels, welded to each face sheet at 75 mm on center maximum and continuously welded to lock and hinge edge vertical formed steel stiffeners.
 - .12 Provide fire labelled door product for those openings requiring fire protection ratings as scheduled.

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- .2 Hardware Preparations:
- .1 Doors shall be factory blanked, reinforced, drilled and tapped for fully templated mortised hardware only, in accordance with the final approved schedule and templates provided by the hardware supplier.
 - .2 Doors shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
 - .3 Doors shall be factory reinforced only for surface mounted hardware.
 - .4 Templated holes 12.7 mm diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by the contractor responsible for installation, on site at the time of application. Templated holes less than 12.7 mm diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
 - .5 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully templated shall be by the contractor responsible for installation, on site at the time of application.
 - .6 Hardware reinforcement gage or thickness shall be in accordance with the hardware manufacturers' templates but shall not be less than 3.5 mm for hinges or pivots, locking devices, concealed closers or holders, nor less than 2.7 mm for surface applied devices.
 - .7 Doors shall be prepared for 114.3 mm heavy weight 4.6mm hinges minimum.
 - .8 All pairs of fire labeled doors shall be provided with 2.7 mm steel surface mounted flat bar astragal, shipped loose for application on site by the Subcontractor responsible for installation.
 - .9 Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and inter-connected with CSA approved 12.7 mm diameter conduit and connectors.
- .3 Conduit
- .1 Conduit within door frame from lock box to junction box and to door position indicator switch box shall be supplied and installed by this Section. All other conduit by others.
 - .1 Access plates or covers, the same thickness as the frame to which they are connected, fastened with a minimum of four (4) #8-32 tamper resistant machine screws at 150 mm on center maximum. shall be provided where specified on the schedules or details or the final approved schedule or templates provided by the hardware supplier.
- .4 Glazing:
- .1 Where indicated on the schedules or details, doors shall be prepared for glazing materials of the specified types, sizes and thickness.
 - .2 Glazed openings shall be reinforced with 4 mm formed "Z" stiffeners welded to each face sheet at 125 mm on center maximum and in each corner. "Z"

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- stiffeners shall form an integral, permanent glazing stop with a minimum height of 19 mm for non-security glazing, 25 mm minimum height for security glazing. Integral stop shall be located on the secure side of the door, as designated by the Departmental Representative.
- .3 Where security glazing materials are specified, removable 4 mm formed steel "Z" angle or "L" Angle stops shall be provided and per the drawings. Corners shall be fully welded forming a one (1) piece frame. Frame shall be secured with ¼ - 20 button head, tamper resistant machine screws at 150 mm on center maximum, two (2) per stop minimum. Minimum stop engagement height shall provide a minimum of 25 mm of security glazing engagement allowing for expansion gap.
 - .4 Where non-security glazing materials are specified, removable 1.9 mm steel channel stops shall be provided. Corners shall be tightly fitted, with butted corners. Stops shall be secured with #8-32 counter-sunk, tamper resistant machine screws at 230 mm on center maximum, two (2) per stop minimum. Minimum stop height shall be 19 mm.
 - .5 Finishing:
 - .1 Remove weld slag and spatter from exposed surfaces.
 - .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces.
 - .3 On exposed surfaces where zinc has been removed during fabrication, doors shall receive a factory applied touch-up primer.
 - .4 Primer shall be fully cured prior to shipment.

2.3 DETENTION DOOR FRAME CONSTRUCTION

- .1 General:
 - .1 All detention security steel frame product shall be of the types, sizes and profiles indicated on the schedules or details.
 - .2 Frame product shall be fabricated from 2.7 mm steel or greater thickness as specified on drawings, exclusive of coating.
 - .3 Jambs, heads, mullions, sills and center rails shall be straight and uniform throughout their lengths.
 - .4 Frame product shall be assembled square, free of defects, warps or buckles.
 - .5 Corner joint faces shall be accurately mitered and tightly fitted with integral stops mitered or butted, continuously welded on the inside of the profile.
 - .6 Joints at mullions, sills or center rails shall be coped accurately, butted at corners and tightly fitted, with faces and soffits fully welded.
 - .7 Exposed faces shall be filled and sanded to present a smooth, uniform surface.
 - .8 Frame product shall be fabricated with integral stops having a minimum height of 19 mm.

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- .9 Insulation of open sections of exterior wall door frame (jambs, heads and sills) shall be provided and installed by the Subcontractor responsible for the building envelope.
 - .10 Where required due to site access, as indicated on the schedules or details, when advised by the Subcontractor responsible for co-ordination or installation, or when shipping limitations so dictate, frame product shall be fabricated in sections for splicing in the field.
 - .11 Field spliced jambs, heads and sills shall be provided with 2.7 mm steel splice plates securely welded into one section, extending 100 mm minimum each side of splice joint.
 - .12 Field splices at closed sections (mullions or center rails) shall be 2.7 mm steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100 mm minimum into closed sections when assembled.
 - .13 Field splice joints shall be fully welded, filled and ground to present a smooth uniform surface after assembly by the Subcontractor responsible for installation.
 - .14 Each frame shall be reinforced with a ASTM A627 Grade 1 Tool Resistant Steel member, profile to be selected by frame contractor, at frame head, jambs, and sills where they occur, welded to the inside of the profile at 300 mm on center maximum, lapping at corners.
 - .15 Each door opening shall be provided with two (2) temporary steel jamb spreaders welded to the base of the jambs or mullions to maintain proper alignment during shipping and handling. Spreaders shall be removed by the contractor responsible for installation prior to anchoring of frame product to floor.
 - .16 Each door opening shall be prepared for GJ-64 or equivalent, single stud door silencers, three (3) for single door openings, two (2) for double door openings. Silencers shall be shipped loose for installation by the Subcontractor.
 - .17 Provide fire labelled frame product for those openings requiring fire protection ratings as scheduled.
- .2 Hardware Preparations:
- .1 Frame product shall be blanked, reinforced, drilled and tapped for fully templated mortised hardware only, in accordance with the final approved schedule and templates provided by the hardware supplier.
 - .2 Frame product shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
 - .3 Frame product shall be reinforced only for surface mounted hardware.
 - .4 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully templated shall be by the contractor responsible for installation, on site at the time of application.
 - .5 Hardware reinforcement gage or thickness shall be in accordance with the hardware manufacturers' templates, but shall not be less than 3.5 mm for

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- hinges, pivots, strikes, locking devices, concealed closers and holders, nor less than 2.7 mm for surface applied devices.
- .6 Mortised cut outs shall be protected with 0.80 mm steel minimum guard boxes where frame product is installed in masonry or concrete openings.
 - .7 Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and inter-connected with CSA approved 12.7 mm diameter conduit and connectors.
 - .8 Access plates or covers of 2.7 mm steel, fastened with a minimum of four (4) #8-32 tamper resistant machine screws at 150 mm on center shall be provided where specified on the schedules or details or the templates provided by the hardware supplier.
- .3 Anchorage:
- .1 Frame product shall be provided with anchorage appropriate to floor, wall and frame construction and as shown on the drawings.
 - .2 Frame product set in new unit masonry shall be welded to the horizontal wall reinforcing at 600 mm on center at the jambs, minimum of three per jamb and to the vertical wall reinforcement at 400 mm on center at the head, minimum of two per opening.
 - .3 Install frame products prior to construction of the adjacent wall, each jamb shall be provided with 2.7 mm steel floor anchors. Each anchor shall be provided with two (2) holes for mounting to the floor and shall be securely welded to the inside of the jamb profile.
 - .4 Jambs of frames in previously placed masonry shall be securely welded to hook shaped 15M horizontal reinforcement at 600 mm on center, minimum of three per jamb, welded to the inside of the frame profile, to be cast into new grout at new jamb blocks and existing cut masonry blocks.
 - .5 Head of frames in previously placed masonry shall be securely welded to hook shaped 15M vertical reinforcement at 400 mm on center, minimum of two per head, welded to the inside of the frame profile, to be cast into grout at new header masonry blocks.
 - .6 Head, jambs and sill of frames in new cast-in-place concrete walls shall be welded to vertical and horizontal wall reinforcement extended into frame at 400 mm on center minimum, a minimum of two per side.
- .4 Finishing:
- .1 Remove weld slag and spatter from exposed surfaces.
 - .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth uniform surfaces.
 - .3 On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up only.
 - .4 Primer shall be fully cured prior to shipment.

2.4 BAR-LESS DETENTION WINDOW FRAME CONSTRUCTION

- .1 General:
 - .1 All detention security steel frame product shall be of the types, sizes and profiles indicated on the schedules or details.
 - .2 Frames shall meet the performance requirements of ASTM F1592-05, Grade 3.
 - .3 Frame product shall be fabricated from 2.7 mm steel or greater thickness as specified on drawings, exclusive of coating.
 - .1 Include the following but not limited to:
 - .1 Security Office Frames
 - .2 Dispensary Frames
 - .4 Jambs, heads, mullions, sills and center rails shall be straight and uniform throughout their lengths.
 - .5 Frame product shall be assembled square, free of defects, warps or buckles.
 - .6 Corner joint faces shall be accurately mitered and tightly fitted with integral stops mitered or butted, continuously welded on the inside of the profile.
 - .7 Joints at mullions, sills or center rails shall be coped accurately, butted at corners and tightly fitted, with faces and soffits fully welded.
 - .8 Exposed faces shall be filled and sanded to present a smooth, uniform surface.
 - .9 Frame product shall be fabricated with integral stops as indicated on drawings, providing 25mm minimum engagement with the security glazing, allowing for expansion gap.
 - .10 Where required due to site access, as indicated on the schedules or details, when advised by the Subcontractor responsible for co-ordination or installation, or when shipping limitations so dictate, frame product shall be fabricated in sections for splicing in the field.
 - .11 Field spliced jambs, heads and sills shall be provided with 2.7 mm steel splice plates securely welded into one section, extending 100 mm minimum each side of splice joint.
 - .12 Field splices at closed sections (mullions or center rails) shall be 2.7 mm steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100 mm minimum into closed sections when assembled.
 - .13 Field splice joints shall be fully welded, filled and ground to present a smooth uniform surface after assembly by the Subcontractor responsible for installation.
 - .14 Each frame shall be reinforced with a ASTM A627 Grade 1 Tool Resistant Steel member, profile to be selected by frame contractor, at frame head, jamb, sill and mullions, welded to the inside of the profile at 300 mm on center maximum, lapping at corners.

- .2 Anchorage:
 - .1 Frame product shall be provided with anchorage appropriate to sill, wall and frame construction and as shown on the drawings.
 - .2 Frame product set in new unit masonry shall be welded to the horizontal wall reinforcing at 600 mm on center minimum at the jambs, minimum of two per jamb and to the vertical wall reinforcement at 400 mm on center minimum at the head, minimum of two per opening.
 - .3 Install frame product simultaneously with adjacent masonry wall construction.
- .3 Glazed Openings:
 - .1 Where indicated on schedules or details, frame product shall be prepared for glazing materials of the types, sizes and thickness specified.
 - .2 Glazed openings shall be provided with continuous 2.7 mm steel reinforcing welded to the inside of the profile at 300 mm on center maximum.
 - .3 Where security glazing materials are specified, removable 4 mm formed steel "L" stops shall be provided. Corners shall be fully welded forming a one (1) piece frame. Frame shall be secured with 9.6mm min. tamper resistant machine screws at 200 mm on center maximum, two (2) per stop minimum. Minimum stop height shall provide 25 mm engagement with security glazing, allowing for expansion gap.
 - .4 Provision shall be made to protect glazing screws and tapped reinforcements where frame members are grouted.
- .4 Finishing:
 - .1 Remove weld slag and spatter from exposed surfaces.
 - .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth uniform surfaces.
 - .3 On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up only.
 - .4 Primer shall be fully cured prior to shipment.

2.5 SIZES AND TOLERANCES

- .1 Widths of door openings shall be measured from inside of frame jamb rebates with a tolerance of +1.6 mm, - 0.8 mm.
- .2 Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rebate of the frame with a tolerance of ± 1.2 mm.
- .3 Unless hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3.0 mm clearance at jambs and head. A clearance of 19 mm between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be ± 1.2 mm.

- .4 Manufacturing tolerances on formed frame profiles shall be ± 0.8 mm for faces, stop heights and jamb depths. Tolerances for throat openings and door rebates shall be ± 1.6 mm and ± 0.4 mm respectively. Hardware cutout dimensions shall be as per template dimensions, + 0.4 mm.

2.6 HARDWARE LOCATIONS

- .1 Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified.
- .2 Top of upper hinge preparation for 114.3 mm hinges shall be located 180 mm down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3 mm hinges shall be located 310 mm from finished floor. Intermediate hinge preparations shall be spaced equally between top and bottom cut outs.
- .3 Strike preparation for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033 mm from finished floor. Strikes for deadlocks shall be centered at 1220 mm from finished floor. Strikes for panic and fire exit hardware shall be located as per the device manufacturers' templates.
- .4 Push and/or pulls on doors shall be centered 1070 mm from finished floor.
- .5 Preparations not noted above shall be as per hardware manufacturers' templates.
- .6 Hardware preparation tolerances shall comply with the ANSI A115 Series standards.

2.7 GLAZING

- .1 In accordance with Section 08 80 50.

Part 3 Execution

3.1 INSTALLATION

- .1 Set frame product plumb, square, aligned, without twist at correct elevation.
- .2 Frame Product Installation Tolerances:
- .1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be ± 1.6 mm.
- .2 Squareness tolerance, measured through a line from one jamb at the upper corner of the product, to the opposite jamb, shall be ± 1.6 mm.
- .3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be ± 1.6 mm.
- .4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be ± 1.6 mm.
- .3 Fire labeled product shall be installed in accordance with NFPA-80.
- .4 Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install wood spreaders at mid-point of frame rebate height to maintain frame widths.

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- .5 Provide vertical support at center of head for openings exceeding 1250 mm in width.
 - .6 Remove wood spreaders after product has been built-in.
 - .7 Secure anchorages and connections to adjacent construction.
 - .8 Frame product in unit masonry shall be fully grouted in place.
 - .9 Install doors, maintaining specified clearances.
 - .10 Adjust operable parts for correct clearances and function.
 - .11 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
 - .12 Any grout or other bonding material shall be cleaned from products immediately following installation.
 - .13 Prior to site touch-up, exposed surfaces of galvanneal steel to be finish painted with latex paints shall be cleaned with soap and water to remove foreign matter. When alkyd finish paints are specified, turpentine or paint thinners shall be used. Refer to paint manufacturers recommendations for additional information.
 - .14 Exposed field welds shall be finished to present a smooth uniform surface and shall be touched-up with a rust inhibitive primer.
 - .15 Exposed surfaces which have been scratched or otherwise marred during installation or handling shall touched-up with a rust inhibitive primer.
 - .16 Finish paint in accordance with Section 09 90 00.
 - .17 Install glazing materials and door silencers.

3.2 INSTALLATION OF HARDWARE

- .1 Install hardware in accordance with manufacturer's instructions.
- .2 Coordinate hardware installation with painting section and remove prefinished removable items if required for painting.
- .3 Adjust all parts for proper and smooth operation.

3.2 FIELD QUALITY CONTROL

- .1 The Detention Equipment Contractor (DEC) must perform at least two preliminary site inspections during the construction process to ensure detention frames are being installed according to plans and specifications and comply with NAAMM and ASTM requirements. Provide preliminary site inspection reports outlining frame installation quality and notify Departmental Representative of any and all discrepancies and concerns.
- .4 The DEC's commissioning verification will be required for the installation of the doors, frames, hardware and associated detention equipment for each scheduled door.
- .5 The DEC shall cooperate with the resident field inspector and Departmental Representative allowing access to the work for proper reviews, inspections and verifications.

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- .6 The scope of mandatory Pre-commissioning and Documentation shall be as follows:
- .1 On delivery, check the following:
 - .1 conformance to shop drawings;
 - .2 gauge of steel, warpage, welding and cutouts;
 - .3 Material (submit applicable lab tests);
 - .4 construction of doors (sample door for testing as required);
 - .5 rough-in for associated hardware/detention equipment; and
 - .6 size and location of reinforcements and anchors.
 - .2 When frames are built-in, check the following:
 - .1 alignment;
 - .2 dimensions of openings before and after grouting.
 - .3 After door has been installed, check the following:
 - .1 alignment;
 - .2 tolerances;
 - .3 rough-in, templates and alignment of all detention equipment.
 - .4 After hardware/detention equipment has been installed, check the following:
 - .1 functionality;
 - .2 cylinder/lock assembly;
 - .3 peripherals (DPIs, etc.)
 - .5 Submit three (3) copies of the Pre-commissioning results to the Departmental Representative upon completion of tests and prior to Final Commissioning and substantial performance.

3.3

DEMONSTRATION

- .1 .1 Demonstrate, guide and instruct the Departmental Representative on operation and maintenance of doors and door frames together with locking devices, indicators and over-ride features.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 92 00 – Sealants
- .5 Section 08 50 00 – Aluminum Windows
- .6 Section 08 71 00 – Door Hardware
- .7 Section 08 80 50 – Glazing

1.2 REFERENCES

- .1 Aluminum Association (AA)
 - .1 DAF 45-03, Designation System for Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA 501-15, Methods of Test for Exterior Walls.
 - .2 AAMA 609-15, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
 - .3 AAMA 611-14, Voluntary Specification for Anodized Architectural Aluminum.
 - .4 AAMA 1503-09, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - .5 AAMA AFPA—1-15, Anodic Finishes/Painted Aluminum.
 - .6 AAMA CW-RS-1-12, The Rain Screen Principle and Pressure Equalized Wall Design.
 - .7 AAMA RPC-00, Rain Penetration Control: Applying Current Knowledge.
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 - .2 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .3 ASTM B221/B221M-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .4 ASTM B429/B429M-10e1, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - .5 ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.
 - .6 ASTM E330-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

- .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
- .5 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA W47.1-09, Certification of Companies for fusion Welding of Steel, Includes Update No. 3 (2011), Update No. 5 (2012), Update No.6 (2013).
 - .4 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum, Includes Update No.1 (2011), Update No.2 (2012).
 - .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014).
 - .6 CSA W59.2-M1991 (R2013), Welded Aluminum Construction.
- .6 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International)
 - .1 Surface Preparation Guidelines:
 - .1 SSPC-SP COM Surface Preparation Commentary for Steel and Concrete Substrates.
 - .2 SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems.
- .7 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S702-09AM1, Standard for Thermal Insulation Mineral Fibre for Buildings, Includes Amendment 1 (January 2012).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada. Indicate VOC's for caulking materials during application and curing.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:

- .1 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:
 - .1 Interior trim and exterior junctions with adjacent construction.
 - .2 Junctions between combination units.
 - .3 Elevations of units.
 - .4 Core thicknesses of components.
 - .5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
 - .6 Location of caulking.
 - .7 Each type of door system including location.
 - .8 Arrangement of hardware and required clearances.
- .2 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .4 Manufacturers' Field Reports: Submit two copies of manufacturers field reports.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.

1.6 QUALITY ASSURANCE

- .1 Qualifications: Fabricator shall have minimum of 5 years successful experience in fabrication and erection of metal entrances of similar sizes, shapes and finishes to units required for this project and shall have ample facilities to produce, furnish and supply units as required for installation without delay to Work.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Protection:
 - .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
 - .2 Leave protective covering in place until final cleaning of building.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

1.9 WARRANTY

- .1 Provide manufacturers written guarantee, signed and issued in name of Departmental Representative, to replace following items for defective material and workmanship for time stated from date of Substantial Performance:
 - .1 Framing, panels and glazing: failure of performance requirements; 2 years.
 - .2 Sealed glass units (misting, dusting and seal failure): in accordance with Section 08 80 50.
 - .3 Sealants, caulking: failure to maintain seal; 2 years.
 - .4 Aluminum brakeshapes: oil canning and delaminating; 2 years.
 - .5 Finishes: failure specified finishes not attributable to normal weathering: 20 years.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design Criteria.
 - .1 Design frames and doors in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of -35 to +35 degrees C.
 - .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330 under wind load of 1.2 kpa. Submit certificate of tests performed.
 - .3 Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E283 at a pressure differential of 6.24 psf (300 Pa) for single doors and 1.567 psf (75 PA) for pairs of doors. A single 915 mm x 2134 mm entrance door and frame shall not exceed 0.50 cfm per square foot. A pair of 1830 mm x 2134 mm entrance doors and frame shall not exceed 1.0 cfm per square foot.
 - .2 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.
 - .3 Provide continuous air barrier and vapour retarder through door system. Primarily in line with inside pane of glass and heel bead of glazing compound.

2.2 MATERIALS

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T5, T6, or T54 anodizing quality.
- .2 Sheet aluminum: Alloy 1100, F temper, 3 mm minimum thickness exposed sheet finished to match frames as specified.
- .3 Steel reinforcement: to CAN/CSA-G40.20/G40.21, grade 300 W, shop painted with zinc chromate primer, thickness as required to support imposed loads and in no case less than 4.8 mm thick.

- .4 Fasteners: to ASTM A167, stainless steel, type 304 or cadmium plated steel, finished to match adjacent material and selected to prevent galvanic action with fastened materials of suitable size to sustain imposed loads.
- .5 Door bumpers: black neoprene, entrance manufacturer's standard.
- .6 Door bottom seal: adjustable door seal of extruded aluminum frame and vinyl weather seal, recessed in door bottom.
- .7 Isolation coating: bituminous paint, acid and alkali resistant asphaltic paint in accordance with MPI Architectural Painting Specification Manual approved product listing.
- .8 Glazing materials: refer to Section 08 80 50.
- .9 Glass Gaskets: As specified under Section 08 80 50.
- .10 Spacers for glazing, backpans/aluminum spandrels to be full length, purpose made, aluminum channels.
- .11 Sealant: Including primer, joint filler, as specified in Section 07 92 00.
- .12 Thermal separator: Polyvinylchloride, 50 Shore A durometer hardness +5.

2.3 ALUMINUM FRAMES

- .1 Exterior Aluminum Door and Sidelight Frames: to match window frames specified in Section 08 50 00 – Aluminum Windows
- .2 Interior Aluminum Frames: nominal 51 mm sightline x 152 mm deep, non-thermal, center glazed, screw spline, punched opening fabrication.

2.4 ALUMINUM SWING DOORS

- .1 Aluminum doors fabricated of rigid extruded rectangular aluminum tube cut and welded together and with internal reinforcing at corners. Some manufacturer's may have to modify their standard system to meet the minimum bottom rail size noted for standard door construction.
- .2 Doors: 45 mm thickness, wide stile, with profiles as indicated on Drawings, standard interlock, meeting and 127 mm jamb stiles with sealed unit safety glass for exterior doors, door sizes as scheduled on Drawings.

2.5 HARDWARE MATERIALS

- .1 Door hardware in accordance with Section 08 71 00.
- .2 Panic Exit Devices: In accordance with BHMA A156.3, Grade 1, listed and labelled by a testing and inspecting agency acceptable to Authorities Having Jurisdiction for panic protection, type and function as listed in Section 08 71 00.
- .3 Weather Stripping: Manufacturer's standard replaceable components, and as follows:
 - .1 Compression Type: Moulded neoprene meeting ASTM D2000 or moulded PVC meeting ASTM D 2287.
 - .2 Sliding Type: Wool, polypropylene, or nylon woven pile with nylon fabric or aluminum-strip backing meeting AAMA 701.

- .4 Weather Sweeps: Manufacturer's standard exterior door bottom sweep with concealed fasteners on mounting strip.
- .5 Provide all hardware of each type from one manufacturer.
- .6 Keying as indicated in Section 08 71 00.

2.6 ALUMINUM FINISHES

- .1 Clear Anodized: Exposed aluminum surfaces shall be Aluminum Association (AA) Architectural Class I, AA-M12C22A41 for exterior applications and Architectural Class II, AA-M12C22A31 for interior applications.
- .2 Unexposed aluminum: Mill finish.

2.7 STEEL FINISHES

- .1 Finish steel clips and reinforcing steel with zinc coating to CSA G164.

2.8 ALUMINUM BRAKESHAPES

- .1 Shop laminate sheet aluminum to treated plywood backing over rigid insulation to profiles and sizes as indicated; Conceal plywood backing with aluminum.
- .2 Brake aluminum to profiles prior to painting and/or anodizing (except clear anodized anodic oxide finish).
- .3 Finish: To match window exterior exposed aluminum.

2.9 FABRICATION GENERAL

- .1 Doors and framing to be by same manufacturer.
- .2 Fit and assemble all Work in the shop insofar as practical
- .3 Reinforce members and joints with steel plates, bars, rods or angles for rigidity and strength as needed to fulfill performance requirements. Use concealed stainless steel fasteners for jointing which cannot be welded.
- .4 Fit joints tightly and secure mechanically.
- .5 Provide cut-outs and integral reinforcing as required to receive hardware.
- .6 Separate unlike metals or alloys with a heavy coating of bituminous paint, separator gaskets or slip gaskets as required to prevent galvanic action.
- .7 Provide weepholes in glazing recess and an airseal at interior glassline.
- .8 Glazing to be held by pressure plate system with snap-on covers.
- .9 Glass fabrication specified under Section 08 80 50.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSPECTION

- .1 Inspect Work and conditions affecting the Work of this Section. Proceed only after deficiencies, if any, have been corrected.
- .2 Construct flashings built-in or provided by others integrate with system to divert moisture to exterior.
- .3 Verify that reglets, anchor blocks or inserts required to receive system are correctly located and installed.
- .4 Verify that anchors and setting or installing components provided by this Section to others for installation are properly located and installed.
- .5 Verify that building air and vapour retarding membranes can be sealed to entrance units to maintain building envelope system integrity.

3.3 PREPARATION

- .1 Obtain all dimensions from the job site.
- .2 Provide data, dimensions and components, anchors and assemblies to be installed by others in proper time for installation.

3.4 INSTALLATION

- .1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.
- .2 Conceal all anchors and fitments. Exposed heads of fasteners not permitted. All joints in exposed work to be flush hairline butt joints.
- .3 Use anchors that will permit sufficient adjustment for accurate alignment. Make allowance for deflection of building structure.
- .4 Build in and provide any supplementary reinforcing and bracing required by assembly loads and deflections.
- .5 Secure Work adequately to structure in a manner not restricting thermal and wind movement.
- .6 Correctly locate and install flashings, deflectors and weep holes and verify proper drainage of moisture to exterior.
- .7 Maintain alignment with adjacent Work.
- .8 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coatings of bituminous paint.
- .9 Verify all stops, gaskets, splines, seals, etc. are perfectly aligned and ready to receive glazing and insulated panels as specified herein.
- .10 Install glazing to details and instruction, using material specified.
- .11 When a full mullion is used at perimeter framing, glazing, pocket may be stabilized for pressure plate with a block of rigid insulation.
- .12 Glazing stops, snap covers and pressure plates shall be of a continuous length from corner to corner, and be fitted at corners.

- .13 All preformed tapes or gaskets shall be of a continuous length corner to corner and shall be cut over length to prevent stretching. Joints, splices and corners shall be mitred and sealed.
- .14 Clean all contact surfaces of glazing with solvent and wipe dry. Verify all glazing channels are clean, true to line, and free of dirt or debris and that weep and drainage vents are open.
- .15 Rest glazing on setting blocks at 1/4 points.
- .16 Seal full perimeter of door lights to provide and maintain the designed air/vapour/thermal barrier integrity and weather tightness.
- .17 Pack fibrous insulation or foamed-in-place insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .18 Hang doors using hardware scheduled. Adjust as required for proper operation.
- .19 Install weatherstrip to provide positive contact.
- .20 Install sealants and back-up materials in strict accordance with manufacturer's written instruction.
- .21 Make cut-outs for hardware ie: card readers and push buttons.

3.5 CLEANING

- .1 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
- .2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .4 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.
- .5 Clean glass and glazing materials with approved non-abrasive cleaner.
- .6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 08 11 00 – Metal Doors and Frames
- .2 Section 08 71 00 - Door Hardware
- .3 Section 08 80 50 - Glazing
- .4 Section 09 91 99 – Painting for Minor Works

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A208.1-2009, Particleboard.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
 - .1 AWMAC/AWI Architectural Woodwork Standards, 2nd Edition, 2014.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 11.3-M87, Hardboard
- .4 Canadian Hardwood Plywood and Veneer Association (CHPVA)
 - .1 CHPA Official Grading Rules for Rotary Cut Face Veneers.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.
- .6 Environmental Choice Program (ECP)
 - .1 CCD-045-92, Sealants and Caulking Compounds.
 - .2 CCD-046-92, Adhesives.
- .7 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2010.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's:
 - .1 For caulking materials during application and curing.
 - .2 For door materials and adhesives.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Show construction and materials used in cores, size and species of edge strip, thickness and species of cross-banding, and thickness and species of face veneer.
 - .2 Show details of openings and mouldings for glazing.

- .3 Indicate locations, sizes and types of all doors to be supplied, reference to the Door and Hardware Schedule.
 - .4 Indicate elevation of each kind of door, details of construction, location and extent of hardware blocking, requirements for factory finishing and other pertinent data.
 - .5 Include finishing specifications for doors to receive factory-applied finish.
 - .6 Include certifications as might be required to show compliance with specifications.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit one 300 x 300 mm corner sample of each type wood door.
 - .2 Show door construction, core, glazing detail and faces.

1.4 QUALITY ASSURANCE

- .1 Fabricate doors in accordance with the AWMAC/AWI Architectural Woodwork Standards, Section 9 - Doors, Premium grade.
- .2 Manufacturer Qualification: Manufacturer specializing in products in this section who have a minimum of five years of documented experience and are a member in good standing of the Architectural Woodwork Manufacturers Association of Canada (AWMAC).
- .3 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .4 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver doors and panels to minimize storage on site and when site conditions conform to requirements for storage.
- .2 Storage and Protection:
 - .1 Store and handle doors and panels in accordance with AWMAC requirements, and as follows:
 - .1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
 - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
 - .3 Protect doors from scratches, handling marks and other damage.
 - .4 Store doors away from direct sunlight.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.7 WARRANTY

- .1 Provide warranty issued in the name of the Departmental Representative stating that doors are warranted against defects in materials and workmanship for the life of the original installation.
- .2 Warranty to include coverage for reasonable amount to remove, replace, refinish, and re-hang doors that do not meet accepted AWMAC tolerances.

Part 2 Products

2.1 SOLID CORE DOORS

- .1 Flush wood doors: solid core to AWMAC Standard.
- .2 Dry lumber to an average moisture content of between 6 and 12% maximum at time of manufacture.
- .3 Construction:
 - .1 Solid particleboard core having minimum density of 449 kg/m³ in accordance with ANSI A208.1 and as follows:
 - .1 Stiles and Rails: Structural Composite Lumber (SCL) bonded to core to AWMAC Manual standards and as follows:
 - .1 Side Stiles: SCL with 16 mm hardwood edge, to match face veneers; no finger jointed materials permitted.
 - .2 Top and Bottom Rails: SCL with 16 mm soft wood cap.
 - .2 Reinforcement: with wood lock blocks.
 - .3 Construction: 5-ply
 - .4 Use: interior.
 - .2 Door cores to be fully bonded and abrasive planed or sanded prior to laminating faces to core materials.
 - .3 Door Thickness: 45 mm overall.
- .4 Face Panels:
 - .1 Decorative Wood Veneer: AWMAC quality grade and hardwood species, supplied from same source, clear and bright in colour with minimum of pin knots, mineral or sugar streaks, no open defects, heartwood, or wild grain, and minimal colour variation between flitches, meeting the requirements for Hardwood Plywood Veneer Association (HPVA) quality grade and hardwood species as indicated.
 - .1 Grade: Premium, with Grade A faces
 - .2 Species: to be selected.
 - .3 Cut and Match Between Veneer Leaves: to be selected.
 - .4 Finish: Factory finished as indicated below for transparent finishes.
 - .5 Minimum Thickness: 0.50 mm.
 - .6 Paired doors to have matching veneer pattern for uniform appearance.
- .5 Adhesive: Type I (waterproof)

- .6 Metal Door Frames: Refer to Section 08 11 00 – Metal Doors and Frames.

2.2 ACCESSORIES

- .1 Glass: Clear tempered safety glass as specified under Section 08 80 50.
- .2 Glazing Stops: Solid hardwood with mitred corners, to match veneers.

2.3 FABRICATION

- .1 Fabricate doors in accordance with AWS section 9.
- .2 Vertical edge strips to match face veneer.
- .3 Prepare doors for glazing where required. Provide wood species to match face panel, glazing stops with mitred corners.
- .4 Doors shall be pre-fitted, bevelled and machined at the factory for all mortise hardware items as per templates and approved hardware schedules provided.
- .5 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
- .6 Radius vertical edges of double acting doors to 60 mm radius.

2.4 FINISHES

- .1 Factory finish doors in accordance with AWS Section 5 – Finishing, System 9 UV-Curable, Acrylated Epoxy, Polyester or Urethane as a minimum.
- .2 Paint in accordance with Section 09 91 99 – Painting for Minor Works.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Unwrap and protect doors in accordance with AWMAC.
- .2 Install doors and hardware in accordance with manufacturer's printed instructions and AWMAC.
- .3 Adjust hardware for correct function.
- .4 Install glazing in accordance with Section 08 80 50 - Glazing.
- .5 Install stops.
- .6 Secure transom and side panels by means of stops, concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

3.3 ADJUSTMENT

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

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for supply and installation of the following types of manually operated overhead coiling doors:

- .1 Counter doors

1.2 RELATED SECTIONS

- .1 Section 04 22 00 - Concrete Unit Masonry
.2 Section 05 50 00 - Metal Fabrications
.3 Section 07 92 00 - Sealants
.4 Section 08 71 00 - Door Hardware
.5 Section 09 21 16 - Gypsum Board Assemblies
.6 Section 09 91 99 – Painting for Minor Works

1.3 REFERENCES

- .1 Aluminum Association (AA).
.1 AA DAF 45, Designation System for Aluminum Finishes.
.2 American Architectural Manufacturers Association (AAMA).
.1 AAMA 609.1-93, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
.3 American Society for Testing and Materials International, (ASTM).
.1 ASTM A36/A36M-12, Standard Specification for Carbon Structural Steel.
.2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.3 ASTM A653/A653M-13, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.4 ASTM B209/B209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
.5 ASTM B221/B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
.6 ASTM A924/A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Consultant, Departmental Representative, installer, manufacturer's representative to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.

- .4 Review manufacturer's installation instructions and warranty requirements.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
 - .2 Submit summary of forces and loads on walls and jamb
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit duplicate 300 mm long pieces of coiling curtain, slats, guides.
- .3 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Indicate each type of grille, arrangement of hardware, operating mechanism and required clearances.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for overhead coiling doors, and hardware for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.
 - .1 Include name and contact information of original installer.
 - .2 Submit manufacturer's brochures and parts list describing actual materials used for installed system.

1.7 QUALITY ASSURANCE

- .1 Qualifications: Provide proof of qualifications when requested by Departmental Representative:
 - .1 Manufacturer: Obtain products listed in this Section from listed manufacturers and that have local distribution and servicing facilities.
 - .2 Installers: Use installers that have completed manufacturer's authorized training program and that are certified to install and maintain units delivered for this Project.
 - .3 Source Limitations: Obtain products through one source from a single manufacturer; obtain electrical operators and controls from overhead coiling door manufacturer supplying products to this project.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

1.9 WARRANTY

- .1 Provide a manufacturer's 2 year warranty against defects in workmanship and materials.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and other loads and stresses without evidencing permanent deformation of door components.
- .2 Operation Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles.

2.2 COUNTER DOORS

- .1 Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices with slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - .1 Aluminum Door Curtain Slats: ASTM B209M or ASTM B221M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated:
 - .1 Aluminum Extrusion Thickness: 1.2 mm.
 - .2 Flat profile slats: nominal 40 mm high x 10 mm deep.
 - .2 End Locks: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
 - .3 Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, aluminum extrusions to suit type of curtain slats with continuous lift handle and vinyl astragal.
 - .4 Curtain Jamb Guides:
 - .1 Fabricate curtain jamb guides of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading.
 - .2 Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent over travel of curtain.
 - .5 Integral Frame, Hood, and Fascia:
 - .1 Fabricate from minimum 1.5 mm thick, hot dip galvanized steel sheet with Z275 zinc coating, in accordance with ASTM A653M.

- .2 Contour to fit end brackets; roll and reinforce top and bottom edges for stiffness.
- .3 Provide closed ends for surface mounted hoods; provide intermediate support brackets to prevent sagging.
- .4 Hood Material: Fabricate hoods for aluminum doors, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; 0.80 mm minimum thickness, in accordance with ASTM B209M.

2.3 ACCESSORIES

- .1 Locking: Concealed sliding bolt deadlock in bottom bar operated by cylinder lock.

2.4 COUNTER BALANCING MECHANISM

- .1 Counterbalance doors using adjustable tension, steel helical torsion spring mounted around steel shaft and contained in spring barrel connected to door curtain with barrel rings using manufacturer's standard grease sealed or self lubricating graphite bearings for rotating members.
- .2 Fabricate spring barrel from hot formed, structural quality, welded or seamless carbon steel pipe, of sufficient diameter and wall thickness to support rolled up curtain without distortion of slats and to limit barrel deflection to not more than 2.5 mm/m of span under full load.
- .3 Fabricate spring balance from one or more oil tempered, heat treated steel helical torsion springs; size springs to counterbalance weight of curtain with uniform adjustment accessible from outside barrel; include cast steel barrel plugs to secure ends of springs to barrel and shaft.
- .4 Fabricate torsion rod for counterbalance shaft of cold rolled steel, sized to hold fixed spring ends and carry torsion load.
- .5 Provide manufacturer's standard cast iron or cold rolled steel plate mounting brackets.

2.5 MANUAL DOOR OPERATORS

- .1 Crank Hoist Operator: Provide crank hoist operator consisting of crank and crank gearbox, steel crank drive shaft, and gear reduction unit; size gears to require no more than 150 N force to turn crank; fabricate gearbox to be oil tight and completely enclose operating mechanism; provide manufacturer's standard crank locking device; provide manufacturer's standard removable operating arm for each crank gear unit.

2.6 FINISHES

- .1 Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes for manufacturer's standard Class II, clear anodic finish.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Install doors in accordance with manufacturer's printed instructions.
- .2 Install coiling doors and operating equipment and required hardware, jamb and head moulding strips, anchors, inserts, hangers, and equipment supports in accordance with manufacturer's written instructions and as specified.
- .3 Adjust door operating components to ensure smooth opening and closing of doors.

3.3 CLOSEOUT ACTIVITIES

- .1 Adjusting: Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion.
- .2 Demonstration: Engage a factory authorized service representative to train Departmental Representative's maintenance personnel to test, adjust, operate, and maintain coiling grille.

3.4 CLEANING

- .1 Perform cleaning of aluminum components in accordance with: AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean with damp rag and approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .4 Remove traces of primer, caulking; clean doors and frames.
- .5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section includes manually operated ICU/CCU entrances.

1.2 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 07 92 00 – Sealants
- .3 Section 08 71 00 – Door Hardware
- .4 Section 08 80 50 – Glazing
- .5 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

- .1 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA 611-12, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 - .2 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .3 ASTM B221/B221M-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- .3 Glazing Association of North America (GANA)
 - .1 GANA Glazing Manual.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.
- .2 Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing ICU/CCU entrances.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for ICU/CCU entrances.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.

- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit samples for each type of exposed finish required, on materials of same thickness and material indicated for the Work indicating normal colour and texture variations, on 305 mm long section.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Qualification Data: submit proof of qualified installer as indicated below.
- .6 Warranties: submit sample of special warranties

1.6 QUALITY ASSURANCE

- .1 Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
- .2 Source Limitations: Obtain ICU/CCU entrances from single source from single manufacturer.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.8 SITE CONDITIONS

- .1 Field Measurements: Verify openings to receive ICU/CCU entrances assemblies by field measurements before fabrication and indicate measurements on shop drawings.
- .2 Established Dimensions: Establish dimensions and proceed with fabricating ICU/CCU entrances without site measurements where site measurements cannot be made without delaying the Work, coordinated with other construction to ensure that actual dimensions correspond to established dimensions.

1.9 WARRANTY

- .1 Warranty Period: One year from date of Substantial Completion.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 General: Provide manufacturer's standard ICU/CCU entrances including door leaves, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation.
- .2 Opening-Force Requirement, Sliding: Not more than 22.2 N to fully open door.
- .3 ICU/CCU Entrance:
 - .1 Configuration: Single-telescoping three-panel door, with breakaway capability for sliding leaves only.
 - .2 Mounting: Between jambs.

- .3 Floor Track Configuration: No track across sliding-door opening and at sidelites (trackles).
- .4 Finish aluminum framing, doors, and header as indicated below.

2.2 COMPONENTS

- .1 Framing Members: Manufacturer's standard extruded aluminum, minimum 3.2 mm thick and reinforced as required to support imposed loads.
 - .1 Nominal Size: 45 mm by 115 mm
 - .2 Extruded Glazing Stops and Applied Trim: Minimum 1.6 mm wall thickness.
- .2 Stile and Rail Doors: Manufacturer's standard 45 mm thick glazed doors with minimum 3.2 mm thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.
 - .1 Glazing Stops and Gaskets: Square extruded-aluminum stops and preformed gaskets for glazing indicated.
 - .2 Stile Design: Narrow stile; 54 mm
 - .3 Rail Design: 90 mm nominal height or as otherwise indicated on Drawings.
 - .4 Muntin Bars: Horizontal tubular rail member for each door; match stile design.
- .3 Sidelites: Manufacturer's standard 4 5mm deep sidelites with minimum 3.2 mm thick, extruded-aluminum tubular stile and rail members matching door design and finish.
 - .1 Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
 - .2 Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.
- .4 Glazing: in accordance with Section 08 80 50 – Glazing
- .5 Headers: Fabricated from minimum 3.2 mm thick extruded aluminum, and extending full width of ICU/CCU entrance units to conceal carrier assemblies and roller tracks. Provide hinged or removable access panels for service and adjustment. Secure panels to prevent unauthorized access.
- .6 Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly. Provide minimum of two ball-bearing roller wheels and two anti-rise rollers for each active leaf.
- .7 Concealed Bottom Rollers: Manufacturer's standard.

2.3 HARDWARE

- .1 General: Provide units in sizes and types recommended by ICU/CCU entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
- .2 Breakaway Hardware: Provide release hardware that allows indicated panels to swing out in direction of egress to full 90 degrees from sliding mode. Include positive latching and panel gasketing.
 - .1 Maximum Force to Open Panel: 44.5 N
 - .2 Release Position: Sliding door fully open
- .3 Limit Arm: Provide to control doors in the swing mode.
- .4 Pulls: Manufacturer's standard recessed units on both sides of each operable door.
- .5 Manual Flush Bolts: BHMA A156.16, Grade 1, edge mortised, lever-extension type; located at bottom of each swing-out sidelite.

2.4 FABRICATION

- .1 Framing: Provide ICU/CCU entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site.
 - .1 Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 - .2 Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - .3 Form profiles that are straight and free of defects or deformations.
 - .4 Provide components with concealed fasteners and anchor and connection devices.
 - .5 Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
 - .6 Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
- .2 Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- .3 Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA Glazing Manual.
- .4 Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation.

2.5 GENERAL FINISH REQUIREMENTS

- .1 Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.
- .2 Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

- .3 Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- .1 Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of ICU/CCU entrances.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
 - .1 Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - .2 Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- .2 Install ICU/CCU entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - .1 Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - .2 Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - .3 Level recesses for recessed floor tracks using shrinkage-resistant grout.
- .3 Glazing: Install 6 mm glazing as specified in Section 08 80 50 – Glazing.
- .4 Sealants: Comply with requirements in Section 07 92 00 - Sealants for installing sealants, fillers, and gaskets.
 - .1 Set framing members, floor tracks, and flashings in full sealant bed.
 - .2 Seal perimeter of framing members with sealant.
- .5 Grounding: Connect ICU/CCU-entrance, electrical grounding systems to building grounding system as specified in Division 26.

3.3 ADJUSTING

- .1 Adjust operating hardware and moving parts for smooth and safe operation; lubricate as recommended by manufacturer.
- .2 Adjust force to open swing panels.
- .3 Test grounding system for compliance with requirements of authorities having jurisdiction.

3.4 CLEANING AND PROTECTION

- .1 Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
- .2 Comply with requirements in Section 08 80 50 - Glazing for cleaning and protecting glass.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes conventionally glazed aluminum windows installed as stick built systems consisting of, but not limited to, the following:
 - .1 Fixed, clear, low emissivity (Low E) sealed glass units.
 - .2 Dry glazed from exterior with screw on pressure plates, keyed-in neoprene gasket and thermal break.
 - .3 Internal weep drainage and compartmentalization in accordance with established design principles for rain screen and pressure equalization in curtain wall systems.
 - .4 Snap-On covers.
 - .5 Sunshades
- .2 Drawings contain details that suggest directions for solving some of the major design requirements; these details can be developed further by the Contractor provided that the final installation adheres to aesthetic criteria established by the drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

1.2 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 07 21 13 – Board Insulation
- .4 Section 07 21 19 – Foam-in-Place Insulation
- .5 Section 07 26 00 – Vapour Retarders
- .6 Section 07 62 00 – Sheet Metal Flashing and Trim
- .7 Section 07 92 00 – Sealants
- .8 Section 08 11 16 – Aluminum Doors and Frames
- .9 Section 08 80 50 – Glazing
- .10 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

- .1 Aluminum Association (AA)
 - .1 Aluminum Design Manual, 2010 Edition.
 - .2 Welding Aluminum: Theory and Practice, 2002.
 - .3 Properties of Aluminum Alloys: Fatigue Data and the Effects of Temperature, Product Form, and Processing, 2008.
- .2 American Architectural Manufacturer's Association (AAMA)
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11 - NAFS - North American fenestration standard/Specification for windows, doors, and skylights
 - .2 AAMA 501-15, Methods of Test for Exterior Walls.

- .3 AAMA 611-14, Voluntary Standards for Anodized Architectural Aluminum.
- .4 AAMA 1503-09, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- .5 AAMA AFPA-1-15, Anodic Finishes/Painted Aluminum.
- .6 AAMA CW-RS-1-12, The Rain Screen Principle and Pressure Equalized Wall Design.
- .7 AAMA RPC-00, Rain Penetration Control: Applying Current Knowledge.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 - .2 ASTM A480/A480M-16a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
 - .3 ASTM B209/209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .4 ASTM B221/B221M-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .5 ASTM B429/B429M-10e1, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - .6 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.40-97, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB 12.1-M90, Tempered or Laminated Safety Glass.
 - .3 CAN/CGSB 12.3-M91, Flat, Clear Float Glass.
 - .4 CAN/CGSB 12.8-97, Insulating Glass Units.
 - .5 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .5 Canadian Standards Association (CSA) International
 - .1 CAN/CSA A440/A440.1-00 (R2005), Windows / User Selection Guide to CSA Standard A440-00, Windows. Includes Update No. 1 (2000), Update No. 2 (2006), Update No. 3 (2006).
 - .2 CAN/CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels, Includes Update No.1 (2014).
 - .3 CAN/CSA Z91-02 (R2013), Health and Safety Code for Suspended Equipment Operations.
- .6 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International)
 - .1 Surface Preparation Guidelines:
 - .1 SSPC-SP COM Surface Preparation Commentary for Steel and Concrete Substrates
 - .2 SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's for sealant materials.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit shop drawings signed and sealed by the Manufacturer's Engineer clearly indicating:
 - .1 Components, materials, finishes, and locations of anchorage.
 - .2 Section details showing all window perimeter conditions.
 - .3 Mullion details and frame corner connections.
 - .4 Sill flashing terminations, in isometric view, including coordination with wall cladding materials.
 - .5 Frame anchorage details.
 - .6 Details showing sealing techniques within and around perimeter of framing and operable sash.
 - .7 Connection to building sheet membrane air and vapour retarder.
 - .8 Required sizes and tolerance of openings.
- .3 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Window fabricator shall have a minimum of 5 years successful experience in the fabrication and erection of metal windows of similar sizes, shapes and finishes to the units required for this project and shall have ample facilities to produce, furnish and supply the units as required for installation without delay to the Work.
- .2 Retain a professional engineer registered in British Columbia experienced in structural design in glass and aluminum window units, connections to door units and connections to building, to ensure the adequacy of the structural aspects of the design, manufacture, and installation of complete assembly. This Engineer is called the "Manufacturer's Engineer" elsewhere in this Section.
- .3 Only fabricators approved by Manufacturer shall fabricate and install products of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle and store units in accordance with manufacturer's directions.
- .2 Store units at site on raised wood pallets protected from the elements and corrosive materials. Do not remove from crates or other protective covering until ready for installation.

- .3 Store all glass units vertically on end with solid bearing full thickness of insulating units.
- .4 Store pre-fabricated frame assemblies blocked off the ground to prevent warping, twisting, undo strain on assembly or physical abuse and damage.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 JOB CONDITIONS

- .1 Protect aluminum finishes and glazing during erection against disfiguration, contamination or damage by abuse of harmful materials. Install protective cover where exposure to damage is critical.
- .2 After glass is installed, mark each light with large cross or other symbol to make glass obvious and noticeable to other trades. Use substance which will not stain, mark or "Shadow" glass either by itself or by reaction with sunlight, moisture or the environment. Do not use masking tape.
- .3 Co-ordinate installation of windows with Work specified in other Sections to ensure proper placement and installation of vapour barrier, insulation and flashing in order that air/vapour/thermal barrier of building is intact and moisture will be diverted to the exterior.

1.9 WARRANTY

- .1 Provide manufacturers written guarantee, signed and issued to the Departmental Representative, to replace the following items for defective material and workmanship for the time stated from date of Substantial Performance:
 - .1 Framing, panels and glazing: failure of performance requirements specified in Contract Documents; 2 years.
 - .2 Sealed glass units: as indicated in Section 08 80 50.
 - .3 Sealants, caulking: failure to maintain seal; 2 years.
 - .4 Aluminum brake shapes: oil-canning and delaminations; 2 years.
- .2 Provide Warranty for aluminum windows to include in maintenance manuals as specified in Section 01 01 50 – General Instructions, Operations and Maintenance Data Manuals.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Performance Requirements: Provide assemblies able to withstand positive and negative pressures normal to the plane of window in accordance with Building Code climatic requirements based on 1 in 30 year criteria in accordance with CAN/CSA A440/A441.
- .2 Air Infiltration: tested in accordance with ASTM E283. Air infiltration rate shall not exceed 0.3 l/s · m² at a static air pressure differential 300 Pa.

- .3 Water Resistance, (static): tested in accordance with ASTM E331. There shall be no leakage at a static air pressure differential of 479 Pa as defined in AAMA 501.
- .4 Water Resistance, (dynamic): tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 479 Pa as defined in AAMA 501.
- .5 Structural performance shall be based on Aluminum Association "Specification for Aluminum Structures" or CSA Standard CAN3-S157. There shall be no deflection in excess of L/175 of the span of any framing member at design load.
- .6 Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than 0.40.
- .7 Condensation Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than Captured – 57 frame and 60 glass.
- .8 Provide aluminum framed window systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - .1 Thermal movements.
 - .2 Movements of supporting structure including, but not limited to, deflection from uniformly distributed and concentrated live loads.
 - .3 Dimensional tolerances of building frame and other adjacent construction.
- .9 Provide drainage from all spaces around insulating glass units, including each horizontal space created by setting blocks.
- .10 Provide baffles or other protection at drainage openings to prevent direct entrance of wind-driven rain.

2.2 MATERIALS

- .1 Aluminum: Aluminum Association (AA) alloy 6063-T5 or 6063-T6 for aluminum extrusions and AA 1100, anodizing quality, for aluminum sheet, minimum 3 mm thickness.
- .2 Fasteners: To ASTM A480, stainless steel, type 304 selected to prevent galvanic action with the components fastened, of suitable size to sustain imposed loads.
- .3 Gaskets: Neoprene or EPDM with dimensional tolerances and durometer hardness and of suitable size and shape to meet the requirements of the specifications and their specific application. Gaskets shall be virgin material and as follows:
 - .1 For EPDM - TDB-460-1
 - .2 For Neoprene - TDB-270-1
- .4 Supporting angles, plates, bars, rods, and other steel accessories: Mild steel CAN/CSA-G40.20/G40.21, shop painted with zinc chromate primer, thickness as required to sustain imposed loads and in no case less than 5 mm thick.
- .5 Sealant: Including primer, joint filler, as specified in Section 07 92 00.
- .6 Isolation coating: alkali resistant bituminous paint.
- .7 Thermal separator: Polyvinylchloride, 50 Shore A durometer hardness +5.
- .8 Glazing Tape: Refer to Section 08 80 50.

- .9 Metal air seal/vapour barrier (by window supplier) to be bonded to window frame and extend behind mounting frame. Seal all corners to maintain air seal vapour retarder. Install flexible flashing with continuous metal retaining strip to lap to interior wall assembly.

2.3 ALUMINUM FRAMES

- .1 Frame Type: To profiles indicated and as required to fulfill performance requirements, nominal thickness 2.5 mm, suitable alloy and proper temper for extruding and adequate structural characteristics; and suitable for finishing as specified:
 - .1 Construction: Thermally broken
 - .2 Glazing Throat: to suit double sealed unit.
 - .3 Back Frame Profile: Nominal 50 mm wide x depth as directed on Drawings.
 - .4 Cover Depth: Nominal 50 mm wide x depth as directed on Drawings.

2.4 INSULATED SPANDREL PANELS

- .1 Back Pan: Aluminum sheet in accordance with ASTM B209, 1.6 mm thickness, formed into a pan shape to fit into glazing throat with back of pan flush with inside face of back section.
- .2 Insulation: Rigid mineral fibre insulation held in place with manufacturer's standard fixing system to back face of back pan.
- .3 Aluminum Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8% of panel dimension in width or length, and as follows:
 - .1 Exterior Skin: Aluminum.
 - .1 Thickness: 1.6 mm minimum; confirm thickness with manufacturer.
 - .2 Finish: Matching framing system
 - .3 Texture: as directed by Departmental Representative
 - .4 Backing Sheet: as recommended by manufacturer.

2.5 SUN SHADES

- .1 Structural Performance:
 - .1 Combined load on sunshade configurations to be determined in accordance with ASCE 7 or applicable code requirements. Combined load consists of wind, snow and ice loads.
 - .2 Design sunshade configurations to withstand stresses due to combined load. Stresses resulting from thermal expansion/contraction, shall not cause permanent deformation of sunshade assemblies or disengagement from the glazed system.
 - .3 Test sunshade configurations to meet a minimum load of 3.11 kPa with a factor of safety of 2 times the design load for the horizontal blade and a factor of safety of 1.5 times the design load for the vertical blade.
 - .4 Blade deflection shall not exceed L/120 of span length.

- .2 Aluminum Extrusions: Alloy and temper recommended by curtain wall manufacturer for strength, corrosion resistance, and application of required finish; not less than 1.8 mm wall thickness at any location for the main frame and complying with ASTM B221: 6063-T6, 6105-T5, or 6061-T6 alloy and temper. Aluminum sheet alloy meeting requirements of ASTM B209.

- .1 Blade Style: single blade
- .2 Projection: nominal 355 mm
- .3 Angle: mounted as 0 degrees.

2.6 GLAZING AND ACCESSORIES

- .1 Double Glazed Insulating Glass Units: as specified in Section 08 80 50 – Glazing.

2.7 FABRICATION: FRAMES

- .1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
- .3 Face dimensions detailed are maximum permissible sizes.
- .4 Brace frames to maintain squareness and rigidity during shipment and installation.
- .5 Finish steel clips and reinforcement with 380 g/m² zinc coating to CAN/CSA-G164.

2.8 FABRICATION: SUNSHADES

- .1 Form or extrude aluminum shapes before finishing.
- .2 Fabricate components with the following characteristics when assembled:
 - .1 Profile: straight, and free of defects or deformations.
 - .2 Accurately fitted joints with ends coped or mitered.
 - .3 Accommodates for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - .4 Use concealed fasteners, anchors and connection devices.
- .3 Sunshade: Fabricate components for assembly following approved shop drawings.
- .4 Clearly mark components after fabrication to identify their location in Project.

2.9 ALUMINUM FINISHES

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Anodized: Exposed aluminum surfaces shall be Aluminum Association (AA) Architectural Class II, AA-M12C22A31, clear anodized.
- .2 Isolation Coating

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

2.10 AIR BARRIER AND VAPOUR RETARDER

- .1 Equip window frames with factory installed air and vapour retarder material for sealing to building air and vapour barrier as follows:
 - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
 - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air and vapour barrier from interior.

Part 3 Execution

3.1 INSPECTION

- .1 Inspect Work and conditions affecting the Work of this Section. Proceed only after deficiencies have been corrected.
- .2 Ensure that all flashings built-in or provided by others integrate with system to divert moisture to exterior.
- .3 Ensure that all anchor blocks or inserts required to receive system are correctly located and installed.
- .4 Ensure that all anchors and setting or installing components provided by this Section for installation are properly located and installed.
- .5 Ensure that building air and vapour retarding membranes can be sealed to window units to maintain system integrity. Coordinate with materials installation specified in Section 07 21 19 – Foam-In-Place Insulation and Section 07 26 00.

3.2 PREPARATION

- .1 Obtain all dimensions from the job site.
- .2 Provide data, dimensions and components, anchors and assemblies to be installed by others in proper time for installation.

3.3 INSTALLATION

- .1 Erect Work in strict accordance with manufacturer's written instructions.
- .2 Conceal all anchors and fitments. Exposed heads of fasteners not permitted. All joints in exposed work to be flush hairline butt joints.
- .3 Use anchors that will permit sufficient adjustment for accurate alignment. Make allowance for deflection of building structure.

- .4 Build in and provide any supplementary reinforcing and bracing required by assembly loads and deflections.
- .5 Secure Work adequately to structure in a manner not restricting thermal and wind movement.
- .6 Correctly locate and install flashings, deflectors and weep holes to ensure proper drainage of moisture to exterior.
- .7 Maintain alignment with adjacent Work.
- .8 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coatings of bituminous paint.
- .9 Fill shim spaces at perimeter of assembly to maintain continuity of thermal barrier with foam-in-place insulation and seal with materials specified in Section 07 92 00 – Sealants.

3.4 GLAZING INSTALLATION

- .1 Ensure all stops, gaskets, splines, seals etc., are aligned and ready to receive glazing and insulated panels as specified herein.
- .2 Install glazing to approved details and instruction, using material specified in accordance with manufacturer's instructions.
- .3 Glazing stops, snap covers shall be of a continuous length from corner to corner, and be fitted at corners.
- .4 All preformed tapes or gaskets shall be of a continuous length corner to corner and shall be cut over length to prevent stretching. Joints, splices and corners shall be mitred and sealed.
- .5 Clean all contact surfaces of glazing with solvent and wipe dry. Ensure all glazing channels are clean, true to line, and free of dirt or debris and that weep and drainage vents are open.
- .6 Rest glazing on setting blocks at 1/4 points.
- .7 Install shims at sides to align glass units.
- .8 Apply a full heel bead of non-drying non-skinning sealant to the interior perimeter of each glass unit to provide positive air/vapour seal to warm light of glass.

3.5 INSTALLATION: SUNSHADES

- .1 Install sunshades in accordance with manufacturer's instruction and reviewed shop drawings.
- .2 Install components plumb and true in alignment with established lines and grades.
- .3 Do not install damaged components.
- .4 Fit joints to produce hairline joints free of burrs and distortion.
- .5 Rigidly secure non-movement joints.
- .6 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

- .7 Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- .8 Seal joints watertight where shown on approved shop drawings and/or manufacturer's standard installation instructions.

3.6 SEALANTS

- .1 Caulk and seal full perimeter of windows to building air/vapour retarder to provide and maintain the designed air/vapour/thermal barrier integrity and weather tightness.
- .2 Install sealants and back-up materials in strict accordance with manufacturer's written instruction.

3.7 CLEANING

- .1 At completion and continuously as Work proceeds, remove all surplus materials, debris and scrap.
- .2 At completion of Work, remove all protective surface covering film and wrappings. Clean all glass, panels and frames using mild soap or other cleaning agent approved by manufacturer.
- .3 Remove all excess glazing or joint sealing materials from exposed surfaces. Clean and polish glass.

END OF SECTION

1.1 General

1.2 RELATED SECTIONS

- .1 Section 08 11 13 – Steel Doors and Frames.
- .2 Section 08 11 16 – Aluminum Doors and Frames
- .3 Section 08 14 16 – Flush Wood Doors.
- .4 Division 26: Electrical wiring for magnetic strikes, electric releases and electric locks.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI A117.1-2009, Standard for Accessible and Usable Buildings and Facilities.
 - .2 ANSI/BHMA A156, Series of Standards.
 - .3 ANSI/BHMA A156.10-2011, Power Operated Pedestrian Doors.
 - .4 ANSI/BHMA A156.1-2013, Butts and Hinges.
 - .5 ANSI/BHMA A156.12-2013, Interconnected Locks and Latches.
 - .6 ANSI/BHMA A156.13-2012, Mortise Locks and Latches, Series 1000.
 - .7 ANSI/BHMA A156.14-2013, Sliding and Folding Door Hardware.
 - .8 ANSI/BHMA A156.15-2011, Release Devices – Closer Holder, Electromagnetic and Electromechanical.
 - .9 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
 - .10 ANSI/BHMA A156.17-2010, Self Closing Hinges and Pivots.
 - .11 ANSI/BHMA A156.18-2012, Materials and Finishes.
 - .12 ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power Operated Doors.
 - .13 ANSI/BHMA A156.20-2012, Strap and Tee Hinges and Hasps.
 - .14 ANSI/BHMA A156.2-2011, Bored and Preassembled Locks and Latches.
 - .15 ANSI/BHMA A156.21-2009, American National Standard for Thresholds.
 - .16 ANSI/BHMA A156.26-2012, Continuous Hinges.
 - .17 ANSI/BHMA A156.3-2008, Exit Devices.
 - .18 ANSI/BHMA A156.4-2013, Door Controls – Closers.
 - .19 ANSI/BHMA A156.6-2010, Architectural Door Trim.
 - .20 ANSI/BHMA A156.8-2010, Door Controls – Overhead Stops and Holders.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA)
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .3 Builders Hardware Manufacturers Association (BHMA)
 - .1 Directory of Certified Products.
- .4 Door and Hardware Institute (DHI)

- .1 Sequence and Format for the Hardware Schedule.
- .2 ANSI/DHI A115.IG, Installation Guide for Doors and Hardware.

1.4 PRE-INSTALLATION MEETINGS

- .1 Pre-Installation Meetings: convene pre-installation meeting in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's warranty requirements.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .2 After approval samples will be returned for incorporation in the Work.
- .3 Hardware List:
 - .1 Submit contract hardware list in accordance with Section 08 71 10.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
 - .3 Coordinate Division 28 Security Contractor, Division 26 Electrical Contractor and Division 8 Door and Hardware Contractors to jointly prepare, submit, and obtain certified approval from the shop drawings for work related to door access control systems prior to undertaking the on-site work. The joint submission will clarify and assign responsibility between these Divisions for labour and materials associated with the supply and installation of electronic and physical components for doors and access control. An individual drawing shall be submitted in AutoCadd format for each door within the project scope depicting both public and secure side of door and arrangement of access control and security components, conduit, and cabling.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

- .5 Closeout Submittals
 - .1 Provide operation and maintenance data for door closers, locksets, door holders, electrified hardware, and fire exit hardware for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.

1.6 MAINTENANCE MATERIAL

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.
 - .2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
 - .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.
 - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .2 Storage and Protection:
 - .1 Store finishing hardware in locked, clean and dry area.

1.9 WASTE DISPOSAL AND MANAGEMENT

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

1.10 WARRANTY

- .1 Provide written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
- .2 Failures include, but are not limited to, the following:
 - .1 Structural failures including excessive deflection, cracking, or breakage.
 - .2 Faulty operation of operators and door hardware.

- .3 Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- .3 Warranty Period: From date of Substantial Performance, and as follows:

Hardware Type	Warranty Term
Locks, latches and cylinders	10 years
Cylinders	1 year
Hinges	Lifetime
Closers	25 year
Miscellaneous	1 year
Electrical Hardware:	1 year ¹

Part 2 Products

2.1 HARDWARE ITEMS

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

2.2 DOOR HARDWARE

- .1 As scheduled in Section 08 71 10.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.4 KEYING

- 1. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Departmental Representative's permanent keying system or furnished in the same keyway (or key section) as the Departmental Representative's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Departmental Representative. Provide Keys directly to SMO Officer per 01 14 10 Security Requirements, Paragraph 1.12.
- 2. Cylinders, removable and interchangeable core system, Locks and Keying System by one manufacturer only: Stanley Best Access 7-pin removable core system.
- 3. Transmit Grand Masterkeys, Masterkeys and other Security keys to Departmental Representative by Registered Mail, return receipt requested. Provide Keys directly to SMO Officer per 01 14 10 Security Requirements, Paragraph 1.12.

4. Furnish keys in the following quantities:
 - .1 1 each Grand Masterkeys
 - .2 4 each Masterkeys
 - .3 2 each Change keys each keyed core
 - .4 15 each Construction masterkeys
 - .5 1 each Control keys

- .5 The Departmental Representative, or the Departmental Representative's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

- .6 Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Departmental Representative and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

2.5 DOOR TRIM

- .1 All doors are to have solid tube 19mm Diameter, u-shaped lever handle trim, finish 626, that returns to within 12 mm of the face of the door, with 70mm diameter rose.

2.6 KICKPLATES

- .1 Kick plates shall be 1.27mm Type 304 satin stainless steel.
- .2 Kick plates shall be installed on push side of door only unless noted otherwise.

2.7 DOOR CONTACTS

- .1 Door contacts shall be provided in Division 28.

2.8 LOCK POWER SUPPLIES

- .1 Power supplies shall be provided in Division 28.

2.9 ELECTRONIC ACCESS CONTROL DEVICES

- .1 Electronic access control devices shall be provided in Division 28.

2.10 DOOR THRESHOLDS

- .1 Door thresholds shall be the full width of the door frame in a single piece.
- .2 Door thresholds height and transitions shall be compliant with accessible design as per threshold details on drawing A501.

2.11 MATERIALS AND FASTENERS

- .1 Furnish hardware with all necessary fasteners, mounting brackets and special tools required for the proper installation as recommended by the manufacturer.

Fastening devices shall be of the same material and finish as the item to which it is fastened.

- .2 All exposed fasteners shall be tamperproof security fasteners. Provide machine screws and anchors for all stops and toggle bolts and backing where required for wall stops.

2.12 WIRE, CABLE AND CONDUIT

- .1 Cabling for detention hardware shall be supplied and installed by others. All cable shall be PVC insulated multi-conductor stranded. All wiring for hardware and systems shall be installed in conduit or wire trays.
- .2 All serviceable devices such as locks shall have connections terminated with MOLEX type connectors provided by the lock manufacturer. All connections on the controls side of the lock pigtail shall be secure. Refer to Division 26 and Division 28 documents for specifications on wire connection details.
- .3 The BSCS contractor shall terminate cabling, within swing door frames, from field wiring to all Molex pigtail connectors provided by the hardware manufacturer. The BSCS contractor shall terminate controls end of all cabling for lock control output and monitoring status inputs in the BSCS Room.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 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 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .3 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.

3.3 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 DEMONSTRATION

- .1 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.
- .2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6 SCHEDULE

Hardware group No. 2: G146A – Lead lined door

- .1 1 Set Pivot CO7111 646.
- .2 1 Intermediate Pivot CO7311 626
- .3 1 Mortise Lock Grade 1 ANSI A156.13 F05 x Construction Core 626.
C/W Lead Lined Lock Case.
- .4 1 Permanent Core PREM. 626
- .5 1 Armorplate 304 .050 915 mm x 35 mm LDW x 3m tape 4BE 630.
- .6 1 Wall Stop L52251 630.
- .7 1 Smoke Seal ROE154 x Door Size BRN
- .8 1 Surface Mount Automatic Door Bottom Lead Lined R3Y336 x DW 628

Hardware group No. 3: G153

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F19 x Construction Core 626.
C/W Occupied/Vacant Indicator.
- .3 1 Heavy Duty Closer C02021 REG ARM TB 689.
- .4 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .5 1 Wall Stop L52251 630.
- .6 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 4: G158A

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F05 x Construction Core 626
- .3 1 Permanent Core PREM. 626
- .4 1 Heavy Duty Closer C02021 POSITIVE STOP ARM TB 689.
- .5 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .6 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 6: G162B

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F05 x Construction Core 626.
- .3 1 Permanent Core PREM. 626
- .4 1 Electric Strike E09321 x LBM 12/24 VDC 630.
- .5 1 Heavy Duty Closer C02021 POSITIVE STOP ARM TB 689.
- .6 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .7 1 Wall Stop L52251 630.
- .8 1 Smoke Seal ROE154 x Door Size BRN
- .9 1 Door Contact by Security.
- .10 1 Power Supply/Controller by Security.
- .11 1 Access Control by Security.

Note: 120VDC is required at the head of the door (confirm location) for power supply, 15A dedicated circuit. All conduit and back boxes with pull cords are to be provided by the electrical contractor.

Hardware group No. 7: G163, G164

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F07 x Construction Core 626.
- .3 1 Permanent Core PREM. 626 626
- .4 1 Heavy Duty Closer C02021 REG ARM TB 689.
- .5 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .6 1 Wall Stop L52251 630.
- .7 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 8: G165

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F07 x Construction Core 626.
- .3 1 Permanent Core PREM. 626 626
- .4 1 Heavy Duty Closer C02021 REG ARM TB 689.
- .5 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .6 1 Wall Stop L52251 630.
- .7 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 9: G170A

- .1 1 Heavy Duty Continuous Geared Hinge A31011G x DH 689.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F30 x Construction Core 626.
- .3 1 Permanent Core PREM. 626
- .4 1 Electric Strike E09321 x LBM 12/24 VDC 630.
- .5 1 Heavy Duty Closer C02021 POSITIVE STOP ARM TB 689.
- .6 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .7 1 Weatherstrip By Door Supplier.
- .8 1 Threshold J32100 x OW 628
- .9 1 Sweep R3A416 x DW 628
- .10 1 Door Contact by Security.
- .11 1 Power Supply/Controller by Security.
- .12 1 Access Control by Security.

Note: 120VDC is required at the head of the door (confirm location) for power supply, 15A dedicated circuit. All conduit and back boxes with pull cords are to be provided by the electrical contractor.

Hardware group No. 12: G172

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F05 x Construction Core 626.
- .3 1 Permanent Core PREM. 626
- .4 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .5 1 Wall Stop L52251 630.
- .6 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 13: G186

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F07 x Construction Core 626.
C/W Occupied/Vacant Indicator.
- .3 1 Permanent Core PREM. 626
- .4 1 Heavy Duty Closer C02021 REG ARM TB 689.
- .5 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .6 1 Wall Stop L52251 630.
- .7 1 Threshold J32100 x OW 628
- .8 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 15: G177

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F01 x Construction Core 626.
C/W Occupied/Vacant Indicator thumb lever, resets with latch retraction.
- .3 1 Wall Stop L52251 630.
- .4 1 Threshold J32100 x OW 628
- .5 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .6 1 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 16: G178, G179, G180, G181, G182

- .1 5 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 5 Mortise Lock Grade 1 ANSI A156.13 F05 x Construction Core 626.
- .3 5 Permanent Core PREM. 626
- .4 5 Wall Stop L52251 630.
- .5 5 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .6 5 Smoke Seal ROE154 x Door Size BRN

Hardware group No. 17: G183

- .1 Sliding ICU - Doors - 2 Panel Manual
SEE SECTION 08 42 43 FOR SPECIFICATION

Hardware group No. 21: G187

- .1 1 Heavy Duty Barrel Continuous hinge A156.26 2.1.3 x DH 630.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F05 x Construction Core 626.
- .3 1 Permanent Core PREM. 626
- .4 1 Electric Strike E09321 x LBM 12/24 VDC 630.
- .5 1 Heavy Duty Closer C02021 REG ARM TB 689.
- .6 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .7 1 Wall Stop L52251 630.
- .8 1 Smoke Seal ROE154 x Door Size BRN
- .9 1 Door Contact by Security.
- .10 1 Power Supply/Controller by Security.
- .11 1 Access Control by Security.

Note: 120VDC is required at the head of the door (confirm location) for power supply,
15A dedicated circuit. All conduit and back boxes with pull cords are to be provided by the electrical contractor.

Hardware group No. 24: G189

- .1 1 Heavy Duty Continuous Geared Hinge A31011G x DH 689.
- .2 1 Mortise Lock Grade 1 ANSI A156.13 F30 x Construction Core 626.
- .3 1 Permanent Core PREM. 626
- .4 1 Electric Strike E09321 x LBM 12/24 VDC 630.
- .5 1 Heavy Duty Closer C02021 POSITIVE STOP ARM TB 689.
- .6 1 Kick plate 304 .050 302 mm x 35 mm LDW 4BE 630.
- .7 1 Weatherstrip By Door Supplier.
- .8 1 Threshold J32100 x OW 628
- .9 1 Sweep R3A416 x DW 628
- .10 1 Door Contact by Security.
- .11 1 Power Supply/Controller by Security.
- .12 1 Access Control by Security.

Note: 120VDC is required at the head of the door (confirm location) for power supply,
15A dedicated circuit. All conduit and back boxes with pull cords are to be provided by the electrical contractor.

END OF SECTION

Part 1 General

1.1 DOCUMENTS

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

1.2 COORDINATION

- .1 It is required that a single Detention Equipment Contractor be responsible for and submit a combined bid for Section 08 11 10 Detention Doors and Frames and Section 08 71 10 Detention Hardware.

1.3 SECTION INCLUDES

- .1 The supply, installation and termination of all detention hardware and related equipment specified within this section. The supply and installation of all commercial hardware specified within this section. The complete supply and installation of all components as directed within this section to form a complete operating system.

1.4 RELATED SECTIONS

- .1 Section 08 80 50 Glazing
- .2 Section 08 11 10 Detention Metal Doors and Frames
- .3 Division 26 Electrical
- .4 Division 27 Communications
- .5 Division 28 Electronic Safety and Security

1.5 QUALITY ASSURANCE

- .1 The Detention Equipment Contractor (DEC) shall meet all the requirements listed herein. Contractors shall have a minimum of ten (10) years documented experience furnishing detention hardware and shall be registered in the Province of British Columbia with adequate equipment, maintenance and advisory facilities in the location of the project to fulfill contract obligations.
- .2 The Detention Equipment Contractor (DEC) shall have in their direct employ a full-time superintendent to be responsible for the supervision and coordination of this work. The Superintendent shall have a minimum of ten (10) years of documented experience in the supervision of all phases of detention hardware installation and shall have worked on at least two (2) detention facility projects of similar character and magnitude as required for the specified work. If requested by the Departmental Representative, provide a written statement outlining superintendent experience, contact references, and a demonstration of said qualifications to the satisfaction of the Departmental Representative prior to commencing work. The Superintendent shall be at the site at all times when the

work is being performed. The supervision of site work for this section cannot be performed by a subcontractor of the DEC without the approval of the Departmental Representative. Any changes to the approved superintendent shall require written approval of the Departmental Representative.

- .3 Hardware shall be installed by qualified, trades people regularly engaged in the installation of detention hardware. Installers shall have a minimum of five (5) years documented experience in the installation of detention hardware of the type required for this project. The DEC shall provide a written statement outlining installers experience and contact references and, if requested shall provide a demonstration of said qualifications to the satisfaction of the Departmental Representative prior to commencing work. Any changes to the approved installation crews shall require written approval of the Departmental Representative.
- .4 Manufacturers providing equipment shall have not less than ten (10) successive years of field experience and shall be actively engaged in the design and manufacture of detention locks and detention equipment of the type required for this project. The manufacturer shall provide a list of at least five (5) institutions for which similar products are in operation two of which have been in operation for at least three years. For each facility list the name and location of the installation, the Departmental Representative's representative and contact numbers.
- .5 Submit lock manufacturers' certified test reports from a nationally recognized firm acceptable to the Departmental Representative that indicates that all locks and sliding door devices if specified, have successfully passed the standard test methods defined in ASTM F1577-95b, Security Grade 1, 2 & 3 and ASTM F1643-95 Security Grade 1 & 2.

1.6 SUBMITTALS

- .1 Submit shop drawings and samples in accordance with Contract Documents. Be responsible for any costs incurred due to delays as a result of Submittals not in accordance with contract documents.
- .2 Submit an Electronic copy of the detailed hardware schedule for approval prior to ordering hardware. Schedules shall be standard vertical format. Headings shall include room designations, door numbers, door size and material, frame material, handing, fire resistance rating, degree of opening, and original hardware group. Each opening shall have its own Item number and only openings, which are identical in every detail, may be grouped together. Product description shall be complete in every detail as recommended by the manufacturer under ordering procedures including sizes and fasteners. Shop drawings not submitted in accordance with contract documents will be rejected outright.
- .3 Submit an Electronic copy of Engineering drawings for electrified systems including: block diagrams indicating all components, riser diagrams detailing conduit and cabling allocations, and enclosure back box types, lock pigtail configurations, complete system point to point circuit diagrams detailing interface of all devices to BSCS system and all other required information to provide a detailed review of functional criteria and equipment assessment.

- .4 Submit an Electronic copy of the detailed keying schedule. Keying schedule shall have columns for scheduled Item number, door number, lock or cylinder type, and keying detail. Keying detail nomenclature shall be as defined in DHI document "Keying - Procedures, Systems and Nomenclature.
- .5 Submit an Electronic copy of catalogue cut sheets with hardware schedule where substitute products have been approved.
- .6 Submit one (1) sample of each device if requested by Departmental Representative.
- .7 Submit a work plan within forty (40) days of contract award outlining the intended sequencing of all work.
- .8 Upon completion of project submit one portable lock testing unit to maintenance staff.
- .9 Upon Substantial Performance submit four (4) hard copies and one electronic copy of the following to the Architect:
 - .1 One (1) Copy of as installed hardware schedule.
 - .2 One (1) Copy of as installed wiring diagrams.
 - .3 One (1) Copy of all installation instructions.
 - .4 One (1) Copy of parts and maintenance data.
 - .5 One (1) Binder for above material

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver all hardware in ample time to allow for completion of work in accordance with construction schedule. Each Item shall be clearly tagged with the Item or door number for which it is intended.
- .2 Provide suitable secure storage space with shelving for storing hardware. Prior to installation confirm that all hardware delivered is accounted for and sort hardware on shelving provided. Maintain the space clean and dry and well illuminated.

1.8 COORDINATION

- .1 All hardware applications and products specified herein have been selected to allow for all available options and therefore the exact operation is deemed to be a site configurable variable. It will be the responsibility of this contractor to determine the exact functionality and operational requirement for all electrified hardware as well as the exact requirements for interface to related systems prior to commencing work.
- .2 Convene a design review meeting within forty days of Contract award. Coordinate functional review of design documents and resolve any conflicts between Contract Documents and actual requirements.
- .3 Review and confirm all locking functions, hardware locations, lock and door status monitoring and controls interface requirements with Departmental Representative prior to submitting shop drawings and ordering hardware.

- .4 Coordinate final conduit system design, device locations, and electrical service allocations and requirements. The Division 26 contractor shall be responsible for the supply and installation of all industry standard conduit, back boxes, junction boxes, device boxes, and terminal panels to provide a complete conduit system. The DEC is to provide all manufactured system specific enclosures to Division 26 contractor for installation as part of the conduit system. Substantial corrosion resistant pull strings to be installed in all conduit runs.
- .5 Check all architectural details and confirm special frame rebate details and applications. Provide special lip strikes, or any special peripheral components suitable for the application as detailed. Refer to door schedule and details to confirm glazing sizes and applications. Provide hardware sized or templated to accommodate glazed openings.
- .6 Coordinate hardware components and locations with door and frame manufacturers to ensure correct door and frame preparation. Inform manufacturers where conduit may be required within their respective assemblies and provide all required templates for door and frame preparation. Ensure that frames have been prepared correctly and that appropriate back boxes for conduit termination have been provided at correct locations prior to frame installation. Ensure that doors have been prepared correctly for all devices and that doors contain flexible conduit at correct location if required.
- .7 Coordinate installation of detention hardware with general contractor to ensure that all dust creating activities have been completed in and around areas where detention hardware will be installed. Site conditions at the time of the detention hardware installation must not interfere with hardware manufacturers' warranty requirements. Cleaning, repair and or replacement of locks and components due to on site contaminants will be the responsibility of the DEC contractor if this is not coordinated in advance of the detention hardware installation.

1.9 WARRANTY

- .1 All products and systems shall be guaranteed for a minimum of 12 months against defects in design, workmanship, materials and finishes. Any defects shall be made good at no additional cost to the Departmental Representative. Warranty period commences upon Substantial Performance.

1.10 COMMISSIONING

- .1 Coordinate with Section 01 91 00 Commissioning

- .1 The electro-mechanical locking system is to be commissioned and verified with the Departmental Representative to ensure the system is installed and operating to the requirements of the specifications.
- .2 The DEC must perform at least two preliminary site inspections during the construction process to ensure detention frames are being installed according to plans and specifications and comply with NAAMM and ASTM requirements. Provide preliminary site inspection reports outlining frame installation quality and notify Departmental Representative of any and all discrepancies and concerns.
- .3 The DEC must submit a pre-commissioning report upon completion of testing and verification of all detention hardware.
Pre-commissioning report to include:
 - .1 Electronic Functionality and door status.
 - .2 Mechanical operation and dead lock functions.
 - .3 Door and frame alignment and hardware tolerances.
 - .4 Itemised list of hardware per opening.
- .5 Review and confirm that all detention doors and locking hardware have been installed within factory required tolerances.
- .6 Notify Departmental Representative of any and all discrepancies and concerns prior to final commissioning.
- .7 Submit Final Commissioning verification log to Departmental Representative for inclusion into Operation and Maintenance Manuals.

Part 2 Products

2.1 MANUFACTURERS

- .1 The products and manufacturer specified herein have been selected to establish a minimum requirement for design, finish, operation, functionality and have been proven to be compatible with systems or products specified in other sections.
 - .1 Detention Hinges Southern Steel
 - .2 Detention Locks Southern Steel
 - .3 Detention Cylinders Southern Steel
 - .4 Detention Stops Southern Steel
 - .5 Detention Push and Pulls Southern Steel
 - .6 Detention Door Position Indicators Southern Steel
 - .7 Detention Door Closers - Concealed LCN 2010 Series
 - .8 Detention Door Kick plates Standard Metal
 - .9 Detention Threshold and Weather-seals Pemko
 - .10 Automatic Door Bottoms 420ASL

2.2 FINISHES

- .1 Finishes shall be as follows except where noted otherwise:
 - .1 Detention Hinges US32D Stainless Steel
 - .2 Detention Locks Galvanized
 - .3 Detention Cylinders US4 Finish
 - .4 Detention Push and Pulls US26D Chromium Plated
 - .5 Detention Dr Position Indicators US32D Stainless Steel
 - .6 Detention Door Closers 689 Satin Aluminum Lacquer
 - .7 Detention Door Kick plates 630 Satin Stainless Steel
 - .8 Thresholds and Weather seals Anodized Aluminum

2.3 DETENTION CYLINDER KEYING

- .1 Meet with Departmental Representative and facility personnel to determine all keying requirements. Prepare and submit a keying schedule for approval. Confirm all lock functions and locking directions with Departmental Representative prior to ordering hardware.
- .2 All detention grade locks shall be provided with Southern Steel, Mogul Key Cylinders or Southern Steel, Para-centric Keyways as indicated in hardware groups.
- .3 All locks and cylinders shall be factory keyed to new factory registered key system.
- .4 Forward all keys, key charts, and keying information by registered delivery to Departmental Representatives designated representative. Provide Keys directly to SMO Officer per 01 14 10 Security Requirements, Paragraph 1.12.
- .5 For all detention key cylinders provide:
 - .1 Four (4) Change Keys per cylinder.

2.4 DETENTION HINGES - FULL MORTISE

- .1 Full mortise detention hinges shall be size 114mm x 114mm. Material shall be Type 304 investment cast stainless steel with hospital tips and integral security studs on both leaves. Pins shall be concealed non-removable hardened stainless steel. Hinges shall be provided and installed with ¼-20 flathead Torx Plus machine screws.
- .2 Provide three (3) hinges per leaf for doors up to 900mm and four (4) hinges per leaf for doors over 900mm. Provide three hinges per leaf for doors up to 2150mm in height and one (1) additional hinge for each additional 300mm in height. Provide four (4) hinges per leaf for all exterior doors and for all sally port doors.
- .3 Hinges shall be equal to Southern Steel # 204FMSS.

2.5 DETENTION DOOR PULLS - RAISED

- .1 Raised detention door pulls shall be cast brass or bronze base metal and shall be plated to specified finish. Overall length shall be 223mm, hand hold shall be 133mm and grip clearance shall be 39mm. Pulls shall be provided and installed with 3/8-16 oval head Torx Plus machine screws
- .2 Raised detention pulls shall be Southern Steel # 212.

2.6 DETENTION DOOR PULLS - FLUSH

- .1 Flush detention door pulls shall be cast brass or bronze base metal and shall be plated to specified finish. Size shall be 100mm x 127mm. Material shall be 3mm and be provided with 25mm deep pocket. Flush Pulls shall be provided and installed with ¼ x 20 countersunk flathead Torx Plus machine screws.
- .2 Flush detention pulls shall be Southern Steel # 214.

2.7 DETENTION DOOR STOPS

- .1 Detention doorstops shall be a tamper resistant device with a bumper that is 50mm diameter x 90mm in length and manufactured from a non-hazardous silicone elastomer. The threaded and grooved steel shank shall be 19mm diameter and embedded at least half the length into the bumper. The mounting shank shall extend 65mm beyond the bumper bottom. Stops shall be embedded into the wall or floor. Overall length shall be 223mm, hand hold shall be 133mm and grip clearance shall be 39mm.
- .2 Detention door stops shall be equal to Southern Steel # 420.

2.8 DETENTION DOOR CLOSERS

- .1 All door closers shall have heavy-duty cast iron cylinders. Closers for doors designated as detention doors shall be fully concealed on the head of the door frame. All exposed fasteners shall be Torx Plus.
- .2 Detention door closers shall be LCN 2010 STD series with painted arms and dress cover.

2.9 DOOR KICKPLATES

- .1 Kick plates on detention doors shall be 1.57mm Type 304 satin stainless steel fastened with stainless steel rivets.
- .2 Kick plates shall be installed on push side of door only unless noted otherwise. Kick plate width shall be sized 35mm less than door width on push side and 25mm less than door width on pull side. Kick plates on pairs of doors shall be sized 25mm less than door width on both sides.
- .3 Kick plates shall be equal to Standard Metal K10B.

2.10 DETENTION DOOR POSITION SWITCHES

- .1 Detention door position switches shall be a magnetic read switch mortise type assembly used for remotely monitoring the door position status. The device shall

be moisture resistant and fit within a 51mm hollow metal door rebate. The device shall be supplied with a 913mm vinyl jacketed wire lead and a 3-pin Molex connector. The device shall be all stainless steel construction. The switch and magnet shall be encased in epoxy resin. Overall dimension shall be 32mm x 124mm x 25mm.

- .2 Detention door position switches shall be mounted in the door rebate of the frame at 150 mm on centre line down from the frame head in the lock jamb. Corresponding magnet shall be mounted in the door edge to match the location of switch. Ensure magnet capacity will provide constant and uninterrupted closing of the switch when activated.
- .3 Recessed detention door position switches shall be equal to Southern Steel # 200MRS.

2.11 ELECTRO-MECHANICAL SWINGING DOOR LOCKING DEVICES

- .1 A maximum security remote, motor operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95b, Security Grade 2. A 250mm frame mounted slam-lock with automatic deadlocking equal to Southern Steel # 10120AM NL K2S LEK.
 - .1 Physical Characteristics:
 - .1 The lock shall automatically deadlock when the door is slam-locked.
 - .2 Latch bolt shall be stainless steel.
 - .3 Lock shall have a mechanical roller-bolt deadlock actuator and shall automatically deadlock when door is closed.
 - .4 Lock shall be supplied with Southern Steel Mogul Key Cylinders.
 - .5 Lock shall be provided with mechanical key over ride.
 - .6 Lock shall be provided with lock status switch which shall indicate both secure and non-secure status positions.
 - .7 Lock shall be provided with (LEK) Local Electronic Key Switch. Door is electro-mechanically unlocked by key operated switch inside lock when key is inserted and turned.
 - .8 Lock shall operate by remote control when supplied by 24VDC electrical current to the motor.
 - .9 Lock shall be provided with Molex connector c/w field side pig tail.
 - .2 Special Features: When specified by the security hardware/door schedule, the following features shall be provided.
 - .1 Underwriters Laboratories Inc. (UL): UL approved electrically controlled single point lock for use on swinging fire doors having a rating up to and including 3 hours. (Consult manufacturer when a UL label is required).

- .2 ASTM Grade 1 Rating (GR1): Meet ASTM F1577 Grade 1 Impact Standards. (Note: Special mounting and strike keeper required to meet this feature, consult the manufacturer).
- .3 Adjustable Deadlock Actuator (ADA): Allows for adjustment of roller type deadlock actuator when standard strike/keeper is not used.

2.12 LOCK POWER SUPPLIES

- .1 Power supplies shall be provided in Division 28.

2.13 MATERIALS AND FASTENERS

- .1 Furnish hardware with all necessary fasteners, mounting brackets and special tools required for the proper installation as recommended by the manufacturer. Fastening devices shall be of the same material and finish as the item to which it is fastened.
- .2 All exposed fasteners shall be Tamperproof Torx Plus. Tamper Resistant Torx screws are acceptable if designated mounting screws are not available in Torx Plus. Provide machine screws and anchors for all stops and toggle bolts and backing where required for wall stops.

2.14 WIRE, CABLE AND CONDUIT

- .1 Cabling for detention hardware shall be supplied and installed by others. All cable shall be PVC insulated multi-conductor stranded. All wiring for hardware and systems shall be installed in conduit or wire trays.
- .2 All serviceable devices such as locks and door position indicators shall have connections terminated with MOLEX type connectors provided by the lock manufacturer. All connections on the controls side of the lock pigtail shall be secure. Refer to Division 26 and Division 28 documents for specifications on wire connection details.
- .3 The BSCS contractor shall terminate cabling, within swing door frames, from field wiring to all Molex pigtail connectors provided by the detention hardware manufacturer. The BSCS contractor shall terminate controls end of all cabling for lock control output and monitoring status inputs in the BSCS Room.

Part 3 Execution

3.1 COORDINATION

- .1 Coordinate with electrical contractors, controls contractors, automatic door contractors, door hardware manufacturers, door and frame manufacturers and any other trades who may have field devices operating to the demands of the system.

3.2 INSPECTION

- .1 Inspect surfaces and conditions on site prior to commencing work. Verify that all door and frame assemblies have been prepared correctly prior to commencing work. Commencement of work assumes acceptance of site conditions.
- .2 Verify that all conduit, back boxes, junction boxes, device boxes, and terminal panels have been installed where required and conform to hardware templates and installation requirements prior to commencing work.
- .3 Prior to final inspection verify that all hardware has been installed according to the approved hardware schedule and manufacturer's instructions, and ensure correct operation.

3.3 INSTALLATION

- .1 Install all doors and hardware in accordance with approved hardware schedule, manufacturers' installation instructions, and DHI document "Installation Guide for Doors and Hardware". Install hardware to the degree of opening as listed in the approved hardware schedule.
- .2 Template and install O/H stops and holders to the required degree of opening to protect exposed trim from contacting other surfaces.
- .3 Install adhesive fastened materials on a clean dry surface. Ensure that gasketing does not interfere with closing or latching of door assemblies.
- .4 Install wall stops to contact levers or pulls where they protrude from the door. Where push plates and pulls are mounted back to back, through bolts for pulls shall be countersunk and plates shall cover bolt heads.
- .5 Size all universal closers to suit site conditions and in accordance with barrier free accessibility code. Adjust all door closers after HVAC system has been balanced to ensure proper closing operation without slamming or stalling doors.
- .6 BSCS contractor (Division 28) shall terminate all control wiring at the device end wire harness and at the BSCS control panels.

3.4 TESTING AND COMMISSIONING

- .1 Prior to final inspection verify that all hardware has been installed according to the approved hardware schedule and manufacturer's instructions. Test all electrical hardware and monitoring devices to ensure that hardware is fully operational.
- .2 Commissioning shall be performed for both stand alone operations and operations integrated with BSCS functionality and monitoring. Access and egress control functions shall be demonstrated for all functions. Door position monitoring and bolt position monitoring shall be demonstrated. Coordinate commissioning of integrated operations with controls contractor to complete the door and security requirements to a fully operational state including; control, monitoring, alarm and reset functions, as well as free or delayed egress exit related functions if specified.

3.5 PROTECTION AND MAINTENANCE

- .1 Be responsible for protective treatment and other precautions required to ensure that hardware components will be without damage until completion of the Work. Replace any item that is scratched, marred, or damaged. Instruct the Departmental Representative on the proper operation, care and maintenance of hardware and door systems. Instruct Departmental Representatives on proper maintenance and care of all serviceable items. Provide all maintenance data as outlined in contract documents.

3.6 EXTRA STOCK

- .1 Provide the following extra stock:
 - .1 One (1) Electric Lock Southern Steel 10120AM NL LEK K2S LH
 - .2 One (1) Electric Lock Southern Steel 10120AM NL LEK K2S RH
 - .3 Two (2) Door Position Switches Southern Steel 200MRS
 - .4 One (1) Lock Tester Southern/Folger

3.7 DETENTION HARDWARE SETS

SET S1 Exterior Detention Swing Door – Mechanical Lock G171

4	Hinges	Southern Steel 204 FMSS
1	Mechanical Deadlock	Southern Steel 1080A-2 HM
1	Escutcheon	Southern Steel 218-2
2	Cylinders	Southern Steel, Mogul
4	Keys	Southern Steel, Moqul Keys-New
Code		
1	Raised Pull	Southern Steel 212
1	Flush Pull	Southern Steel 214
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Threshold	253 x 3AFG
1	Auto Door Bottom	420ASL
1	Weatherseal	29310 CPK

Note: Lock operated mechanically by key only. No electric unlock operation.
 Lock status and door position monitoring required.

SET S2 Interior Detention Swing Door – Electro-Mechanical Lock G162A

4	Hinges	Southern Steel 204 FMSS
1	Electro-mechanical Lock	Southern Steel 10120AM NL K2S
LEK		
2	Cylinders	Southern Steel, Mogul

4	Keys	Southern Steel, Moqul Keys
1	Raised Pull	Southern Steel 212
1	Flush Pull	Southern Steel 214
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Door Stop	Southern Steel # 420.

SET S3 Interior Detention Swing Door – Electro-Mechanical Lock G185A, G185B, G187A

3	Hinges	Southern Steel 204 FMSS
1	Electro-mechanical Lock	Southern Steel 10120AMNL K2S
LEK		
2	Cylinders	Southern Steel, Mogul
4	Keys	Southern Steel, Moqul Keys
1	Raised Pull	Southern Steel 212
1	Flush Pull	Southern Steel 214
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Door Stop	Southern Steel # 420.

SET S4 Exterior Detention Door – Mechanical Lock G174, G176, G184

3	Hinges	Southern Steel 204FMSS
1	Mechanical Deadlock	Southern Steel 1080A-2 HM
1	Escutcheon	Southern Steel 218-2
4	Keys	Southern Steel Para-centric
1	Keeper with Dust Box	Southern Steel 4C
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Threshold	253 x 3AFG
1	Auto Door Bottom	420ASL
1	Weatherseal	29310 CPK

Note: Door position monitoring only provided.

SET S5 Exterior Detention Door – Mechanical Lock Double Doors G175

6	Hinges	Southern Steel 204FMSS
1	Mechanical Deadlock	Southern Steel 1080A-2 HM
1	Escutcheon	Southern Steel 218-2
4	Keys	Southern Steel Para-centric
1	Keeper with Dust Box	Southern Steel 4C
2	Door Position Switch	Southern Steel 200MRS Wired in Series

Note: Ensure that a common back box or adjoining conduit is installed

for both DPS's so correct wiring can be accomplished.

2	Door Closer	LCN 2010 STD Series
2	Kickplate	K10C 250 x DW
1	Threshold	253 x 3AFG Size to Suit Opening
2	Auto Door Bottoms	420ASL
1	Weatherseal	29310 CPK Size to Suit Opening
1	2.7 mm steel surface mounted flat bar astragal c/w weatherseal	
1	Head Bolt and Keeper	Southern Steel 10105 and 10105B
4	Keys	Southern Steel 10105K

Note: Door position monitoring only provided.

SET S6 Exterior Access Hatch – Mechanical Lock Doors G001

3	Hinges	Southern Steel 204FMSS
1	Mechanical Deadlock	Southern Steel 1080A-2 HM
1	Escutcheon	Southern Steel 218-2
4	Keys	Southern Steel Para-centric
1	Keeper c/w Switch	Southern Steel 4CL
2	Door Position Switch	Southern Steel 200MRS

Note: DPS Wired in Series with Monitor Switch in Keeper ensure adjoining conduit is installed so correct wiring can be accomplished.

2	Door Closer	LCN 2010 STD Series x 3054 Hold Open
1	Weatherseal	29310 CPK Size to suit opening apply to both sides, head and sill

SET S7 Interior Detention Door – Institutional Mortise Lock G187B

3	Hinges	Southern Steel 204FMSS
1	Institutional Mortise Lock	Southern Steel 10563L BHC
Note: Active Lever on Hinge Side of Door		
2	Builders Cylinders	Best Cormax
4	Keys	Best
1	Keeper with Dust Box	Southern Steel 500CDB
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Door Stop	Southern Steel # 420.
1	Smoke Seal	ROE154 x Door Size BRN

Note: Door position monitoring only provided.

SET S8 Interior Detention Door – Mechanical Lock G170B

4	Hinges	Southern Steel 204FMSS
1	Mechanical Deadlock	Southern Steel 1080A-2 HM
1	Escutcheon	Southern Steel 218-2
2	Cylinders	Southern Steel, Mogul
4	Keys	Southern Steel, Moqul Keys-New
Code		
1	Raised Pull	Southern Steel 212
1	Flush Pull	Southern Steel 214
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Door Stop	Southern Steel # 420.

Note: Door position monitoring only provided.

SET S9 Interior Detention Door – Mechanical Lock G140A

3	Hinges	Southern Steel 204FMSS
1	Mechanical Deadlock	Southern Steel 1080A-2 HM
1	Escutcheon	Southern Steel 218-2
2	Cylinders	Southern Steel, Mogul
4	Keys	Southern Steel, Moqul Keys-New
Code		
1	Raised Pull	Southern Steel 212
1	Flush Pull	Southern Steel 214
1	Door Position Switch	Southern Steel 200MRS
1	Door Closer	LCN 2010 STD Series
1	Kickplate	K10C 250 x DW
1	Door Stop	Southern Steel # 420.
1	Smoke Seal	ROE154 x Door Size BRN
1	Threshold	J32100 x OW 628

Note: Door position monitoring only provided.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 08 11 00 – Metal Doors and Frames
- .2 Section 08 11 16 – Aluminum Doors and Frames
- .3 Section 08 14 16 – Flush Wood Doors
- .4 Section 08 50 00 – Aluminum Windows
- .5 Section 08 42 43 – ICU Doors
- .6 Section 10 28 10 – Toilet and Bath Accessories
- .7 Section 13 49 00 – Radiation Protection

1.2 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI Z97.1-2009, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C542-05 (2011), Specification for Lock-Strip Gaskets.
 - .2 ASTM D790-10, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .3 ASTM D2240-05(2010), Standard Test Method for Rubber Property - ;Durometer Hardness.
 - .4 ASTM E84-11a, Test Method for Surface Burning Characteristics of Building Materials.
 - .5 ASTM E330-02(2010), Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .6 ASTM F1233-08, Test Method for Security Glazing Materials and Systems.
- .3 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .3 CAN/CGSB-12.8-97 AMEND, Insulating Glass Units.
 - .4 CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings
- .4 Canadian Standards Association (CSA International).
 - .1 CAN/CSA A440.2-09/A440.3-09, Fenestration energy performance/User guide to CSA A440.2-09.
 - .2 CSA Certification Program for Windows and Doors 2000.
- .5 Environmental Choice Program (ECP)
 - .1 CCD-045-95, Sealants and Caulking.
- .6 Glazing Association of North America (GANA)

- .1 GANA Glazing Manual.
- .2 GANA Glazing Reference.
- .7 Insulating Glass Manufacturers Alliance.
- .8 National Fire Protection Association (NFPA):
 - .1 NFPA 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition.
 - .2 NFPA 252, Fire Tests of Door Assemblies, 2012 Edition.
 - .3 NFPA 257, Fire Test for Window and Glass Block Assemblies, 2012 Edition.

1.3 ADMINSTRATIVE REQUIREMENTS

- .1 Convene pre-installation meetings: one week prior to beginning work of this Section.
 - .1 Verify project requirements.
 - .2 Review installation conditions.
 - .3 Co-ordinate with other building subtrades.
 - .4 Review manufacturer's instructions and warranty requirements.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data. Indicate VOC's:
 - .1 For glazing sealant materials during application and curing.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit shop drawings for window glazing and include the following:
 - .1 Submit glass thermal and wind load stress analysis documenting adequate glass thickness and/or heat treatment to meet stresses generated. Thermal stress analysis to consider effects of external shading, conduction at glass edge, heat build-up and contribution of Low-E coatings.
 - .2 Shop drawings shall be signed and sealed by a professional engineer qualified in the province of the Work, and who was responsible for their preparation.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit 300 mm x 300 mm size of each glazing type. Departmental Representative reserves the right to change colour of glass after review of submitted samples.

- .4 Information Submittals:
 - .1 Manufacturer's Instructions: Submit manufacturer's installation instructions.
 - .2 Submit proof of IGMAC certification for insulating glass units, including component codes.
- .5 Closeout Submittals:
 - .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Manufacturer's technical recommendations:
 - .1 Perform glazing work in accordance with written recommendations from the glass manufacturer or glass fabricator.
 - .2 Certify glass compatibility with glazing materials (i.e. insulating glass sealants, structural sealants and silicones, gaskets, setting blocks, etc.)
 - .3 Designs to be analyzed for thermal stress and wind/snow loads.
 - .4 Provide shop inspection for glass.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Provide testing and analysis of glass under provisions of Section 01 01 50 – General Instructions, Quality Control.
 - .2 Provide shop inspection and testing for glass.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Glazing for Fire-Rated Door and Window Assemblies: Glass tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labelled per requirements of authorities having jurisdiction.

1.6 SITE CONDITIONS

- .1 Environmental Requirements:
 - .1 Install glazing when ambient temperature is 4 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 WARRANTY

- .1 Provide manufacturers guarantee for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work.
 - .1 Sealed Glass Units: Replace units that exhibit failure of hermetic seal under normal use evidenced by the obstruction of vision by dust, moisture, or film on interior surface of glass: 10 Years.
 - .2 Coated- Glass: Replace units that display peeling, cracking, and other deterioration in metallic coating under normal use: 10 Years.
 - .3 Provide warranty for glazing to include in maintenance manuals as specified in Section 01 01 50 – General Instructions, Operations and Maintenance Data Manuals.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330 and in accordance with CAN/CGSB-12.20.
- .3 Limit center-of-glass deflection to the smallest of:
 - .1 Displacement associated with the structural capacity of the glazing unit.
 - .2 $L-100$, where L is the shortest side dimension of the unit measured in inches.
 - .3 Or 19 mm

2.2 MATERIALS

- .1 Safety glass: to CAN/CGSB-12.1, transparent, 6 mm minimum thickness and as indicated on Drawings.
 - .1 Type: 2-tempered.
 - .2 Class: B-float.
 - .3 Category: II – 540 J impact resistance.
- .2 Polycarbonate Laminate Security Glazing:
 - .1 Clear laminated polycarbonate to CAN/CGSB12.12, constructed as follows:
 - .1 3 mm clear polycarbonate sheet on outer surfaces. Minimum one surface with permanent abrasion resistant coating.
 - .2 Polyurethane lamination interlayers.
 - .3 Core sheet: laminated 6 mm polycarbonate.
 - .4 Gauge/Tolerance: 12.7 mm \pm 5%

- .5 Conforming to the following performance requirements:
 - .1 Meets forced entry ASTM F1915 Grade 2 or HP White – TP-0500.00 level II (Step 14).
 - .2 WMFL 60-minute forced entry attack resistance.
- .6 Light transmission to ASTM D1003: 82% (average Gardner value)
- .7 Flexural Strength: to ASTM D790; not less than 13500 psi.
- .3 Fire Rated Glass: Comprised of multiple layers of tempered glass ceramic, laminated with transparent intumescent materials, providing distortion free viewing through pane and as follows:
 - .1 Thickness: As required by manufacturer to meet structural requirements for performance and specified.
 - .2 Impact Safety Rating: Category I, 665 J/m in accordance with ANSI Z97.1.
 - .3 Fire Rating: As indicated in door and frame schedule.
 - .4 Labelled: Permanent logo listing name of product, manufacturer, testing laboratory, fire rating period and safety requirements.
- .4 Leaded Glass: refer to Section 13 49 00 – Radiation Protection
- .5 Low Emissivity (Low E) Glass: to CAN/CGSB-12.10, thickness as indicated.
 - .1 U-Value Winter Nighttime: 0.29
 - .2 U-Value Summer Daytime: 0.27
 - .3 SHGC: 0.39
 - .4 Shading Coefficient: 0.45
 - .5 Visible Light Transmittance: 70%

2.3 MATERIALS: SEALED INSULATING GLASS

- .1 Drawings and Specifications for insulated glass units are intended to show design concept, configuration, components and arrangement; they are not intended to identify nor solve completely the problems from thermal stress. Insulating glass units shall withstand thermal stresses created by shadowing of exterior components or assembly and elevated interstitial space temperatures. Glass thermal stress analysis shall be provided by Contractor.
- .2 Double Pane Insulating Glass Units: meet or exceed requirements of CAN/CGSB-12.8. Units shall be certified by the Insulated Glass Manufacturers Alliance (IGMA). Overall unit thickness shall be 25 mm using 6 mm glass thickness for individual panes. Use two stage seal method of manufacture, as follows:
 - .1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator, super spacer bar or TDSE Intercept.
 - .2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.

- .3 Spacer/separator to provide continuous vapour barrier between interior of sealed unit and secondary seal.
- .4 Clear Safety Glass: to CAN/CGSB-12.1-M90, as indicated on Drawings and as follows:
 - .1 Type: 2-tempered.
 - .2 Class: B-float.
- .5 Inter-cavity space thickness: 13 mm with low conductivity spacers.
- .6 Glass coating: surface number 2, low "E"
- .7 Inert gas fill: argon.

2.4 MATERIALS: SECURITY GLAZING ASSEMBLY

- .1 Drawings and Specifications for Security Glazing Assembly units are intended to show design concept, configuration, components and arrangement.
- .2 Overall unit thickness shall be 30.7 mm:
 - 6 mm Tempered Safety Glass
 - 3 mm Air Space
 - 12.7 mm Polycarbonate Laminate Security Glazing
 - 3 mm Air Space
 - 6 mm Tempered Safety Glass
- .3 Clear Safety Glass: to CAN/CGSB-12.1-M90, as per 08 80 50 paragraph 2.2.1
- .4 Polycarbonate Laminate Security Glazing:
 - Clear laminated polycarbonate to CAN/CGSB12.12, as per 08 80 50 paragraph 2.2.2
- .5 Spacer/separator of Santoprene rubber for compatibility with Polycarbonate Glazing to provide air space between protective 6 mm tempered glazing layers and 12.7 mm polycarbonate core at manufacturers recommended spacing.
- .6 Glazing Tape: Preformed polyisobutylene tape compatible with polycarbonate and glass glazing, continuous integral shim, paper release, black colour, width x thickness recommended by manufacturer.
- .7 Primer – Sealers and Cleaners: To glazing Manufacturer's Standards

2.5 ACCESSORIES

- .1 Sealant: in accordance with Section 07 92 00 – Joint Sealants. Purpose made for glazing use, compatible with polycarbonate and glass units. Sealant colour selected by Departmental Representative where exposed to view.
- .2 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.

- .3 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face. Use Santoprene rubber for Polycarbonate laminate glazing.
- .4 Glazing tape:
 - .1 Preformed butyl compound compatible with polycarbonate and glass glazing, with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
 - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal.
- .5 Glazing compound for fire rated glazing materials:
 - .1 Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2%, designed for compression of 25% to effect an air and vapour seal.
 - .2 Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50% in both extension and compression (total 100%); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.
 - .3 Setting Blocks: Hardwood, glass width by 100 mm x 5 mm thick.
 - .4 Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
 - .5 Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.
- .6 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, black colour.
- .7 Glazing clips: manufacturer's standard type.
- .8 Lock-strip gaskets: to ASTM C542.
- .9 Other Glazing Accessories: to CAN/CSA-A440.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

- .1 Ensure all glazing rebates smooth and true, free of projections nails, screws, fastenings properly set to prevent contact with glass.
- .2 Ensure all stops, splines, glazing accessories provided by others accurately cut to length and proper size and type for specific glazing.
- .3 Clean contact surfaces with solvent and wipe dry.
- .4 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .5 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

- .1 Perform work in accordance with GANA Glazing Manual, IGMA, and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .5 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.
- .6 Trim protruding tape edge.

3.5 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with GANA Glazing Manual, IGMA, and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

3.6 SECURITY GLAZING INSTALLATION

- .1 Window Glazing: Install security laminated polycarbonate in combination with sacrificial glass layers. Install glazing assembly using 30 x 35 x 4 mm steel angle stops, per 08 11 10 Detention Metal Doors and Frame. Install glass and retain with steel angle stops fastened with Security screws, screwed to frame. Install

screws at 150 mm oc. Use compatible glazing tape between each layer of glazing and at metal contact. Rest glazing on setting blocks and centre glazing with spacer shims, allowing for thermal expansion.

- .2 Door Glazing: Install laminated polycarbonate security glazing in combination with sacrificial glass layer as indicated on drawings.
- .3 Sacrificial glass layer installed on both sides.

3.7 FIRE RATED GLASS

- .1 Comply with GANA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- .2 Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- .3 Place hardwood setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.
- .4 Glaze vertically into labelled fire rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described above.
- .6 Do not remove protective edge tape.
- .7 Install removable stop and secure without displacement of tape.
- .8 Do not pressure glaze.
- .9 Knife trim protruding tape.
- .10 Provide minimum 5 mm edge clearance.
- .11 Install vision panels in fire rated doors to requirements of NFPA 80.
- .12 Install so that appropriate fire rating labels and markings remain permanently visible.

3.8 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking.
- .3 Remove glazing materials from finish surfaces.
- .4 Remove labels after work is complete.
- .5 Clean glass using approved non-abrasive cleaner in accordance with manufacture's instructions.
- .6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.9 PROTECTION OF FINISHED WORK

- .1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.10 SCHEDULE

- .1 Aluminum Frames:
 - .1 Exterior: Insulating glass units, 6 mm clear tempered glass exterior light; 6 mm clear tempered glass interior light, low e coating to #2 surface.
 - .2 Interior: Single pane 6 mm tempered safety glazing.
- .2 Aluminum Doors:
 - .1 Exterior: Sealed glass unit tempered safety glazed doors and sidelights. 6 mm clear exterior light; 6 mm clear interior light, low E coating to #2 surface.
- .3 Hollow Metal Doors and Borrowed Lights:
 - .1 Exterior Doors: Sealed glass unit, 6 mm tempered safety glazing for both lights with low e coating to #2 surface.
 - .2 Interior Doors, unless otherwise noted: Single pane 6 mm tempered safety glazing.
 - .3 Provide fire rated glass for rated doors as indicated on Drawings.
 - .4 Security Windows and DD1 Doors Type A & B: Provide polycarbonate security glazing where indicated on Drawings and in accordance with Section 08 11 10.
- .4 Wood Doors:
 - .1 Single pane 6 mm tempered safety glazing.
- .5 ICU Doors:
 - .1 Single pane 6 mm tempered safety glazing.
- .6 Other glass types as indicated on Drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 22 00 – Concrete Unit Masonry
- .2 Section 05 50 00 – Metal Fabrications
- .3 Section 06 10 00 – Rough Carpentry
- .4 Section 07 84 00 – Firestopping
- .5 Section 07 92 00 – Sealants
- .6 Section 09 22 16 – Non-Structural Metal Framing
- .7 Section 09 30 13 – Tiling
- .8 Section 09 91 99 – Painting for Minor Works
- .9 Section 13 49 00 – Radiation Protection

1.2 REFERENCES

- .1 Aluminum Association (AA)
 - .1 AA DAF-45, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C475/C475M-15, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C514-04(2014), Specification for Nails for the Application of Gypsum Board.
 - .3 ASTM C840-16, Specification for Application and Finishing of Gypsum Board.
 - .4 ASTM C954-15, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .5 ASTM C1002-16, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .6 ASTM C1047-14a, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .7 ASTM C1177/C1177M-13, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .8 ASTM C1280-13a, Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
 - .9 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Board.
- .3 Association of the Wall and Ceilings Industries International (AWCI)
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86., Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.
- .3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.5 SITE ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 GYPSUM MATERIALS

- .1 Standard board: to ASTM C1396/C1396M and as follows:
 - .1 Type: regular and fire resistant.
 - .2 Size: 1200 mm x maximum practical length.
 - .3 Thickness: as indicated on Drawings.
 - .4 Ends: square cut.
 - .5 Edges: tapered.
- .2 Sag Resistant Gypsum Board: to ASTM C1396/C1396M and as follows:
 - .1 Type: regular and fire resistant.
 - .2 Thickness: as indicated on Drawings.

- .3 Ends: square cut.
- .4 Edges: tapered.
- .3 Mould resistant board: to ASTM C1396/C1396M and as follows:
 - .1 Type: regular and fire resistant.
 - .2 Size: 1200 mm x maximum practical length.
 - .3 Thickness: as indicated on Drawings.
- .4 Cementitious backer board: to ASTM C1325 and as follows:
 - .1 Size: 1200 mm x maximum practical length.
 - .2 Thickness: as indicated on Drawings.
- .5 Gypsum shaft liner board: to ASTM C1658/C1658M and as follows:
 - .1 Type: ULC fire rated.
 - .2 Faces: fibreglass.
 - .3 Size: maximum permissible length and width.
 - .4 Thickness: 25 mm or thickness to suit manufacturers standard system and fire rating indicated on Drawings.
 - .5 Ends: square.
 - .6 Edges: bevelled.

2.2 FRAMING MATERIALS

- .1 Studs and Tracks: as indicated in Section 09 22 16.
- .2 Metal Furring Members: channels, hangers, tie wire, inserts, anchors, fasteners: ASTM C841.
- .3 Drywall furring channels: 0.75 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .4 Resilient clips and drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .5 Shaft Wall Framing System: to ASTM C645 manufacturer's standard shaft wall steel framing system having ASTM A653M, Z180, hot-dip galvanized zinc coating; minimum steel thickness of 0.46 mm thick or heavier as required by detailed design required for indicated spans; including head and bottom rails, channels, trim and accessories required for a complete installation.

2.3 INSULATION MATERIALS

- .1 Mineral Fiber Insulation For Fire and Smoke Rated Assemblies: Un-faced preformed GreenGuard™ or formaldehyde free binder fibrous insulation meeting the requirements of ULC S702; having maximum flame spread and smoke developed of 20/20 in accordance with CAN/ULC S102 and being non-combustible in accordance with CAN/ULC S114 and as follows:
 - .1 Type: 1.
 - .2 Width: to friction fit in stud spaces.
 - .3 Thickness: to fill a minimum of 90% of the cavity thickness.

- .2 Glass Fiber Acoustical Insulation For Non-rated Assemblies: Un-faced, preformed GreenGuard™ or formaldehyde free binder fibrous insulation meeting the requirements of ASTM C423, ASTM E90, ASTM E413 and ULC S702 and as follows:
 - .1 Type: 1.
 - .2 Width: to friction fit in stud spaces.
 - .3 Thickness: to fill a minimum of 90% of the cavity thickness.

2.4 CEILING/WALL ACCESS DOORS

- .1 Architectural, flush mounting access panels for gypsum board installation, thickness and fire rating to match wall assembly, manufacturer's standard sizes selected to suit access requirements, complete with extruded aluminum frame, concealed hinge and a removable door panel, air tight gasket and screwdriver slot latch mechanism. Confirm proposed location and number of access doors with Departmental Representative prior to installation.

2.5 ACCESSORIES

- .1 Nails: to ASTM C514.
- .2 Steel drill screws: to ASTM C1002.
- .3 Stud adhesive: to CAN/CGSB-71.25.
- .4 Laminating compound: as recommended by manufacturer, asbestos-free.
- .5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, PVC or zinc-coated metal at contractor option, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .6 Shadow mould: 35 mm high, snap-on trim, of 0.6 mm base steel thickness galvanized sheet pre-finished in satin enamel or extruded PVC plastic, white colour.
- .7 Strippable Edge Trim: Extruded PVC with pre-masked L-shaped tape on trim with tear away protective serrated strip for removal after compound and paint is applied, for use at areas where gypsum butts aluminum frames and where gypsum butts concrete or concrete block.
- .8 Sealants: in accordance with Section 07 92 00 - Sealants.
- .9 Acoustic sealant: non-hardening, non-skinning, permanently flexible and having VOC content less than the VOC limits of State of California's South Coast Air Quality Management District Rule #1168 and in accordance with Section 07 92 00 – Sealants.
- .10 Insulating strip: rubberized, moisture resistant, 3 mm thick cork or closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .11 Joint Treatment Materials: Provide joint compound and accessory materials in accordance with ASTM C475 and as follows:
 - .1 Joint Tape:
 - .1 Interior Gypsum Board: Paper.

- .2 Interior Mould Resistant Gypsum Board: Fibreglass mesh tape.
- .3 Cement Backing Panels: As recommended by panel manufacturer.
- .2 Joint Compound for Interior Gypsum Board: Vinyl based, non-asbestos, low dusting type compatible with other compounds applied on previous or for successive coats, and as follows:
 - .1 Pre-filling: Setting type taping compound.
 - .2 Embedding and First Coat: Drying type compound.
 - .3 Fill Coat: Drying type compound.
 - .4 Finish Coat: Drying type, sandable topping compound.
 - .5 Skim Coat: Drying type, sandable topping compound.
- .3 Joint Compound for Backing Panels:
 - .1 Gypsum based tile backing board: Use setting type taping and setting type, sandable topping compounds.
- .4 Joint Compound for Interior Mould Resistant Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - .1 Pre-filling: Setting type joint compound.
 - .2 Embedding and First Coat: Setting type joint compound.
 - .3 Fill Coat: Setting type, sandable topping compound.
 - .4 Skim Coat: Setting type joint compound, sandable topping compound.

2.6 FINISHES

- .1 Paint: in accordance with Section 09 91 99 – Painting for Minor Works.
- .2 Tiling: in accordance with Section 09 30 13 – Tiling.

Part 3 Execution

3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Do application of gypsum sheathing in accordance with ASTM C1280.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.
- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

- .8 Furr gypsum board faced vertical bulkheads within and at termination of ceilings.
- .9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .10 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .13 Erect drywall resilient furring transversely across studs and joists spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.
- .14 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply gypsum board to concrete and concrete block surfaces, where indicated, using laminating adhesive.
 - .1 Comply with gypsum board manufacturer's recommendations.
 - .2 Brace or fasten gypsum board until fastening adhesive has set.
 - .3 Mechanically fasten gypsum board at top and bottom of each sheet.
- .4 Apply mould-resistant gypsum board where indicated and adjacent to slop sinks and janitors closets. Apply mould-resistant sealant to edges, ends, cut-outs

which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

- .5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .7 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .8 Install gypsum board with face side out.
- .9 Do not install damaged or damp boards.
- .10 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.3 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.
- .6 Construct control joints of preformed units or two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.
- .7 Provide continuous polyethylene dust barrier behind and across control joints.
- .8 Locate control joints where indicated and at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.
- .9 Install control joints straight and true.
- .10 Construct expansion joints at building expansion and construction joints. Provide continuous dust barrier.
- .11 Install expansion joint straight and true.
- .12 Splice corners and intersections together and secure to each member with 3 screws.

- .13 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .14 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .15 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 1 for areas not exposed to view: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable and for plenum areas above ceilings, in attics or in concealed spaces.
 - .2 Level 4 for exposed areas: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges and where light textures or wall coverings are to be applied.
 - .3 Level 5 for repairing and preparing existing gypsum for paint finish: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges. Use this level of finish to minimize joint photographing, in long corridors, and where severe lighting occurs.
- .16 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .17 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .18 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .19 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .20 Mix joint compound slightly thinner than for joint taping.
- .21 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
- .22 Allow skim coat to dry completely.
- .23 Remove ridges by light sanding or wiping with damp cloth.

- .24 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 41 00 – Structural Metal Stud Framing
- .2 Section 05 50 00 - Metal Fabrications
- .3 Section 06 10 00 - Rough Carpentry
- .4 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C645-13, Standard Specification for Nonstructural Steel Framing Members.
 - .2 ASTM C754-11, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Environmental Choice Program (ECP).
 - .1 CCD-047-05, Architectural Surface Coatings.
 - .2 CCD-048-06, Surface Coatings - Recycled Water-borne.

1.3 ADMINSTRATIVE REQUIREMENTS

- .1 Convene pre-installation meetings one week prior to beginning work of this Section in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation conditions.
 - .3 Co-ordinate with other building subtrades.
 - .4 Review manufacturer's instructions.

1.4 QUALITY ASSURANCE

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645, stud sizes as indicated on Drawings, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Use 0.75 mm heavy weight framing to support fire rated door frames. Knock-out service holes at 460 mm centres.
- .2 Runners: Width, gauge and galvanizing to match steel studs, and as follows:
 - .1 Double Runner Deflection Track: Outside runner using 50 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.
 - .2 Slotted Deflection Track for Fire Separations: Premanufactured slotted top runner with 63 mm down standing legs and having 6 mm wide x 38 mm high slots spaced at 25 mm o/c along length of runner; tested and certified for use in fire rated wall construction.
 - .1 Base Runner: Bottom track with 33 mm upstanding legs.
- .3 Metal channel stiffener: sizes as required, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Acoustical sealant: to Section 07 92 00.
- .5 Insulating strip: rubberized, moisture resistant 3 mm thick cork or foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.
- .6 Fasteners for Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

Part 3 Execution

3.1 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .3 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to bottom track using screws.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

- .9 Install heavy gauge (1.52 mm thick) single jamb studs at openings.
- .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Extend partitions to ceiling height except where noted otherwise on drawings.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks. Use double track slip joint as indicated.
- .16 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .17 Install two continuous beads of acoustical sealant or continuous insulating strip under studs and tracks around perimeter of sound control partitions.

3.2 STEEL STUD HEIGHT SCHEDULE

Maximum Stud Height (mm) based on lateral pressure of 240 Pa with deflection limit of L/240

Stud Spacing O.C.	300	400	600	300	400	600
Stud Depth (mm)	0.48 mm Steel Design Thickness			0.88 mm Steel Design Thickness		
64	3630	3430	3230	4240	3910	3530
92	4670	4370	4090	5440	5000	4500
102	5000	4670	4320	6070	5590	5000
152	6730	6020	5110	8150	7470	6580

Based upon tests with 13mm gypsum board both sides with screw fasteners spaced at 300 mm o.c. Heights also apply to greater gypsum board thickness and multiple gypsum board layers.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 07 21 13 – Board Insulation
- .3 Section 07 26 00 – Vapour Retarders
- .4 Section 07 62 00 – Sheet Metal Flashing and Trim
- .5 Section 07 92 00 – Sealants
- .6 Section 09 21 16 – Gypsum Board Assemblies
- .7 Section 09 91 99 – Painting for Minor Works

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .2 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar
 - .3 ASTM C150/C150M-12, Standard Specification for Portland Cement
 - .4 ASTM C847-12, Standard Specification for Metal Lath
 - .5 ASTM C897-05(2009), Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters
 - .6 ASTM C926-14a, Standard Specification for Application of Portland Cement-Based Plaster
 - .7 ASTM C933-13, Standard Specification for Welded Wire Lath
 - .8 ASTM C1063-14b, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
 - .9 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A179-94, Mortar and Grout for Unit Masonry.
 - .2 CSA A3000-03, Cementitious Materials Compendium
 - .3 CSA A8/A5/A362-93, Portland Cement / Masonry Cement / Blended Hydraulic Cement.
- .3 Northwest Wall and Ceiling Bureau (NWCB)
 - .1 AWCB Stucco Resource Guide
- .4 Portland Cement Association (PCA)
 - .1 Portland Cement Plaster/Stucco Manual

1.3 ADMINSTRATIVE REQUIREMENTS

- .1 Convene pre-installation meetings one week prior to beginning work of this Section in accordance with Section 01 01 50 – General Instructions, Project Meetings to:

- .1 Verify project requirements.
- .2 Review installation conditions.
- .3 Co-ordinate with other building subtrades.
- .4 Review manufacturer's instructions.
- .5 Confirmation of drainage requirements.
- .6 Confirmation of reinforcement at corners and wall intersections.
- .7 Coordination of interior and exterior crack control measures.
- .8 Confirmation of methods for controlling efflorescence during construction.
- .9 Location of sample panels.
- .10 Review of submitted parging samples.
- .11 Review of hot and cold weather requirements.

1.4 SUBMITTALS

- .1 Provide requested information in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
- .2 Product data:
 - .1 Submit manufacturer's technical product literature and specifications and indicate actual proprietary components used for project, installation instructions and recommendations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada.
- .3 Samples:
 - .1 Samples: Submit 400 mm x 400 mm panel for verification of colour and texture. Prepare sample using same tools and techniques for actual project application. Sample panel to be approved by the Departmental Representative prior to proceeding with work.
- .4 Submit proposed mix proportions and sand analysis report.
- .5 Submit compressive strength reports on the proposed parging mix(es). Submit statements of material properties indicating compliance with specified requirements for each type and size of the following:
 - .1 Cementitious Materials:
 - .1 Include brand, type, and name of manufacturer for site mixed mortar materials.
 - .2 Include description of type and proportions of ingredients for pre-blended, dry mortar mixes.
 - .3 Include description of type and proportions of ingredients for grout mixes.
 - .2 Accessories:
 - .1 Metal accessories.
- .6 Submit detailed description of methods, materials, and equipment used in accordance with cold or hot weather requirements; and proposed parging cleaning techniques.

1.5 QUALITY ASSURANCE

- .1 Before starting parging work establish mix proportions based on the limitations set out in Table 2 of CSA A179.
- .2 Test laboratory prepared samples of the proposed parging for compressive strength in accordance with CSA A179.
- .3 Have this testing done by a laboratory approved by Departmental Representative.
- .4 Include the cost of the testing specified above in the Contract Price.

1.6 MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .2 Construct mock up on typical exterior wall and incorporating:
 - .1 Joints to demonstrate aesthetic, control and expansion joint construction.
 - .2 Construction at changes in substrate.
 - .3 Construction at corner stop.
 - .4 Construction at fascias.
 - .5 Construction at both large and small penetrations.
 - .6 Colour, texture and finish.
- .3 Construct mock-up where directed.
- .4 Allow 24 hours for review of mock-up by Departmental Representative before proceeding with work.
- .5 When accepted, mock-up will demonstrate minimum standard for work, and may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Store parging units on elevated platforms in a dry location.
- .2 Stack materials on floors of building so that structural design loads are not exceeded; coordinate with Departmental Representative.
- .3 Cover tops and sides of stacks with waterproof sheeting securely tied to pallets if units are not stored in an enclosed location; do not install parging units until they are dry where they become wet.
- .4 Store cementitious materials on elevated platforms, under cover, and in a dry location; do not use cementitious materials that have become wet or damp.
- .5 Store aggregates where grading and other required characteristics can be maintained; store to prevent contamination by substances deleterious to performance and appearance.
- .6 Deliver pre-blended, dry mortar mix in moisture resistant containers designed for lifting and emptying into dispensing silo; store dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

- .7 Store parging accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- .1 Protection of Parging:
 - .1 Protect parging and other work from marking and other damage.
 - .2 Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work during construction until permanent flashings and membranes are completed.
 - .3 Cover partially completed parging when construction is not in progress to prevent wetting of inside wythes of construction and contribution to efflorescence.
 - .4 Extend cover a minimum of 610 mm down both sides and hold cover securely in place.
 - .5 Secure cover a minimum of 610 mm down face next to un-constructed wythe and hold cover in place where 1 wythe of multi-wythe parging walls is completed in advance of other wythes.
- .2 Stain Prevention:
 - .1 Use non-staining coverings.
 - .2 Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - .3 Protect adjacent surfaces and Work from damage during cleaning of parging.
- .3 Cold Weather Requirements:
 - .1 Do not use frozen materials or materials mixed or coated with ice or frost.
 - .2 Do not build on frozen substrates.
 - .3 Remove and replace parging damaged by frost or by freezing conditions.
 - .4 Comply with cold weather construction requirements contained in reviewed submittals and as follows:
 - .1 Keep materials from freezing and free from ice when air temperature has dropped below 0°C.
 - .2 Build parging in heated enclosures heated using smokeless enclosed flame heaters when temperature remains below 0°C.
 - .3 Keep materials above 5°C during installation and until batch is used.
 - .4 Prevent Work from freezing for a minimum of 48 hours by heated enclosure.
 - .5 Protect parging from frost heave and other forces to which it would normally not be subject after completion of the Work.

- .5 Cold Weather Cleaning:
 - .1 Use liquid cleaning methods only when air temperature is 4°C and above and will remain so until parging has dried, but a minimum of 7 days after completing cleaning.
 - .2 Do not clean parging when wet weather conditions prevent rapid drying of cleaned surfaces.
- .4 Hot Weather Requirements:
 - .1 Comply with hot weather construction requirements contained in reviewed submittals.
 - .2 Protect freshly laid parging from drying too rapidly, by means of waterproof, non-staining coverings.
 - .3 Keep parging dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until parging work is completed and protected by flashings or other permanent construction.

Part 2 Products

2.1 MATERIALS

- .1 Cementitious Materials: In accordance with CSA A179, and as follows:
 - .1 Portland Cement: In accordance with CSA A3000 Type: 10; Colour: Grey.
 - .2 Masonry Cement: In accordance with CSA A8.
 - .3 Quick Lime: In accordance with ASTM A5.
 - .4 Hydrated Lime: In accordance with ASTM C207; Type S or SA
 - .5 Supplementary cementing materials: in accordance with CAN/CSA A3000.
- .2 Aggregates: In accordance with CSA A179, and as follows:
 - .1 Mortar Aggregates:
 - .1 Use same brands of materials and source of aggregate for entire project.
 - .2 Use washed aggregate consisting of natural sand or crushed stone for mortar that is exposed to view.
 - .3 Use aggregate graded with 100% passing the No. 16 (1.18-mm) sieve for joints less than 6 mm thick.
 - .2 Grout Aggregates: In accordance with CSA A179.
- .3 Water: Potable in accordance with CSA A179.
- .4 Grout: In accordance with CSA A179, Table 3.

- .5 Metal Lath: Diamond self-furring expanded mesh 6mm minimum mass 0.98 kg/m² galvanized finish. Maximum mesh opening 25.8 cm².
- .6 Fasteners: hot dip galvanized anchors and plates with high pull out and shear strength and as recommended by parging manufacturer.

2.2 ACCESSORIES

- .1 Sealants: Refer to Section 07 92 00.
- .2 Flashing: Refer to Section 07 62 00.
- .3 Rigid insulation: Refer to Section 07 21 13.
- .4 Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless approved in writing by the Departmental Representative, and as follows:
 - .1 Do not use calcium chloride in parging.
 - .2 Limit cementitious materials in mortar to portland cement and lime.
 - .3 Limit cementitious materials in mortar for exterior and reinforced parging to portland cement and lime.

2.3 PARGING MIX

- .1 Measure and mix all parging to conform to CSA A179.
- .2 Make volume measurements by using a suitably gauged hopper of a size compatible with the size of the batch of parging to be prepared, by the use of a gauge box of unit volume or by other suitable means. Keep the volume measures clean and free from crust.
- .3 Use shovel batching only where the volumes used are checked against a gauge box a minimum of twice daily. Where shovel count is used in place of a hopper, keep a gauge box at the mixing station at all times.
- .4 Mix the dry material completely in a suitable mechanical mixer for a period of not less than 3 minutes and not more than 10 minutes, with the amount of water required to produce the desired workability.
- .5 Use hand mixing only if approved in writing by the Departmental Representative.

Part 3 Execution

3.1 FLASHING INSTALLATION

- .1 Install embedded flashing in obstructions to downward flow of water in wall, and where indicated.
- .2 Install flashing as follows:
 - .1 Prepare parging surfaces so they are smooth and free from projections that could puncture flashing.
 - .2 Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with parging.

- .3 Extend flashing 150 mm at ends and turn up a minimum of 50 mm to form end dams at heads and sills.

3.2 PARGING INSTALLATION

- .1 Install metal lath with long dimension horizontally.
- .2 Horizontal and vertical joints to be overlapped minimum 50 mm.
- .3 Install fasteners vertically at 150 mm centres and horizontally at 400 mm centres or vertically at 100 mm and horizontally at 600 mm. Provide not less than 20 fasteners for every square metre of wall surface.
- .4 Install exterior corners reinforced with vertical strip of metal lath extending 150 mm on both sides of corner.
- .5 Parge exterior faces of below grade parging walls in 2 uniform coats to a total thickness of 19 mm.
- .6 Dampen wall before applying first coat and scarify first coat to enhance bond of subsequent coat.
- .7 Use a steel trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 3 mm in 305 mm.
- .8 Form a wash at top of parging and a cove at bottom.
- .9 Damp cure parging for a minimum of 24 hours and protect parging until cured.

3.3 FIELD QUALITY CONTROL

- .1 During construction one or more of the following tests will be carried out at the discretion of the Departmental Representative: determination of the proportions used at the site by volume measurement; wet sieve analysis of the parging mix and compressive strength tests of job-mixed parging in accordance with CSA A179.
- .2 The cost of field quality control testing shall be included in Contract Price. The frequency of testing and the testing laboratory used shall be at the Departmental Representative's discretion.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 07 92 00 – Sealants
- .2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
 - .1 ANSI/CTI (Ceramic) A108/A118/A136.1-2013, Specification for the Installation of Ceramic Tile - A Collection of 20 ANSI/CTI A108 Series Standards on Ceramic Tile Installation: A108.1A-C, 108.4 - .13, A118.1-.10, ANSI A136.1.
 - .2 CTI (Ceramic) A118.3-2013, Specifications for Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1-2013).
 - .3 CTI (Ceramic) A118.4-2012, Specifications for Latex Portland Cement Mortar (included in ANSI A108.1-2013).
 - .4 CTI (Ceramic) A118.5-1999, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1-2013).
 - .5 CTI (Ceramic) A118.6-2010, Specification for Ceramic Tile Grouts (included in ANSI A108.1-2013).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.
 - .2 ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .3 ASTM C979/C979M-16, Standard Specification for Pigments for Integrally Coloured Concrete.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-75.1-M88, Tile, Ceramic.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA-A3000-13, Cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014).
- .5 International Organization for Standardization (ISO)
 - .1 ISO 13007:2014, Classifications for Adhesives and Grouts.
- .6 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 Tile Council of North America (TCNA)
 - .1 2015 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation.

- .8 Terrazzo Tile and Marble Association of Canada (TTMAC)
 - .1 Tile Specification Guide 09 30 00, 2012-2014, Tile Installation Manual.
 - .2 Hard Surface Maintenance Guide.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Preconstruction Meeting: Arrange a preconstruction meeting in accordance with Section 01 01 50 – General Instructions, Project Meetings attended by Contractor, Departmental Representative, and tile installer to discuss the following:
 - .1 Substrate and backing surfaces flatness requirements.
 - .2 Installation techniques associated with specified materials.
 - .3 Compatibility between specified materials and between adjacent materials.
 - .4 Concerns arising from site conditions.
 - .5 Concerns of installers or suppliers arising from as-constructed conditions.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals Procedures:
 - .1 Include manufacturer's information on:
 - .1 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Mortar and grout.
 - .3 Divider strip.
 - .4 Reinforcing tape.
 - .5 Fasteners.
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals Procedures:
 - .1 Tile: Submit actual tile samples illustrating colour, texture, size and pattern for each type of tile specified.
 - .2 Grout: Submit manufacturer's full range of colours available for each type of grout specified.
 - .3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
 - .4 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions, Closeout Submittal.
- .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
- .3 Maintenance material same production run as installed material.

1.6 QUALITY ASSURANCE

- .1 Conform to requirements of Terrazzo, Tile and Marble Association of Canada (TTMAC), Tile Specification Guide 09 30 00, 2012-2014, Tile Installation Manual.
- .2 Obtain each type of tile material required from single source. For colour consistency, ensure the supplier has capacity to provide products from the same production run, dye lot, calibre and batch number.
- .3 Obtain setting and grouting materials from one manufacturer to ensure compatibility.
- .4 Installer Qualifications: Specializing in tile work having minimum of 5 years successful documented experience with work comparable to that required for this project. Installer must be registered as a member in good standing with the Terrazzo, Tile and Marble Association of Canada.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- .2 Store materials so as to prevent damage or contamination.
- .3 Store materials in a dry area, protected from freezing, staining and damage.
- .4 Store cementitious materials on a dry surface.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

1.9 SITE CONDITIONS

- .1 Surfaces for tile installation must be clean, dimensionally stable, cured, level, plumb and free of contaminants such as oil, sealers and curing compounds.
- .2 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation. Tile and setting material stored at same conditions 48 hours before and 7 days after application.
- .3 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .4 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

Part 2 Products

2.1 MATERIALS

- .1 Factory blend tile that exhibits colour variations within the ranges selected and package so tile units taken from one package show the same range in colours as those taken from other packages.

- .2 Provide tile products manufactured in accordance with CAN/CGSB 75.1 or ANSI A108.1 as appropriate to the Basis-of-Design Materials.

2.2 TILE MATERIALS

- .1 Wall Tile: to CAN/CGSB-75.1, and as follows:
 - .1 Colour, Finish, and Size: to be selected by Departmental Representative.

2.3 MORTAR AND ADHESIVE MATERIALS

- .1 Mortar to be of the following properties unless otherwise specified:
 - .1 Cement: Grey meeting requirements of CSA A3000.
 - .2 Sand: to ASTM C144, passing 16 mesh.
 - .3 Hydrated lime: to ASTM C207, Type N.
 - .4 Latex additive: formulated for use in cement mortar and thin set bond coat.
 - .5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.
 - .6 Mortars and Adhesives:
 - .1 Maximum VOC limit 65 g/L to SCAQMD Rule 1168.
- .2 Thin Set Mortar: single-component, modified, non-sagging, dry-set lightweight cement mortar with polymer and complying with ANSI A118.4, A118.11 and ISO 13007 C2TES1P1.

2.4 GROUT

- .1 Colouring Pigments:
 - .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
 - .2 Colouring pigments to be added to grout by manufacturer.
 - .3 Job coloured grout are not acceptable.
 - .4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.
- .2 Ready-to-Use Grout: Professional-grade, ready-to-use colour consistent quartz aggregate, for use with grout joints 1.5 to 12 mm.
 - .1 Colour: Colours to match materials, confirm colour with Departmental Representative prior to ordering.
 - .2 Performance Requirements:
 - .1 Chemical Resistance: pass ASTM C267
 - .2 Vertical Sag in Joints: pass ANSI A118.3; no noticeable change in joint shape.
 - .3 Cleanability: passes ANSI A118.3
 - .4 Compressive Strength: 33.9 MPa when tested to ANSI A118.6
 - .5 Hardness at 72 hours (Shore A): 85
- .3 Grout:
 - .1 Maximum VOC limit 65 g/L to SCAQMD Rule 1168.

2.5 ACCESSORIES

- .1 Trim shapes:
 - .1 Conform to applicable requirements of adjoining wall tile.
 - .2 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.
 - .3 Height and profile: to suit installation
 - .4 Materials, colours, and finishes: to be confirmed with Departmental Representative.
- .2 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
 - .1 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.

2.6 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Protect surrounding work from damage or disfiguration arising from work of this Section.
- .2 Surfaces: Thoroughly clean substrate surfaces receiving tile finishes to remove grease, oil or dust films, and other contaminants affecting bond of materials within bonding systems and as follows:
 - .1 Clean back of each tile before installation to remove surface contaminants and cutting residue, firing release dust and other debris detrimental to bond and final surface appearance.
- .3 Surface Levelling: apply self levelling compound to make backing surfaces flat and true to tolerances in plane listed in performance requirements above and as required by TTMAC.

3.3 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.

- .3 Back Buttering: Obtain minimum 95% mortar coverage in accordance with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108 series of tile installation standards for the following applications:
 - .1 Tile having tiles 305 mm or larger in any direction.
 - .2 Tile having tiles with raised or textured backs.
 - .3 All porcelain tiles with more than 20% of the tile backs covered with "white firing release" shall be "back buttered" so that 100% of the back is covered with adhesive mortar rated for C627, Extra Heavy Duty rating.
- .4 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .5 Maximum surface tolerance 1:800.
- .6 Make joints between tile uniform, plumb, straight, true, even and flush with adjacent tile. Confirm joint width with Departmental Representative. Ensure sheet layout not visible after installation. Align patterns.
- .7 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .8 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .9 Install metal edge strip to finish tile edges in accordance with manufacturer's instructions.
- .10 Allow minimum 24 hours after installation of tiles, before grouting.
- .11 Clean installed tile surfaces after installation and grouting cured.
- .12 Install prefabricated control and movement joints in tile Work in accordance with detail 301EJ from TTMAC Installation Manual to suit installation indicated.
- .13 Locate expansion, control, contraction, and isolation joints, as indicated in the following table, unless specifically indicated otherwise on the Drawings:

Environment	Minimum	Maximum	Joint Width
Interior	4880 mm	6100 mm	6 mm
Interior/Sunlight	3660 mm	4880 mm	6 mm
Exterior/Normal	2440 mm	3660 mm	10 mm
Exterior/Excessive	2440 mm	3050 mm	13 mm

- .14 Fill control joints with sealant in accordance with Section 07 92 00 - Joint Sealants. Keep building expansion joints free of mortar and grout.

3.4 WALL TILE

- .1 Install in accordance with TTMAC details 302W, 303W, 304W, 305W, as suitable to substrate and application.

3.5 SEALER AND PROTECTIVE COATING

- .1 Apply manufacturer's recommended sealer in strict accordance with manufacturer's written instructions for the specific tile type being sealed.

- .2 Apply sealer to tiles before grouting in cases of absorbent biscuit tiles and again after completion and cleaning of grouting process.

3.6 FIELD QUALITY CONTROL

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

3.7 CLEANING

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 09 21 16 – Gypsum Board Assemblies
- .2 Division 23 Mechanical: HVAC
- .3 Division 26 Electrical: Lighting

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .2 ASTM C635/C635M-13a, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - .3 ASTM C636/C636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - .4 ASTM E1264-08e1, Standard Classification for Acoustical Ceiling Products.
 - .5 ASTM E1477-98a(2013), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
 - .6 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86., Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.

- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit duplicate full size samples of each type of acoustical unit.
 - .2 Include accessories and mitered interior and exterior corners of wall mouldings.

1.4 EXTRA MATERIALS

- .1 Provide extra materials of acoustic units in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.
- .2 Provide acoustical units amounting to 5% of gross ceiling area for each pattern and type required for project.
- .3 Ensure extra materials are from same production run as installed materials.
- .4 Clearly identify each type of acoustic unit, including colour and texture.
- .5 Deliver to Departmental Representative, upon completion of the work of this section.

1.5 QUALITY ASSURANCE

- .1 Single-Source Responsibility: Provide perimeter trim components, panels and grid components by a single manufacturer.
- .2 Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.
- .3 Regulatory Requirements:
 - .1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by Canadian Certification Organization accredited by Standards Council of Canada.

1.6 MOCK-UPS

- .1 Construct mock-ups in accordance with Section 01 01 50 – General Instructions, Quality Control.
- .2 Construct mock-up 10 m² minimum of each type of acoustical panel ceiling including one inside corner and one outside corner
- .3 Construct mock-up where directed.
- .4 Allow for review of mock-up by Departmental Representative before proceeding with ceiling work.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Reviewed mock-up may remain as part of the finished work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements and as follows:

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Store extra materials required for maintenance, where directed by Departmental Representative.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Permit wet work to dry before beginning to install.
- .2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20-40% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

2.2 MATERIALS

- .1 Acoustic Panels: conforming to ASTM E1264:
 - .1 Classification: Type III, Form 2, Pattern C E
 - .2 Material: wet-formed mineral fiber
 - .3 Surface Texture: medium
 - .4 Size: 610 mm x 1220 mm or as otherwise indicated on Drawings.
 - .5 Edge: square
 - .6 Colour: white
 - .7 Noise Reduction Coefficient (NRC): 0.55
 - .8 Flame Spread: Class A
 - .9 Ceiling Attenuation Class (CAC): 35
 - .10 Light Reflectance (LR): 0.83

2.3 ACOUSTICAL SUSPENSION SYSTEM

- .1 Heavy duty system to ASTM C635.
- .2 Basic materials for suspension system: commercial quality cold rolled steel.
- .3 Suspension system: non fire rated, exposed tee bar grid width as appropriate for materials specified.
- .4 Use only materials from same manufacturers of panel products.

- .5 Exposed tee bar grid components: shop painted satin sheen white. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
- .6 Hanger wire: galvanized soft annealed steel wire:
 - .1 3.6 mm diameter for access tile ceilings.
 - .2 2.78 mm diameter for other ceilings.
- .7 Hanger inserts: purpose made.
- .8 Carrying channels: 38 mm channel, of galvanized steel.
- .9 Accessories: splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.
- .10 Edge Mouldings and Trim: Sheet metal edge mouldings and trim selected from manufacturer's standard mouldings for edges and penetrations that fit specified acoustic panel edge and suspension system and as follows:
 - .1 Provide edge mouldings fabricated to diameter required to fit circular penetrations exactly.
 - .2 Provide edge mouldings and trims that match width and configuration of exposed runners including the following configurations:
 - .1 Sheet Metal Fillers: Light zinc coated sheet steel finished to match T-bar
 - .2 Shadow Mould: Rolled sheet metal, one piece, having 19 mm x 13 mm flange and reveal
 - .3 Wall Mould: Channel or angle shape with a 25 mm or 22 mm exposed face
- .11 System Accessories:
 - .1 Sealant: Acrylic type as specified in Section 07 92 00 for use in exposed locations, colour to match ceiling grid.

Part 3 Execution

3.1 EXAMINATION

- .1 Do not install acoustical panels and tiles until work above ceiling has been reviewed by 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 datasheets.

3.3 INSTALLATION OF SUSPENSION SYSTEM

- .1 Installation: in accordance with ASTM C636 except where specified otherwise.

- .2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.
- .3 Do not erect ceiling suspension system until all mechanical and electrical work above ceiling has been reviewed by Departmental Representative.
- .4 Secure hangers to overhead structure using attachment methods acceptable to Departmental Representative.
- .5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
- .6 Lay out system according to reflected ceiling plan.
- .7 Ensure suspension system is co-ordinated with location of related components.
- .8 Install wall moulding to provide correct ceiling height.
- .9 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers grilles and speakers.
- .10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .11 Interlock cross member to main runner to provide rigid assembly.
- .12 Finished ceiling system to be square with adjoining walls and level within 1:1000.
- .13 Expansion joints:
 - .1 Erect two main runners parallel, 25 mm apart, on building expansion joint line. Lay in strip of acoustic tile/board, painted black, 25% narrower than space between 2 'T' bars.
 - .2 Supply and install "Z" shaped metal trim pieces at each side of expansion joint. Design to accommodate plus or minus 25 mm movement and maintain visual closure. Finish metal components to match adjacent exposed metal trim. Provide backing plates behind butt joints.

3.4 INSTALLATION OF ACOUSTIC PANELS

- .1 Install acoustic panels and tiles in ceiling suspension system.

3.5 APPLICATION

- .1 Refer to reflected ceiling plan.
- .2 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

3.6 INTERFACE WITH OTHER WORK

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 06 40 00 – Architectural Woodwork
- .2 Section 07 92 00 – Sealants
- .3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM F1516-13, Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended).
 - .2 ASTM F1861-08(2012)e1, Standard Specification for Resilient Wall Base.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-13, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.3 SUBMITTALS

- .1 Provide product data in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Submit one copy of product data for each type of product specified.
 - .2 Submit WHMIS Material Safety Data Sheets (MSDS) for flooring adhesive and seam welding. Indicate VOC content.
- .2 Provide samples in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Submit 300 mm long base.
- .3 Closeout Submittals:
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions and guidelines for use of waxes and other protective coatings and appearance enhancers in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.

1.4 EXTRA MATERIALS

- .1 Provide extra materials of resilient base and adhesives in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.
- .2 Provide 5 m² of each colour, pattern and type of resilient material required for project for maintenance use.

- .3 Extra materials one piece and from same production run as installed materials.
- .4 Clearly identify each roll of flooring and each container of adhesive.
- .5 Store where directed by Departmental Representative.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Provide products that meet requirements of ULC S102.2 as applicable for required flame spread ratings; labelled and listed by Underwriters Laboratories of Canada (ULC), or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's instructions.
- .2 Deliver materials in good conditions to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- .3 Store materials in a clean, dry, enclosed space off the ground, and protect from the weather and from extremes of heat and cold. Protect adhesive from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- .4 Install materials after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

1.8 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

1.9 WARRANTY

- .1 Provide Manufacturers Warranty for product to be free from manufacturers defects for a period of five (5) years from date of substantial performance.

Part 2 Products

2.1 RESILIENT BASE

- .1 Resilient Base: to ASTM F1861, and as follows:
 - .1 Type: TS – Thermoset Vulcanized Rubber.
 - .2 Group: 1 – solid.
 - .3 Style: as directed by Departmental Representative.
 - .4 Thickness: 3.17 mm.

- .5 Height: as directed by Departmental Representative.
- .6 End Stops and External Corners: premoulded.
- .7 Colour: as directed by Departmental Representative.

2.2 ACCESSORIES

- .1 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
 - .1 Base adhesives:
 - .1 Adhesive: maximum VOC limit 50 g/L to SCAQMD Rule 1168.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION: 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.
- .8 Use toeless type base where floor finish will be carpet, coved type elsewhere.
- .9 Install toeless type base before installation of carpet on floors.
- .10 Heat weld base in accordance with manufacturer's printed instructions.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, Cleaning.
- .2 Remove excess adhesive from base and wall surfaces without damage.
- .3 Clean, seal and wax base surface to flooring manufacturer's printed instructions.

3.4 PROTECTION

- .1 Protect new base from damage.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 This Section includes requirements for seamless, resinous, decorative, broadcast vinyl chip, 100% solids, methyl methacrylate floor system.

1.2 RELATED SECTIONS

- .1 Section 03 35 00 – Concrete Finishing
- .2 Section 07 92 00 – Sealants

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.
 - .2 ASTM D2240-05(2010), Standard Test Method for Rubber Property – Durometer Hardness.
 - .3 ASTM D2794-93(2010), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - .4 ASTM D4060-10, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - .5 ASTM D7234-05, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Departmental Representative, installer, manufacturer's representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with project requirements.
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Initial Selection of Colours and Finishes: submit manufacturer's color charts showing full range of colors and finishes available.

- .2 Verification Sample: submit 150 mm x 150 mm samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.
- .3 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
- .5 Closeout Submittals: Submit in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.
 - .1 Submit copies of manufacturer's written maintenance information for inclusion in the operations manual including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.6 QUALITY ASSURANCE

- .1 Single-Source Responsibility: Obtain primary resinous flooring materials, including primers, resins, hardening agents, aggregates, finish or sealing coats from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- .2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:
 - .1 Manufacturers: Obtain primary materials from a single manufacture with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity.
 - .2 Applicators: Use experienced applicators as approved by materials manufacturer who have completed a minimum of ten (10) applications similar in material and extent to those indicated and whose work has a record of successful in service performance.
- .3 Regulatory Requirements: materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9001 registered quality system.

1.7 MOCK-UPS

- .1 Provide required mock-up in accordance with Section 01 01 50 – General Instructions, Quality Control and as follows:
 - .1 Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .2 Apply full-thickness mockups on 10 m² floor area selected by Departmental Representative.
 - .3 Include 1 m length of integral cove base.
 - .4 Reviewed mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Delivery materials to job site and check for completeness and shipping damage prior to starting work.
- .2 Provide materials that are factory blended and packaged in single, east to manage batches to eliminate site blending errors. Only the on-site weighing of catalyst is acceptable.
- .3 Store materials in a dry, enclosed area protected from exposure to moisture. Maintain temperature of storage area between 16°C and 30°C.

1.9 PROJECT CONDITIONS

- .1 Concrete Substrates: properly cured for a minimum of 30 days and tested to ensure relative humidity or water vapour emission rates are in accordance with manufacturer's recommendations. A vapor barrier or exterior applied waterproofing membrane must be present for concrete slabs below grade.
- .2 Provide utilities including electric, water, heat and lighting. Air temperature between 0°C and 30°C.
- .3 Job area to be free of other trades during, and for a period of 4 hours, after flooring system installation.
- .4 Protect finish flooring from damage by subsequent trades.

1.10 WARRANTY

- .1 Provide manufacturer's written warranty covering both material and workmanship for a period of one (1) one full year from date of Substantial Completion.

Part 2 Products

2.1 MATERIALS

- .1 Resinous Flooring System: nominal 3 mm, 100% solids, methyl methacrylate, decorative, vinyl chip broadcast flooring system. Comprised of a 100% solids, two component, methyl methacrylate primer, a three component 100% solids, filled, methyl methacrylate undercoat, a colour stable, decorative vinyl chip broadcast layer, and two coats of a 100% solids, clear, UV resistant, methyl methacrylate sealer.
 - .1 Physical Properties: Provide flooring system in which minimum physical properties of the complete system, including primers, fillers, aggregates, and sealers, and when tested in accordance with standards or procedures referenced below, are as follows:
 - .1 Tensile Strength (ASTM D638): 5900 psi
 - .2 Hardness (ASTM D2240, Shore D): 80
 - .3 Impact Resistance (ASTM D2794): > 160 in·lbs
 - .4 Abrasive Resistance (ASTM C4060, CS-17, 1 kg load, 1000 cycles): 0.06 gm max weight loss.
 - .5 Bond Strength (ASTM D7234): > 400 psi (100% concrete failure).
 - .6 Heat Resistance Limitation:

- .1 For continuous exposure: 60°C
- .2 For intermittent spills: 93°C
- .7 Cure Rate (at 25°C): allow 1 – 2 hours for tack-free surface. Allow 4 hours minimum for normal operations.
- .2 Colour: to be selected from manufacture's standard colours.

2.2 ACCESSORIES

- .1 Joint and Sealant Materials: type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

Part 3 Execution

3.1 PREPARATION

- .1 Concrete Substrate: prepare concrete by mechanical means including use of diamond grinder, sander, shotblast method and / or other mechanical means for removal of bond inhibiting materials such as curing compounds, dust, form release agents or laitance.
- .2 Provide concrete preparation to ICRI Concrete Surface Profile 3 minimum prior to coating application.

3.2 APPLICATION

- .1 General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic surface of thickness indicated, uninterrupted except at expansion joints or other types of joints indicated or required.
- .2 Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion.
- .3 Basecoat: Mix material according to manufacturer's recommended procedures. Apply 3 mm of basecoat material immediately after mixing using a properly gauged rake and spike rollers. Strict adherence to manufacturer's coverage rates shall be maintained.
- .4 Topcoat: Mix material according to manufacturer's recommended procedures. Topcoat material shall be applied in two coats at 6-8 mils per coat immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates shall be maintained.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .1 Schedule site visits to review Work at stages listed:

- .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .2 The right is reserved to invoke the following material testing procedures at any time, and any number of times during period of flooring application.
- .1 Departmental Representative may engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.
 - .2 Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
 - .3 Engage service of an independent coating inspector to perform core tests to verify installation thickness meets the requirements of the specification. Installer shall repair to the Departmental Representative's satisfaction any damage in the flooring system.
 - .4 If test results show materials being used do not comply with specified requirements, flooring contractor may be directed by Departmental Representative to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CURING, PROTECTION AND CLEANING

- .1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 4 hours after application.
- .2 Protect flooring system from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. Be responsible for protection and cleaning of surfaces after final coats.
- .3 Cleaning: Remove temporary covering and clean resinous flooring system prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring system manufacturer. Be responsible for cleaning of the surfaces prior to inspection.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Provide labour, materials, tools and other equipment, services and supervision required to complete interior and exterior, including above roof, painting and decorating work.
- .2 Surface preparation for this section will be limited to priming and back-priming, and specific pre-treatments noted in this section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.

1.2 RELATED REQUIREMENTS

- .1 Other sections of the specification requiring painting refer to this section. Coordinate requirements of referencing sections.

1.3 REFERENCE STANDARDS

- .1 Environmental Choice Program (ECP):
 - .1 Paints and Surface Coatings, Low VOC Product Listings
- .2 The Master Painters Institute (MPI):
 - .1 New Surfaces: Architectural Painting Specification Manual.
 - .2 Existing Surfaces: Interior Maintenance Repainting Manuals.
- .3 The Society for Protective Coatings (SSPC):
 - .1 Coating Materials Guidelines
 - .2 Surface Preparation Guidelines
 - .3 Application, Inspection and Quality Control Guidelines

1.4 DEFINITIONS

- .1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows, and are used on Drawings to designate required gloss levels for indicated areas:
 - .1 G2 – Velvet: Matte to low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 0 to 10 when measured at 60°.
 - .2 G3 – Eggshell: Low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 10 to 25 when measured at 60°.
 - .3 G4 – Satin: Low to medium sheen with a gloss range of minimum 35 when measured at 85° to meter and 20 to 35 when measured at 60°.
 - .4 G5 – Semi-Gloss: Medium sheen finish with a gloss range of 35 to 70 when measured at 60° to meter.

1.5 SUBMITTALS

- .1 Provide required information in accordance with Section 01 01 50 – General Instructions, Submittals.

- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Product Data: Submit list of all painting materials used for the Work to the Departmental Representative for review prior to ordering materials for each paint system indicated, including block fillers and primers:
 - .1 Material List: An inclusive list of required coating materials indicating each material and cross reference specific coating, finish system, and application; identify each material by manufacturer's catalogue number and general classification.
 - .2 Base Information: Confirmation of manufacturer's ability to supply paint in a variety of base tints, specific to the range of colours being used on this project; indicate colour of base tint used and amount of colourant added to establish Scheduled colours.
 - .3 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
 - .2 Samples: Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application, and as follows:
 - .1 Samples for Verification: When requested by the Departmental Representative, provide samples for each colour and material, with texture to simulate actual conditions, on representative samples of the actual substrate as follows:
 - .1 Painted Wood: 200 mm long or square samples for each colour and material on representative sample wood used for the Work.
 - .2 Painted Gypsum Board: 200 mm long or square samples for each colour and material.
 - .3 Painted Metal: 3 mm plate steel for finishes over metal surfaces.
 - .4 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .3 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:
 - .1 Certification: Submit certification reports for paint products indicating that they meet or exceed low VOC and coloured base requirements listed in this Section.
 - .2 Purchase Orders: Retain purchase orders, invoices and other documents for verification of compliance with specification and design requirements.

1.6 PROJECT CLOSEOUT SUBMISSIONS

- .1 Operation and Maintenance Data: Submit copies of paint manufacturer's written maintenance information for inclusion in the operations manual in accordance with Section 01 01 50 – General Instructions, Closeout Submittals including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.7 QUALITY ASSURANCE

- .1 Conform to the standards contained in the MPI Manual.
- .2 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in service performance, and as follows:
 - .1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.
 - .2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.
 - .3 Only qualified journeymen who have a Tradesman Qualification Certificate of Proficiency shall be engaged in painting and decorating work.
 - .4 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Conform to MPI Manual and manufacturer's requirements.
- .2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.
- .3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.
- .5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.
- .6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.
- .7 Set aside and protect surplus and uncontaminated finish materials not required by the Departmental Representative and deliver or arrange collection for verifiable re-use or re-manufacturing.

Part 2 Products

2.1 MATERIALS

- .1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.
- .3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.
- .4 Colour: to be selected by Departmental Representative after Contract Award.
- .5 Gloss Levels: general gloss levels as follows, confirm prior to painting:
 - .1 Ceilings: Flat
 - .2 Walls: eggshell

Part 3 Execution

3.1 PREPARATION OF SURFACES

- .1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

3.2 APPLICATION

- .1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.
- .2 Paint surfaces requiring paint or stain finish to Premium MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.
- .3 Continue paint finishes through behind wall mounted items.
- .4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

3.3 EXTERIOR PAINTING

- .1 Unless otherwise specified, all exterior painting work to be in accordance with MPI Premium Grade finish requirements.
- .2 Structural Steel and Metal Fabrications:
 - .1 EXT 5.1L – Polyurethane, Pigmented (over organic zinc rich and high build epoxy).

- .3 Steel - High Heat: heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted:
 - .1 EXT 5.2A - Heat resistant enamel finish, maximum 205 °C
 - .2 EXT 5.2B - Heat resistant aluminum enamel finish, maximum 427 °C
 - .3 EXT 5.2C - Inorganic zinc rich coating, maximum 400 °C
 - .4 EXT 5.2D - High heat resistant coating, maximum 593 °C
- .4 Galvanized Metal: not chromate passivated:
 - .1 EXT 5.3B - Alkyd semi-gloss finish (over cementitious primer).
- .5 Bituminous Coated Surfaces: cast iron pipe, concrete, etc.:
 - .1 EXT 10.2A - Latex semi-gloss level finish.

3.4 INTERIOR SURFACES

- .1 Unless otherwise specified, all interior painting work to be in accordance with MPI Premium Grade finish requirements.
- .2 Structural steel and metal fabrications: columns, beams, joists:
 - .1 INT 5.1R - High performance architectural latex semi-gloss level finish.
- .3 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):
 - .1 INT 5.2A - Heat resistant enamel finish, maximum 205 degrees C.
 - .2 INT 5.2B - Heat resistant aluminum paint finish, maximum 427 degrees C.
 - .3 INT 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.
 - .4 INT 5.2D - High heat resistant coating, maximum 593 degrees C.
- .4 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
 - .1 INT 5.3B - Waterborne light industrial semi-gloss level coating.
- .5 Dressed Lumber (including doors, door and window frames, casings, mouldings, etcetera):
 - .1 INT 6.3E – Polyurethane varnish (over stain).
- .6 Plaster and Gypsum Board (gypsum board, drywall, and other sheet gypsum materials):
 - .1 INT 9.2B - High performance architectural latex gloss level as directed by Departmental Representative.
- .7 Bituminous coated surfaces: cast iron pipe, concrete, etc.:
 - .1 INT 10.2A - Latex semi-gloss level finish.

3.5 MAINTENANCE REPAINTING

- .1 Paint existing interior previously finishes surfaces in accordance with the MPI Manual painting systems listed in this section.

3.6 SITE QUALITY CONTROL

- .1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 1220 mm from the painted surface:
 - .1 Runs, sags, hiding or shadowing by inefficient application methods
 - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles
- .2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.
 - .1 Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - .2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - .3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)
- .3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Departmental Representative:
 - .1 Small affected areas may be touched up
 - .2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.
 - .3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

3.7 PROTECTION

- .1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.
- .2 Curing periods shall exceed the manufacturer's recommended minimum time requirements.
- .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.8 RESTORATION

- .1 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.
- .2 Clean, prime and re-paint all bolts, nuts and fasteners after torquing or re-tightening following specified paint finish.

- .3 Remove protective coverings and warning signs as soon as possible after operations cease.
- .4 Protect freshly painted surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

3.9 CLEANUP

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

- .1 Aluminum Association (AA)
 - .1 DAF 45-03(2009), Designation System for Aluminum Finishes.
- .2 American National Standards Institute (ANSI)
 - .1 NPA A208.1-2009, Particleboard Standard.
 - .2 NAP A208.2-2009, Medium Density Fiberboard (MDF) for Interior Applications.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM E84-14, Test for Surface Burning Characteristics of Building Materials.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA O151-09(R2014), Canadian Softwood Plywood.
- .6 Porcelain Enamel Institute (PEI)
 - .1 PEI 501, Appearance Properties of Porcelain Enamel.
 - .2 PEI 502, Mechanical and Physical Properties of Porcelain Enamel.
- .7 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .8 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-S706-09, Standard for Wood Fibre Thermal Insulation for Buildings.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content. Indicate VOC's:
 - .1 For caulking materials during application and curing.
 - .2 For adhesives.

- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frames or trim and accessories.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Marker Boards: Submit minimum 305 mm x 305 mm sample of porcelain enamel finish for each type of marker board required.
 - .2 Tackboards: Submit minimum 305 mm x 305 mm sample of face material in each colour required.
 - .3 Submit 300 mm long sample of trim in each finish type and colour.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Submit closeout data in accordance with Section 01 01 50 – General Instructions, Closeout Submittals.
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Surface burning characteristics of materials: listed and labelled by an organization accredited by Standards Council of Canada.
- .2 Engage an experienced installer who is an authorized representative of visual display board manufacturer for both installation and maintenance of the type of products required for this Project.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Extruded aluminum: aluminum Association alloy AA6063-T5. Minimum 1.5 mm wall thickness.

2.2 MARKER BOARDS

- .1 Face Sheet: Minimum 0.62 mm enamelling grade steel specifically processed for temperatures used in coating porcelain on steel to manufacturers standard process, and as follows:
 - .1 Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and colour cover coat.

- .2 Coat concealed face with a 2-coat process consisting of primer and ground coat.
- .2 Cover Coats: Provide manufacturer's standard, light coloured, special writing surface with gloss finish intended for use with erasable dry markers.
- .3 Core: Use any one of the following core materials to the manufacturer's standard:
 - .1 10 mm thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1 M 1.
 - .2 6 mm thick, tempered hardboard.
 - .3 13 mm gypsum board.
- .4 Backing Sheet: Use any one of the following backing materials to the manufacturer's standard:
 - .1 0.38 mm thick, aluminum sheet backing.
 - .2 0.127 mm thick, aluminum foil sheet backing.
 - .3 0.45 mm thick, galvanized steel sheet backing.
- .5 Laminating Adhesive: Manufacturer's standard, moisture resistant, thermoplastic type adhesive meeting requirements of SCAQMD Rule #1168.
- .6 Trim and Framing: Extruded aluminum to profiles indicated using manufacturer's standard sections appropriate for installation conditions.

2.3 TACKBOARDS

- .1 Linoleum Faced Tackboards: High pressure laminated, linoleum tackboards of 3 ply construction consisting of face sheet, core material, and backing and as follows:
 - .1 Face Sheet: 6 mm thick resilient linoleum tackable surface composed of granulated cork, linseed oil, rosin binders and calendared onto a jute backing with a coloured facing.
 - .2 Colour: selected by Departmental Representative from manufacturer's standard range.
 - .3 Core Material: 6 mm thick low density fibreboard or 8 mm thick particleboard to manufacturer's standard.
 - .4 Laminating Adhesive: Manufacturer's standard, moisture resistant, thermoplastic type adhesive meeting requirements of SCAQMD Rule #1168.
 - .5 Trim and Framing: fixed metal framing as follows:
 - .1 Stainless steel edge protection as directed by Departmental Representative.

2.4 ACCESSORIES

- .1 Chalk Trough: Manufacturer's standard, plate type, continuous for full length of each installation, complete with end closures and matching trim and frame materials.
- .2 Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.

- .3 Anchor clips, brackets and fasteners: concealed type recommended by manufacturer for fixed mounting

2.5 FABRICATION

- .1 Shop fabricated display boards in one piece for lengths 3600 mm or less, for longer sections colour match adjacent pieces.
- .2 Laminate display board and backing sheet to the core in accordance with the display board manufacturer's recommendations.
- .3 Install trim on panels in factory. Make mitres and joints to hair-line fit, free of rough edges with concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted.
- .4 Overlap trim 6 mm onto panels. Provide closed ends for chalktroughs and open-end extrusions.
- .5 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and site assembly.

2.6 FINISHES

- .1 Aluminum trim finishes:
 - .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Anodic finish: designation AA-M12C22A31.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Install display boards in accordance with manufacturer's instructions, parallel to floor, plumb and level, to provide rigid, secure surface.
- .2 Install trim and framing around display boards panels. Make mitres and joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted.
- .3 Mechanical attachment:
 - .1 To concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved.
 - .2 To hollow masonry use toggle bolts or equivalent.
 - .3 To wood or sheet metal use screws. Secure into framing members in stud walls.

3.3 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for supply and installation of curtain track systems and break-away curtains as indicated on Drawings.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

- .1 National Fire Protection Association (NFPA):
 - .1 NFPA 701-04, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- .2 Underwriters Laboratories Canada (ULC):
 - .1 CAN/ULC S109-03, Flame Tests of Flame Resistant Fabrics and Films

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit product data indicating durability, laundry temperature limits, fade resistance, fire test response characteristics for each type of curtain fabric specified, and data for each type of applied curtain treatment.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit shop drawings indicating layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, conditions requiring accessories, dimensions taken from field measurements, and details for blocking in ceiling construction.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Curtain Fabric: 300 mm square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
 - .2 Curtain Track: 100 mm long.
 - .3 Curtain Carrier: full unit.
- .4 Submit manufacturer certificates, signed by manufacturer certifying that products installed are in accordance with specified requirements and meet requirements of Authorities Having Jurisdiction.
- .5 Closeout Submittals: submit in accordance with Section 01 01 50 – General Instructions, Closeout Submittals and as follows:

- .1 Submit operation and maintenance data for curtains, track, and hardware for inclusion in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: Provide work of this Section by installers with minimum two years' experience in installation of cubicle track systems.
- .2 Provide components of this Section by one manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Products shall be delivered to the project site in manufacturer's original packaging.
- .2 Products shall be handed and stored to prevent damage to component materials and finishes.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 PROJECT CONDITIONS

- .1 Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- .2 Field Measurements: Where cubicles are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.9 WARRANTY

- .1 Provide manufacturer's standard warranty against manufacturer defects.

Part 2 Products

2.1 COMPONENTS

- .1 Curtain Track:
 - .1 Constructed of extruded 6063-T5 with minimum 1.6 mm wall thickness.
 - .2 Finish: satin anodized.
 - .3 Suitable for safety tab insertion for break-away drapery.
 - .4 Mounting and Layout: as indicated on Drawings.
 - .5 Track accessories: 100 mm long 19 mm wide safety tabs. Provide 3 safety tabs per 305 mm
- .2 Privacy Curtain:
 - .1 Description: Break-away type draperies as follows:

- .1 Performance Requirements: Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
- .2 100 mm box pleats, double lock stitched with 38 mm loop tape across the top for attachment to track safety tabs. Provide matching fabric reinforcement of top fold.
- .3 75 mm lock stitched bottom hem.
- .4 Maintain 600 mm clear at the bottom of all installations.
- .5 Provide 1400 mm high opaque fabric panels, typical.
- .6 Provide 70% open mesh fabric top, height varies per ceiling height, 450 mm minimum.
- .7 Colour: as directed by Departmental Representative.

2.2 ACCESSORIES

- .1 Provide cubicle track system complete with accessories including end sleeves, and stops. Factory form curved sections to radius indicated on Drawings and supply maximum track lengths, minimizing joints.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Install tracks level and plumb, according to manufacturer's written instructions.
- .2 Locate the cubicle track as indicated on the approved shop drawing for the appropriate substrate.
- .3 Install cubicle track secure, rigid and true to ceiling line.
- .4 Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
- .5 Curtain Carriers: Provide curtain carriers adequate for 150 mm spacing along full length of curtain plus an additional carrier.
- .6 Curtains: Hang curtains on each curtain track.

3.3 ADJUSTING AND CLEANING

- .1 Check and operate all moveable parts and ensure the equipment will function correctly as required. Make any adjustments or realignment necessary to ensure smooth trouble-free operation.
- .2 At completion of the Work, remove all tools and debris from job site and leave area clean.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 09 21 16 - Gypsum Board Assemblies

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data. Indicate VOC's:
 - .1 For caulking materials during application and curing.
 - .2 For adhesives.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate, by large scale details, materials, finishes, dimensions, anchorage and assembly.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit duplicate 300 mm long samples of profiles and colours for corner and door frame.
- .4 Manufacturer's Instructions.
 - .1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

.1 Wall Panels:

- .1 Type: fibre reinforced panel to USDA/FSIS and Canadian Food Inspection Agency and Agriculture Canada approved.
- .2 Dimensions: 2.4 mm thick x 1220 mm x 2440 mm
- .3 Texture: to be selected from manufacturer's standard.
- .4 Fire Rating: Class I/A
- .5 Colour: to be selected from manufacturer's standard.

2.2 ACCESSORIES

- .1 Adhesive: water resistant type as recommended by manufacturer for substrate.
- .2 Sealant: Manufacturer's recommended silicone sealant; colour matched to panels.
- .3 Fastenings: Nylon drive rivets or stainless steel screws as recommended by manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Install panels in accordance with manufacturer's written instructions; maintain a reference copy of installation instructions on site for review by installers and the Departmental Representative.
- .2 Position panels leaving a minimum 6 mm gap at ceiling and floor junction; minimum 3 mm gap between each panel and division bar moulding to allow for normal expansion and contraction; minimum 3 mm gap around pipes, electrical fittings, other projections; and pre-drill oversize by 3 mm holes ready for fastenings.
- .3 Cut and drill panels using a carbide tipped saw blade or drill bit; or cut with snips as recommended by manufacturer.
- .4 Pre-fit each panel before securing in place; leave leading edge of first panel unfastened; trim division bar to accommodate ceiling cove or base moulding:
 - .1 Apply bead of silicone sealant on one side of division bar and install on leading edge of first panel.

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- .2 Push division bar all the way onto panel and pull back to form a minimum 3 mm gap; confirm plumb; tack division bar using fasteners recommended by manufacturer.
 - .3 Fasten leading edge of first panel.
 - .5 Install fasteners at nominal 400 mm o.c. both horizontally and vertically. Maintain edge fasteners 25 mm from panel edge face.
 - .6 Stagger fasteners on opposing panel edges and corners next to a division bar to aid in maintaining tight, flat seam.
 - .7 Use combination of mechanical fasteners and adhesive to ensure flat surface, using compatible adhesives recommended by panel manufacturer prior:
 - .1 Fasten panel at top and work toward bottom or start at centre and work outward.
 - .2 After installation of first panel is completed remove excess sealant immediately.
 - .3 Apply bead of sealant in remaining channel of division bar.
 - .4 Install second panel into division bar.
 - .5 Pull panel back to leave a minimum 3 mm clearance.
 - .6 Check plumb.
 - .7 Remove excess sealant.
 - .8 Fasten second panel except for leading edge.
 - .9 Repeat previous steps until all panels are installed.
 - .8 Remove excess silicone sealant during installation.
 - .9 Seal corner seams, ceiling, and base junctions; install accessories as installation progresses, leaving a minimum 3 mm clearance for normal expansion and contraction of panels.
 - .10 Cut trims neatly, use only full length except where joins are permitted by Departmental Representative; tightly mitre trims at right angle corners; tightly cut trims at Tee junctions to maintain flush straight fit.

3.3 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 09 21 16 – Gypsum Assemblies

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A240/A240M-14, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - .2 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .3 ASTM F476-14, Standard Test Methods for Security of Swinging Door Assemblies.
 - .4 ASTM D543-14, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 01 50 – General Instructions, Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's:
 - .1 For sealant materials during application and curing.
 - .2 For adhesives.

- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Indicate, by large scale details, materials, finishes, dimensions, anchorage and assembly.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Submit duplicate 300 mm long samples of profiles and colours.
- .4 Submit closeout data in accordance with Section 01 01 50 – General Instructions, Closeout Submittals:
 - .1 Provide manufacturer’s printed recommendations for general maintenance and cleaning of each impact resistant wall protection unit for incorporation into operations and maintenance manuals.

1.5 QUALITY ASSURANCE

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

Part 2 Products

2.1 MATERIALS

- .1 Stainless Steel Sheet: ASTM A240.

2.2 CORNER GUARDS

- .1 Metal Corner Guards: Surface mounted, fabricated from single piece, formed metal with eased edges; bend angle turn to match wall condition and as follows:
 - .1 Material: Type 304 stainless steel, finish to be confirmed with Departmental Representative.
 - .2 Thickness: Minimum 1.21 mm.
 - .3 Size: 89 mm legs x height as indicated on Drawings.
 - .4 Corner: 19 mm radius for 90 degree corner and 3 mm radius for 135 degree corners.
 - .5 Mounting: tamper resistant fasteners and adhesive

2.3 WALL PROTECTION

- .1 Impact Resistant Wall Panels: engineered polyethylene terephthalate (PETG) wall panels, as follows:
 - .1 Thickness: 1.02 mm
 - .2 Size: 1220 mm x longest practical length.
 - .3 Fire performance: in accordance with CAN/ULC S202.2 and as follows:
 - .1 Flame Spread: 150 or less

- .2 Smoke Developed: 300 or less.
- .4 Impact Strength: tested to ASTM F476
- .5 Chemical and Stain Resistance: test to ASTM D543.
- .6 Texture: to be selected from manufacturer's standard.
- .7 Colour: to be selected from manufacturer's standard.

2.4 ACCESSORIES

- .1 Adhesive: water resistant type as recommended by manufacturer for substrate.
- .2 Fasteners: nonmagnetic stainless steel and other fasteners compatible with items being fastened. Use security type fasteners where exposed to view.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Install impact resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- .2 Install impact resistant wall protection units in locations and at mounting heights indicated on Drawings.
- .3 Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

3.3 CLEANING

- .1 Clean in accordance with manufacture's instructions.
- .2 Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A153/A153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A666-10, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .4 ASTM A924/A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - .5 ASTM A1008/A1008M-13, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .6 ASTM B16/B16M – 10, Standard Specifications for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
 - .7 ASTM B19 – 10, Standard Specification for Cartridge Brass Sheet, Strip, Plate, Bar, and Disks.
 - .8 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - .9 ASTM C1503 -08(2013), Standard Specification for Silvered Flat Glass Mirror.
- .2 Canadian Standards Association (CSA)
 - .1 CSA-B651-12, Accessible Design for the Built Environment.
 - .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.

- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Samples to be returned for inclusion into work.
- .4 Submit closeout data in accordance with Section 01 01 50 – General Instructions, Closeout Submittals:
 - .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.
 - .2 Include list of sources for disposable supplies, replacement parts and service recommendations.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

1.5 EXTRA MATERIALS

- .1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 01 50 – General Instructions, Closeout Submittals.
- .2 Deliver special tools to Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Sheet steel: to ASTM A653/A653M cold rolled, commercial quality, 0.912 mm minimum nominal thickness, with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A666, Type 304, finish as indicated in component list in 1.519 mm minimum nominal thickness.
- .3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.
- .4 Fasteners: concealed screws and bolts hot dip galvanized after fabrication, tamper and theft resistant exposed fasteners to match material of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

- .1 As indicated in Accessory Schedule on Drawings.

2.3 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

- .1 Chrome and nickel plating: to ASTM B456, finish as directed by Departmental Representative.
- .2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer to CAN/CGSB-1.81 and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88 and bake to hard, durable finish. Sand between final coats. Colour selected from standard range.
- .3 Labels: Non-exposed faces, provide maximum 38 mm diameter stamped manufacturer logo.

Part 3 Execution

3.1 PREPARATION

- .1 Verify wall thickness and construction that will accept recessed accessories.
- .2 Verify that solid blocking for support and anchoring of washroom accessories is installed where required. Confirm exact height and location with Departmental Representative and Manufacturers Instructions.
- .3 Verify that frames and anchors provided, whether by this Section or others, are correctly and securely installed ready to accept the accessory scheduled for the specific location.
- .4 Verify that painting is complete and dry in area of installation before accessories are installed.

3.2 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - .4 Toilet/shower compartments: use male/female through bolts.
- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry

1.2 REFERENCES

- .1 American Society of Testing and Materials (ASTM)
 - .1 ASTM A1008/A1008M-16, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .2 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .2 Canadian General Standard Board (CGSB)
 - .1 CAN/CGSB 1.300-2000, Applied Coating System of Semigloss Baked Finish for Metal Office Furniture.
 - .2 CAN/CGSB-44.40-2001 AMEND., Steel Clothing Locker.

1.3 COORDINATION

- .1 Coordinate size and location of prefabricated metal bases for metal lockers.
- .2 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related work specified in other Sections so that metal lockers can be supported and installed as indicated.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Indicate the following:
 - .1 Type and class of locker.
 - .2 Thickness of metal.
 - .3 Fabricating and assembly methods.
 - .4 Assembled banks of lockers.
 - .5 Tops, rods, hooks, bases, trim and numbers.
 - .6 Filler panels, end/back panels, doors, handles, locking method ventilation method and finishes.
 - .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.
- .3 Provide operation and maintenance data indicating adjustments, repair methods and replacement of locker doors and latching mechanisms for incorporation into

manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Installer to be an authorized representative of metal locker manufacturer for installation and maintenance of locker systems for this Project.
- .2 Obtain metal lockers and accessories through one source from a single manufacturer. Do not modify intended aesthetic appearance of metal lockers without the Departmental Representative's written approval; submit comprehensive explanatory data to Departmental Representative for review where modifications are necessary to meet project requirements before submission of Bids.

1.6 PROJECT CONDITIONS

- .1 Site Measurements: Verify location of concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed, and configuration of recessed openings by Site measurements before fabrication and indicate measurements on Shop Drawings.
- .2 Established Dimensions: Establish recessed opening dimensions and proceed with fabricating metal lockers without Site measurements where Site measurements cannot be made without delaying the Work. Coordinate wall and floor construction so that actual recessed opening dimensions correspond to established dimensions

1.7 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Cold Rolled Steel Sheet: Commercial Steel (CS) Type B in thicknesses indicated, suitable for exposed applications in accordance with ASTM A1008/A1008M.
- .2 Steel Plates, Shapes, and Bars: In accordance with CAN/CSA G40.20/G40.21, Grade 300W.
- .3 Fasteners: Zinc or nickel plated steel, slotless type exposed bolt heads, and self locking nuts or lock washers for nuts on moving parts.
- .4 Anchors: Select material, type, size, and finish required for secure anchorage to each substrate, as follows:
 - .1 Provide nonferrous metal or hot dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
 - .2 Provide toothed steel expansion sleeves for drilled-in-place anchors.

2.2 MANUFACTURED UNITS

- .1 Lockers: to CAN/CGSB-44.40, Type 2 - Double tier locker, Class 2 - A bank of two or more lockers, freestanding.
 - .1 Size: 305 mm wide x 460 mm deep x 1830 mm high.
 - .2 Steel Thickness: No.24 MSG.
 - .3 Assembly: welded
 - .4 Top: sloped.
 - .5 Doors: one-piece double-wall envelope construction steel thickness No .20 MSG, door swing left.
 - .6 Door handle: recessed handle steel with nickel-plated finish.
 - .7 Door Strike: Continuous.
 - .8 Hinges: Continuous concealed leaf fast pin type hinges, minimum 50 mm long opening 180°; fabricated from 1.519 mm base metal thickness steel securely fastened to door and frame and having non-removable pins.

2.3 ACCESSORIES

- .1 Locking system: padlocks hasps; padlocks supplied by others.
- .2 Options: to CAN/CGSB-44.40, hanger rods, steel with nickel-plated finish, steel base, steel end panels, steel trim including corner angles, jamb trim, fillers, number plates, coat hooks, metal nickel finish.
- .3 Base: Standard steel base as supplied by manufacturer.

2.4 FINISH

- .1 Two coats baked polyester enamel or powder coating to manufacturer's standard. Colour selected from manufacturer's standard colours.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine walls, floors, and support bases for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Assemble and install lockers in accordance with manufacturer's written instructions.
- .2 Securely fasten lockers to grounds and nailing strips.
- .3 Install wall trim around recessed locker banks.
- .4 Install filler panels (false fronts) where indicated and where obstructions occur.
- .5 Install finished end, back panels to exposed ends, backs of locker banks.

- .6 Install locker numbers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- .1 Clean, lubricate, and adjust hardware.
- .2 Adjust doors and latches to operate easily without binding.
- .3 Verify that integral locking devices operate properly.
- .4 Protect metal lockers from damage, abuse, dust, dirt, stain, or paint.
- .5 Do not permit metal locker use during construction.
- .6 Touch up marred finishes, or replace metal lockers that cannot be restored to factory finished appearance.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section includes the following: Mechanically assisted, carriage mounted high-density mobile storage units, support rails, fabrication, and installation including leveling of support rails.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 03 35 00 – Concrete Finishing
- .3 Section 09 67 23 – Resinous Flooring

1.3 REFERENCES

- .1 American Standards for Testing and Materials (ASTM)
 - .1 ASTM F3125/F3125M-15a, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
 - .2 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .3 ASTM D968-16, Standard Test Methods for Abrasion Resistance of Organic Coatings by the Falling Abrasive.
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels, Includes Update No.1 (2014).
 - .2 CAN3-O188.1-M78, Interior Mat-Formed Wood Particleboard.
 - .3 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40M-97, Primer, Structural Steel, Oil Alkyd Type
 - .2 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment
 - .3 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .4 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.
 - .5 CAN/CGSB 31-GP-107Ma-1990, Non-Inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

1.4 SYSTEM DESCRIPTION

- .1 General: The system consists of manufactured storage units mounted on manufacturer's track-guided carriages to form a compact storage system. System design permits access to any single aisle by manually moving units until the desired aisle is opened. The carriage/rail system provides uniform carriage movement along the total length of travel, even with unbalanced loads.

- .2 Carriage System Design and Features: The carriage system consists of a formed structural steel frame with machined and balanced wheels riding on steel rails surface mounted to the floor. Rails shall be types selected by the manufacturer to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding. Rail types, quantities and spacing shall be selected by the manufacturer to suit installation conditions and requirements. All bearings used in the drive mechanism shall be permanently shielded and lubricated.
- .3 Movement Controls: Triple or single arm operating wheels with rotating hand knobs shall be provided on the accessible (drive) ends of shelf units, centered on the end panel, located 1051 mm from the base of each unit to permit units to be moved to create a single aisle opening. Turning the handle transmits power through chain drive to drive wheels on each carriage.
- .4 Drive System: The system shall be designed with a positive type mechanically-assisted drive which minimizes end play, ensures there is no play in the drive handle, and that carriages will stop without drifting.
 - .1 System shall include a chain sprocket drive system for each movable carriage to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads. All system components shall be selected to ensure a smooth, even movement along the entire carriage length. Drive system gearing shall be designed to permit 0.45 kg of force applied to the drive handle to move a minimum of 1814 kg of load.
 - .2 A tensioning device shall be provided on each chain drive with provision for adjusting tension without removing end panels.
 - .3 All bearings used in the drive mechanism shall be permanently shielded and lubricated.
- .5 Safety Features:
 - .1 Color-coded visual indicators shall provide verification that carriages are in a locked or unlocked mode.
 - .2 A single safety lock button, mounted on each operating wheel hub, will permit moving a carriage in either direction to create a new access aisle when pulled out (unlocked), or locking the carriage when pushed in.
- .6 Finishes:
 - .1 Fabricated Metal Components And Assemblies: Manufacturer's standard powder coat paint finish.
 - .2 End Panels, Accessible Ends: Low Pressure Laminate

1.5 PERFORMANCE REQUIREMENTS

- .1 Design Requirements: Overall height and length as indicated on Drawings.
- .2 Ease of Movement: Provide mechanically assisted units capable of being moved by exerting a maximum horizontal force of 2.27 kg on the operating wheel.
- .3 Seismic Performance: Provide mobile storage units capable of withstanding the effects of earthquake movement when required by applicable building codes.

1.6 SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 – General Instructions, Submittals.
- .2 Product Data: Submit manufacturer's product literature and installation instructions for each type of shelving, track and installation accessory required. Include data substantiating that products to be furnished comply with requirements of the contract documents.
- .3 Shop Drawings: Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of installation layout including clearances, spacings, and relation to adjacent construction in plan, elevation, and sections. Indicate clear exit and access aisle widths; access to concealed components; assemblies, connections, attachments, reinforcement, and anchorage; and deck details, edge conditions, and extent of finish flooring within area where units are to be installed.
 - .1 Show installation details at non-standard conditions. Furnish floor layouts, technical and installation manuals for every unit shipment with necessary dimensions for rail layout and system configuration at the project site. Include installed weight, load criteria, furnished specialties, and accessories.
 - .2 Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures. Specifically include the following:
 - .1 Location, position and configuration of tracks on all floors.
 - .2 Plan layouts of positions of carriages, including all required clearances.
 - .3 Details of shelving, indicating method and configuration of installation in carriages.
 - .3 Provide location and details of anchorage devices to be embedded in or fastened to other construction.
 - .4 Provide installation schedule and complete erection procedures to ensure proper installation.
- .4 Samples: Submit to Departmental Representative minimum 76 mm square example of each color and texture on actual substrate for each component to remain exposed after installation.
- .5 Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts consisting of actual product pieces, showing full range of colors and textures available.
- .6 Warranty: Submit draft copy of proposed warranty for review by the Departmental Representative.
- .7 Maintenance Data: Provide in form suitable for inclusion in maintenance manuals for mobile storage units. Data shall include operating and maintenance instructions, parts inventory listing, purchase source listing, emergency instructions, and related information.
 - .1 Submit manufacturer's instructions for proper maintenance materials and procedures.

- .2 Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against using materials and methods that may be detrimental to finishes and performance.

1.7 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001 certified for the design, production, installation and service of carriage mounted high-density mobile storage units and support rails. Furnish certificate attesting manufacturer's ISO 9001 quality system registration.
- .2 Installer Qualifications: Engage an experienced installer who is a manufacturer's authorized representative for the specified products for installing carriages and anchoring shelving units to carriages.
 - .1 Minimum Qualifications: 1-year experience installing systems of comparable size and complexity to specified project requirements.
 - .2 Guaranteed 24-hour service response time.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Store shipped materials on site only after arrival of installation crew.
- .2 Installation personnel to arrange delivery of components on site as they are required to avoid components being stored on site.

1.9 PROJECT CONDITIONS

- .1 Field Measurements: Verify dimensions before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- .2 Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating mobile storage units. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.
- .2 Do not dispose of unused materials into landfill.
- .3 Divert unused materials from landfill to recycling facility.

1.11 SEQUENCING AND SCHEDULING

- .1 Sequencing: Coordinate storage shelving system installation with other work to minimize possibility of damage and soiling during remainder of construction period.
- .2 Scheduling: Plan installation to commence after finishing operations, including painting have been completed.

- .3 Built-In Items: Provide components which must be built in at a time which causes no delays general progress of the Work.
- .4 Pre-installation Conference: Schedule and conduct conference on project site to review methods and procedures for installing mobile storage units including, but not limited to, the following:
 - .1 Review project conditions and levelness of flooring and other preparatory work performed under other contracts.
 - .2 Review and verify structural loading limitations.
 - .3 Recommended attendees include:
 - .1 Departmental Representative.
 - .2 Construction Manager or representative.
 - .3 Manufacturer's representative.
 - .4 Subcontractors or installers whose work may affect, or be affected by, the work of this section.

1.12 WARRANTY

- .1 Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Departmental Representative may have under General Conditions provisions of the Contract Documents.
- .2 Warrant the entire movable compact shelving installation against defects in materials and workmanship for a period of five years from date of acceptance by the Department Representative.

Part 2 Products

2.1 MATERIALS

- .1 General: Provide materials and quality of workmanship which meet or exceed established industry standards for products specified. Material thicknesses/gauges are manufacturer's option unless indicated otherwise.
- .2 Plastic Laminates: NEMA LD-3, GP-28, Vertical Grade.
- .3 Grout: Provide non-shrink, non-staining hydraulic cement compound conforming to the following requirements, based on the performance of the test specimens at room temperature and in laboratory air.
 - .1 Linear Movement: No shrinkage while setting; maximum expansion limited to 0.1 mm per 25.4 mm.
 - .2 Compressive Strength: Based on 50 mm cubes made following ASTM standards, tested on a Balding-Southward machine of 27,216 kg capacity, meet or exceed the following:
 - .1 Age: 1 hour - 31026 kPa, 7 days – 55,158 kPa

2.2 MANUFACTURED COMPONENTS

- .1 Rails:

- .1 Material: ASTM/AISI Type 1035 or 1045 steel, manufacturer's selection.
 - .2 Capacity: 1385 kg/M of carriage.
 - .3 Minimum Contact Surface: 16 mm wide.
 - .4 Provide rail sections in minimum 1.83 m lengths.
 - .5 Rail configuration: permit attachment to top of structural floor system with provision for leveling rails to compensate for variations in floor surface level.
 - .6 Provide rail connections designed to provide horizontal and vertical continuity between rail sections, to gradually transfer the concentrated wheel point load to and from adjoining rail sections. Butt joints are not permitted.
 - .7 Anti-Tip Rail Form Covers: Manufacturer shall provide for protection if required to prevent damage to rails during concrete back pours.
- .2 Carriages:
- .1 Provide manufacturer's design movable carriages fabricated of welded or bolted steel construction. Galvanized structural components and/or riveted carriages are unacceptable.
 - .2 Provide fixed carriages of same construction and height as the movable carriages, anchored to rails. Setting fixed shelving directly on floors is not permitted.
 - .3 When required, provide bolted carriage splices designed to maintain proper unit alignment and weight load distribution.
 - .4 Design carriages to allow the shelving uprights to recess and interlock into the carriages a minimum of 19 mm. Top mount carriages are unacceptable.
 - .5 Provide each carriage with two wheels per rail.
- .3 Drive / Guide System:
- .1 Design: Provide drive system which prevents carriage whipping, binding and excessive wheel/rail wear under normal operation.
 - .1 If line shafts are used, all wheels on one side of carriage shall drive.
 - .2 Shafts: Solid steel rod or tube.
 - .3 Shaft Connections: Secured couplings.
 - .4 Bearing Surfaces: Provide rotating load bearing members with ball or roller bearings. Provide shafts with pillow block or flanged self-aligning type bearings.
- .4 Wheels:
- .1 Capacity: Minimum load capacity per wheel: 1455 kg.
 - .2 Size: Minimum 127 mm outside diameter drive wheels.
 - .3 Guides: Determined by manufacturer; minimum 2 locations.
- .5 Face Panels:
- .1 Materials: Plastic laminate clad particle board with plastic edging on vertical edges.

- .2 Finishes: Selected from manufacturer's standard available colors and patterns.

2.3 FABRICATION

- .1 General: Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- .2 Wheels: Provide precision machined and balanced units with permanently shielded and lubricated bearings.
- .3 Carriages: Fabricate to ensure no more than 6 mm maximum deviation from a true straight line. Splice and weld to ensure no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
- .4 Shelving, Supports and Accessories: See individual descriptions in "Shelving" paragraphs.

2.4 FINISHES

- .1 Colors: Selected from manufacturer's standard available colors.
- .2 Paint Finish: Provide factory applied electrostatic powder coat paint as recommended by manufacturer.
- .3 Laminate Finish: Provide factory applied laminate panels at locations indicated on reviewed shop drawings.
- .4 Edgings: Provide preformed edging, color-matched to unit colors selected.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine floor surfaces with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of mobile storage units.
- .2 Verify that building structural system is adequate for installing mobile storage units at locations indicated on reviewed shop drawings.
 - .1 Ensure that rail spacings indicated on shop drawings are in proper locations so existing load-bearing structural members are not overstressed.
- .3 Verify that intended installation locations of mobile storage units will not interfere with nor block established required exit paths or similar means of egress once units are installed.
- .4 Prepare written report, endorsed by Installer, listing conditions detrimental to proper performance of mobile storage units, once installed.
- .5 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Rails:

- .1 Lay out rails using full length units to the maximum extent possible. Use cut lengths only at ends to attain total length required. Locate and position properly, following dimensions indicated on reviewed shop drawings. Verify thickness of finished floor materials to be installed and install level 1.6 mm above finished floor surfaces.
- .2 Verify level, allowing for a minimum 6 mm of grout under high points. Position and support rails so that no movement occurs during grouting.
- .3 Set rails in full grout bed, completely filling any voids entire length of all rails including rail connectors. Trim up sides flush with rails to ensure proper load transfer from rail to supporting floor. Using shims in lieu of full grouting is not permitted.
- .4 Installation Tolerances: Do not exceed levelness of installed rails listed below:
 - .1 Maximum Variation From True Level Within Any Module: 2/4 mm.
 - .2 Maximum Variation Between Adjacent (Parallel) Rails: 1.6 mm perpendicular to rail direction.
 - .3 Maximum Variation In Height: 0.8 mm measured along any 3.05 m rail length.
- .5 Verify rail position and level; anchor to structural floor system with anchor type and spacings indicated on reviewed shop drawings.

.2 Shelving Units Installation:

- .1 General: Follow layout and details shown on reviewed shop drawings and manufacturer's printed installation instructions. Position units level, plumb; at proper location relative to adjoining units and related work.
- .2 Carriages:
 - .1 Place movable carriages on rails. Ensure that all wheels track properly and centering wheels are properly seated on centering rails. Fasten multiple carriage units together to form single movable base where required.
 - .2 Position fixed carriage units to align with movable units.
- .3 Shelving Units:
 - .1 Permanently fasten shelving units to fixed and movable carriages with vibration-proof fasteners.
 - .2 Stabilize shelving units following manufacturer's written instructions. Reinforce shelving units to withstand the stress of movement where required and specified.

3.3 FIELD QUALITY CONTROL

- .1 Verify shelving unit alignment and plumb after installation. Correct if required following manufacturer's instructions
- .2 Remove components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING

- .1 Adjust components and accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

- .1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .2 Dispose of waste materials in conformance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

3.6 DEMONSTRATION AND TRAINING

- .1 Schedule and conduct demonstration of installed equipment and features with Departmental Representative's personnel.
- .2 Schedule and conduct maintenance training with Departmental Representative's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.

3.7 PROTECTION

- .1 Protect system against damage during remainder of construction period. Provide additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 Work of this Section includes manually operated sunscreen roller shades at locations as indicated on Drawings.

1.2 RELATED SECTIONS

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 09 21 16 – Gypsum Board Assemblies
- .3 Section 09 51 13 – Acoustical Panel Ceilings

1.3 REFERENCES

- .1 American Architectural Manufacturer's Association (AAMA)
 - .1 AAMA 611-12, Voluntary Specification for Architectural Anodized Aluminum.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM D1784-11, Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - .2 ASTM G21-09, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .3 Environmental Choice Program (ECP)
 - .1 ECP6694, Office Furniture.
- .4 Green Globes New Construction Canada
 - .1 Green Globes for New Construction, Technical Manual, Version 1.
- .5 National Fire Protection Agency (NFPA)
 - .1 NFPA 701 (2010 Edition), Fire Tests for Flame-Resistant Textiles and Films.
- .6 Underwriters Laboratories Canada (ULC):
 - .1 CAN/ULC S109-03 Flame Tests of Flame Resistant Fabrics and Films

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Submit information for each type of product indicated including, but not limited to, the following:
 - .1 Styles, material descriptions, construction details, dimensions of individual components and profiles, features, and finishes.
 - .2 Operating instructions.

- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Indicate dimensions in relation to window jambs, operator details, head and sill anchorage details, hardware and accessories details.
- .3 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Submit one representative working sample of each type of shading device.
 - .2 After approval samples will be returned for incorporation into the Work.
- .4 Submit closeout data in accordance with Section 01 01 50 – General Instructions, Closeout Submittals:
 - .1 Methods for maintaining roller shades and finishes.
 - .2 Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - .3 Operating hardware.

1.5 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- .2 Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
- .3 Regulatory Requirements:
 - .1 Flame Spread Rating: Provide roller shade panel materials with flame spread and smoke developed characteristics required by Authority Having Jurisdiction, as determined by testing identical products in accordance with CAN/ULC S109.
 - .2 Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver material to site in manufacturer standard packaging. Store and handle as recommended by manufacturer.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 WARRANTY

- .1 Manufacturer Warranty: Provide manufacturer's warranty from commencing from date of Substantial Performance covering the following minimum requirements for materials:
 - .1 Shade Hardware ten (10) years.
 - .2 Shade Fabric/Shade Cloth: ten (10) years.
 - .3 Metal Coatings: ten (10) years.

Part 2 Products

2.1 ROLLER SHADE COMPONENTS

- .1 Roller Tube: One piece extruded 6061-T6 or 6063-T6 aluminum roller tube meeting the requirements of ASTM B429, having anodized finish as follows:
 - .1 Protective Finish: AA-M12 Mechanical Finish; C22 Non-Specular; A21Chemical Finish, etched, medium matte anodic coating; clear coating 0.025 mm or thicker in accordance usingAMA 611; roller tube assemblies having mill finish will not be acceptable.
 - .2 Tube Diameter and Thickness: Manufacturers recommended engineered diameter, wall thickness and aluminum grade as required for maximum allowable deflection of L/700.
 - .3 Tube Configuration: Extrude tube with provision made for mechanical engagement with the operator and drive assembly; and having channels to accept fabric attachment spline.
- .2 Fabric Spline: Extruded vinyl profile, welded to fabric band or panel, allowing removal and re-installation of fabric bands or panels without removing the roller tube and hardware and having the following characteristics:
 - .1 Fabric bands or panels must be replaceable on site.
 - .2 Attachment of the fabric to the tube with double-sided adhesive tapes, adhesives, staples or rivets will not be acceptable.
- .3 Hem Bars and Hem Bar Pockets:
 - .1 Custom shaped flat steel profile; nominal 40 mm high having wall thickness engineered to suit weight requirements and adapt to uneven surfaces; slide hem bar into welded hem bar pocket with closed ends to maintain bottom of shade fabric straight and flat.
- .4 Fasteners: Non-corrosive fasteners as recommended by manufacturer.
- .5 Valance: Style matching hem; as indicated by manufacturer's designation colour.
- .6 Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
- .7 Hold-Down Brackets and Hooks or Pins and Side Channels: Manufacturer's standard for fixing shade in place, keeping shade panel material taut, and reducing light gaps when shades are closed.

2.2 SHADE MATERIALS

- .1 Shading Material: Non-PVC-coated fibreglass, and as follows:
 - .1 Material Width: width to fit opening
 - .2 Bottom Hem: Straight.
 - .3 Material Openness Factor: solid in Exam and Treatment Rooms, perforated in offices, confirm openness with Departmental Representative.
- .2 Direction of Roll: Regular, from back of roller
- .3 Mounting Brackets: Galvanized or zinc-plated steel.
- .4 Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings; removable design for access.
- .5 Top/Back Cover: L shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.
 - .1 Corner Section: Factory formed and welded.
- .6 Bottom Bar: Steel or extruded aluminum, [with plastic or metal capped ends]. Provide [exposed-to-view, external-type] [concealed, by pocket of shade material, internal-type] bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

2.3 OPERATORS

- .1 Manual Chain Operator:
 - .1 Mounting Brackets: Angle shaped brackets size and thickness to manufacturer's standard; unitized pre-moulded assembly; allowing for continuous front or back roll fascia across multiple shades without exposed fasteners.
 - .2 Chain Drive System: Continuous loop of #10 stainless steel bead chain having a rated strength of 40 kg to prevent chain breakage under normal operating conditions; and as limited by ANSI/WCMA A100.1 safety requirements, and as follows:
 - .1 Single chain operator with inertia brake mechanism capable of locking the shade panel at any point of travel.
 - .2 Set travel length of chain operator assembly on-site without disassembly of hardware to suit travel length of shade panel.
 - .3 Chain drive operator shall positively engage drive mechanism through internal profile configuration; friction fitted engagement of the roller tube to drive mechanism will not be acceptable.
 - .4 Chain operator shall prohibit operation by pulling on hem bar.

- .5 Shade roller tube shall be removable from brackets without hardware removal; non-metal components shall be self-lubricating.

2.4 ROLLER SHADE FABRICATION

- .1 Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- .2 Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - .1 Lifting Mechanism: With permanently lubricated moving parts.
- .3 Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 23° C:
 - .1 Shade Units Installed between Inside Jambs: Edge of shade not more than 6 mm from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
- .4 Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.
- .5 Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- .6 Colour-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- .7 Colours of Metal and Plastic Components Exposed to View: as indicated on Finish Schedule, unless otherwise indicated.
- .8 Hembars and Hembar Pockets:
 - .1 Custom shaped Flat steel profile, 37 mm high, wall thickness engineered to weight requirements and adapt to uneven surfaces, in welded hembar pocket with closed ends, to maintain bottom of shade fabric straight, and flat.
- .9 Fasteners:
 - .1 Non-corrosive as recommended by manufacturer.

2.5 ACCESSORIES

- .1 Aluminum Fascia:
 - .1 Back / Regular Roll Shade Fascia:

- .1 Extruded aluminum alloy 6063-T5, prefinished, 105 mm x 45 mm x 1.6 mm wall thickness, custom designed profile to fit onto premoulded end mounting brackets without exposed fasteners. Colour prefinished to match adjacent window framing or as selected by Consultant.
 - .2 Fascia shall allow for continuous placement across multiple shades (to a maximum length of 6100 mm without exposed fasteners).
 - .3 Fascia shall conceal the mounting hardware, power and control cables, drive mechanism, roller tube, and all fabric rolled on the tube.
 - .4 Fascia shall not fit snug against side channels to prevent thermal shock to the glazing system.
- .2 Pockets and Closures:
- .1 Shade Pocket:
 - .1 Manufactured from 2.5 mm thick aluminum or 1.5 mm thick satincoat steel pocket engineered to meet site conditions. Design considerations include, but are not limited to, mounting conditions, wall/ceiling construction, type and quantity of shades in pocket, and shade length, as indicated on the drawings.
 - .2 Aluminum Closure:
 - .1 Extruded aluminum alloy, 6063-T5, prefinished, 82 mm wide x 1.5 mm thickness. Colour shall be prefinished to match the adjacent window framing or as selected by the Consultant.
 - .2 Designed for attachment to the corresponding pocket and/or hardware using an extruded aluminum clip and return angle, both made of 6063-T5 aluminum alloy, without exposed fasteners.

2.6 FINISHES

- .1 Aluminum: clear anodized to AA-M12C22A31.
- .2 Unexposed aluminum unless otherwise specified: mill finish.

Part 3 Execution

3.1 EXAMINATION

- .1 Do not begin installation until substrates have been properly prepared.
- .2 If substrate preparation is the responsibility of another installer, notify Departmental Representative of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- .1 Clean surfaces thoroughly prior to installation.

- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- .1 Install shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 50 mm to interior face of glass. Allow proper clearances for window operation hardware.
- .2 Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- .3 Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- .4 Engage Installer to train Departmental Representative's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 All products supplied by the Qualified Respondent shall meet compliance of applicable CSA, ANSI/BIFMA and other listed testing standards as appropriate to the furniture and equipment type specified.

1.2 OPERATING AND MAINTENANCE INFORMATION

- .1 Provide operations and maintenance information in accordance with Section 01 01 50 – General Instructions Operations and Maintenance Data including, but not limited to, the following:
 - .1 Methods for maintaining all items.
 - .2 Methods for maintaining painted or coated finishes.
 - .3 Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

- .1 Quality Expectations:
 - .1 Warranty requirements set out in this document shall be the Minimum Requirement for quality expectations.
 - .2 Confirm that the manufacturer has met all the requirements of the technical specifications; if custom, non-standard components are necessary to meet the specification, these costs shall be included.
 - .3 Participate in a cost adjustment plan, regarding the deployment of a performance monitoring system which will permit Payments to be adjusted for poor performance or unavailability.
- .2 Codes and Regulations:
 - .1 Adhere to applicable provincial laws, municipal bylaws and the acts, statutes, bylaws, codes, orders, rules and regulations of all governmental authorities having jurisdiction over the work throughout the performance of the Work.
- .3 Non-Obsolescence:
 - .1 Successful Respondent(s) shall provide written notice of any physical change to the product line at time of order, any physical changes to the product line shall accommodate inter-changeability and compatibility with the existing product.

1.4 DELIVERY STORAGE AND HANDLING

- .1 Coordinate with Contractor for delivery times and access to the site:
 - .1 Provide a minimum of fifteen (15) days notice indicating that equipment will be ready for shipment, and the manner in which the shipment will be made.
 - .2 Provide a minimum of 24 hours notice by telephone of anticipated time of actual delivery.

- .2 Delivery Location: Deliver in manufacturer's original intact packaging to the following location:
 - .1 Mountain Institution, 4732 Cemetery Road, Agassiz, BC.
- .3 Sequence the delivery of materials to take into account other contractors that may still be working on site.
- .4 Storage on site for materials will be limited to the immediate area of the Work:
 - .1 There will be no additional site storage available.
 - .2 Arrange and pay for any off site storage costs arising from bulk delivery of materials.
 - .3 Schedule "Just-In-Time" delivery of materials to site and store materials in area of work.
 - .1 No other storage facilities are available on site.
 - .2 Be responsible for obtaining any required off-site storage required for materials of this project.
 - .3 Schedule deliveries to avoid double movements of materials on site.
 - .4 Cooperate with other contractors and schedule delivery of materials to allow for other contractors activities.
- .5 Permanently and legibly mark furniture pieces with the name or recognized trademark of the manufacturer complete with clear and complete instructions outlining any adjustable features of the component, if applicable.
- .6 Tag boxes or items for easy identification and assembly on site.

1.5 WARRANTY

- .1 Provide manufacturer' standard product warranty indicating that they will be responsible to repair or replace affected part or parts to the satisfaction of the Departmental Representative at no additional cost for labour or materials, that fail in materials or workmanship within specified warranty period; materials failures will include, but are not be limited to, manufacturing defects and failure of fabric coverings that wear out within an unreasonable time period; warranty shall be exclusive of normal wear, and as follows:
 - .1 Material Warranty Period: ten (10) years from date of Substantial Performance, prorated, with first three (3) years non-prorated.
 - .2 Workmanship Warranty Period: ten (10) years from date of Substantial Performance.
 - .3 If extended warranty periods are offered on any specified products through the manufacturer, make these available.

Part 2 Products

2.1 ACCEPTABLE PRODUCTS AND MANUFACTURERS

- .1 Refer to attached furniture/equipment schedule directly after this section.
- .2

.3 Item No. 100112 Radiographic Unit:

.1 GE HealthCare Optima XR646 Digital Radiography System with Flashpad Wireless Detector

.1 Table and wall stand with one shared GE Flashpad wireless detector.

.2 Features

System and Positioner

- Wireless amorphous silicon non-tiled digital detector
- High DQE providing excellent image quality and dose efficiency
- Motorized ceiling mounted 1-axis tube suspension with manual override
- Patient-side collimator and technique controls with touch screen digital display
- Automated vertical and longitudinal tracking maintains SID and tube/detector alignment with the table receptor
- Elevating table with 400 kg (882 lbs.) static & 320 kg (705 lbs.) dynamic weight limit with 120 cm removable focus grids.
- Motorized tilting wall stand
- Automated vertical tracking of the digital wall stand
- Wall stand Grids - 120 cm (standard)
- System access & authorization control to support compliance
- Integrated quality procedure
- Touch screen in workstation

a.) Image System General Features

• Detector Size

– Nominal (addressable): 41 cm x 41 cm

• Active Image Area: 40.44 cm x 40.44 cm

– Nominal (addressable): 2048 x 2048 pixels

• Active area: 2022 x 2022 pixels

• Image Depth: 14 Bit

• Pixel Pitch: 200 microns

• Image transfer time: < 1s (wired connection),
< 5s (wireless connection)

• Typical Dynamic Range: 0.6 uR – 7.8 mR @ RQA5

• Maximum Detector Resolution: 2.5 lp/mm

• Typical DQE: 68% @ RQA5, per IEC 62220-1

lp/mm	DQE
0	0.68
0.5	0.62
1	0.53

1.5	0.45
2	0.36
2.5	0.22

b.) Acquisition Workstation

- 1 - 19 in (48 cm) LCD Color Monitors (1280 x 1024 pixels)
- Touch screen
- Hard Disk Storage: 250 GB
- Image storage: < 16,100 images
- RAM: 8 GB

c.) Overhead Tube Suspension

The overhead tube suspension (OTS) system with motorized vertical movement delivers excellent levels of operational support for efficient and precise positioning.

Features

- One axis manual override capability allowing the user to assume complete control for complex positioning
- Auto-Detents – OTS uses the motors to drive each axis into position, assisting the user with locating and securing detents
- Patient Side Touch Screen User Interface - the OTS is equipped with an LCD touch screen, providing the following functions to the user:
 - High-precision telescoping column. Self-aligning bearings. Motorized vertical tracking in digital mode.
 - Longitudinal travel: 3000 mm (118 in.) for 4 m (157 in.) rail
 - Vertical travel: 1800 mm \pm 10 mm (71 in.)
 - Column rotation with 30 degree increments: - 180 to +180 degrees
 - OTS bridges
 - 2 m/3 m

d.) Elevating Table

Table Base

- Motor driven elevating table
- Fully enclosed pedestal base
- Footprint = 100.1 cm x 71.2 cm including foot pedals
- Elevating range = 50 cm – 85 cm (\pm 1 cm)
- Elevation from minimum to maximum height < 18 seconds
- Max. load:
 - 400 kg (882 lbs.) static non-elevating & 320 kg (705 lbs.) dynamic elevating load center

- Front foot pedal as default
- Rear foot pedal optional
- Two-Press Safety Foot Pedal
- Two safety switches to disable motion during patient transfer
- Two emergency stop buttons

Table Top

- Foam core fiber reinforced laminate skin
- 8-way tabletop motion
- Inherent filtration <0.7 mm Al equivalent at 100 kVp
- 93 cm width x 240 cm length
- Longitudinal travel: 680 mm
- Transversal travel: 280 mm
- Non-protruding edge rails for attachments

Removable, High Line Rate Stationary Grids

- Standard: 100 cm (40 in) focus grid with a SID range of 90 cm - 120 cm (70 lines/cm, 12:1 ratio) or 120 cm (47 in) with a SID range of 102 cm – 146 cm (70 lines/cm, 13:1 ratio)
- Aluminum Interspacing Material

Table Detector Servo Mechanics

- Longitudinal tracking of Detector to Tube when the tube is over the tabletop
- Detector Travel 85 cm (27.5 in) (± 1 cm)
- Detector Tray Max. Load: 16kg
- Patient Coverage
 - Lateral 66 cm (± 1 cm)
 - Longitudinal 191 cm (± 1 cm)

Table Accessories

- Tabletop FlashPad digital detector holder
- Patient Hand Grips
- Compression Band

e.) Wallstand

- Wallstand is designed for use with the wireless digital detector, overhead tube suspension, ion chamber and removable non- reciprocating grid

- Wall Stand detector housing dimensions: (with Detector vertical and covers installed)
 - Height < 53 cm
 - Width < 69 cm
 - Minimum height from floor to center of panel 28.5 cm (± 0.5 cm)
 - Maximum height from floor to center of panel 178.5 cm (± 1.5 cm)
 - Wallstand vertical travel 150 cm (± 1 cm)

f.) Power Unit/Generator

Ratings

The digital radiographic imaging system is available with a high frequency generator.

- Power (kW) 50, 65 or 80
- kVp 40 to 150
- mA 10 to 630 for 50 kW system;
- 10 to 800 for 65 kW system
- 10 to 1000 for 80 kW system
- mAs 0.25 to 630 for 50 KW, 65 KW or 80 KW
- Large focus Spot: 10-1000mA 0.25-630mAs
- Small focus Spot: 10-400mA, 0.25-500mAs
- Minimum exposure time with automatic exposure control is as low as 2 ms.
- Maximum exposure time is 2s.

High Voltage Signal Characteristics

- Excellent exposure reproducibility
- Low Ripple. Less than 1% low frequency ripple.

g.) X-ray Source

The Digital Radiographic Imaging System utilizes the Maxiray 100 radiographic tube.

Maxiray 100 Tube Housing Features

- Shockproof housing to minimize leakage radiation. The housing is filled with insulating oil specially formulated to meet the requirements of high-voltage X-ray operation.
- Ambient Operating Temperature 10 °C to 40 °C
- Ambient Transport Temperature >-30 °C
- External blower

- Pressure switch inhibits exposure if oil pressure reaches a preset limit
- NEMA standard high-voltage cable receptacles labeled anode and cathode
- Integrated system design and collimator minimizes off-focal spot radiation

Maxiray 100 Specifications

- Focal Spot Sizes: 0.6 mm/1.3 mm
- Target Angle: 12.5°
- Anode rotation speed: 10,000 rpm
- Small focal spot power: 32 KW
- Large focal spot power: 80 KW
- Maximum Voltage:
 - Anode to Cathode 150 kVp rectified
 - Anode or Cathode to ground 82 kVp
- Minimum Inherent Filtration @ 150 kVp and 75kVp
 - Tube Insert: 0.8 mm Al equivalent
 - Tube Housing: 0.3 mm Al equivalent
 - Leakage Technique: 150 kV, 4 mA

Maxiray 100 Thermal Ratings

- Heat Storage Capacity
 - Anode: 260,000 Joule (350,000 heat units)
 - Tube Unit: 1,110,000 Joule (1,500,000 heat units)
- Maximum Heat Dissipation Rate
 - Anode: 75,000 heat units per min. (925 watts)
 - Tube Unit: 60,000 heat units per min., blower operating (740 watts)
- For three phase, 12 pulse equipment heat units equal $kVp \times mA \times seconds \times 1.35$

Part 3 Execution

3.1 PREPARATION

- .1 Assume full responsibility for and execute complete layout of work to locations.
- .2 Provide devices needed to lay out work:
 - .1 Storage of materials prior to delivery to site ready for setting out of work will be the responsibility of the Respondent.
 - .2 Limited space is available on site in the immediate area of work for laying out and setting up materials required by this Contract.

- .3 Provide all necessary pieces of equipment, materials and furniture required for complete installation.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's written instructions using trained and competent personnel approved by the manufacturer to work with the specific equipment. Work with existing institution vendors accordingly.
 - .1 Dental Equipment Installer:
Tavis Schwingboth
Install Coordinator
Tavis.Schwingboth@henryschein.ca
Henry Schein
778-908-4108
- .2 Train Departmental Representative's personnel in the maintenance of equipment and furniture.

3.3 PROTECTION AND RESTORATION

- .1 Damage to In-Place Work:
 - .1 Conduct a walk through inspection with the Departmental Representative prior to start of work.
 - .2 Any existing damages or defects will be noted, and the Respondent will be required to sign the inspection report indicating acceptance of existing conditions, and state that they will be responsible for repairing any damages arising from work of their Contract.
 - .3 Repair any damages to In-Place Work caused by installation of equipment and furniture.
- .2 Housekeeping:
 - .1 Conduct daily housekeeping in the work area and general cleanup on Fridays:
 - .1 The Respondent will provide one man for every ten men on site or a minimum of one man for the general cleanup.
 - .2 The Respondent shall flatten and place all garbage generated by their activities, place in their delivery vehicle and remove from site on a daily basis.

3.4 FINAL CLEANING

- .1 Remove grease, dirt, dust, stains, labels, fingerprints and other foreign matter from interior and exterior surfaces; vacuum and dust behind grilles, under desks and in all semi-concealed locations; wash all other surfaces not otherwise finished; clean and polish glass on both sides.
- .2 Verify that cleaning agents and methods do not remove finishes and permanent protective coatings on surfaces being cleaned.

- .3 Leave all surfaces in perfectly clean and unsoiled condition. Cleaning in concealed spaces shall consist of vacuum cleaning of all surfaces in affected areas of work only.
- .4 Repair or replace damaged components as directed by the Departmental Representative:
 - .1 Where damage was caused by a different Subcontractor than the installer, coordinate with the Contractor for payment from responsible parties.
 - .2 Damage caused by work of this Contract to other Subcontractors' work shall repaired by the other Subcontractor and paid for by the Respondent.

END OF SECTION

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
CORR	CORRIDOR	100895T	1	BOARD	TRANSFER		30106	20089	HALL
CORR	CORRIDOR	100213T	1	ICE/WATER DISPENSER	COUNTERTOP		30110	20091	HALL
G141	WASHROOM, STAFF	100350	1	CAN	GARBAGE				
G141	WASHROOM, STAFF	100347	1	DISPENSER	PAPER TOWEL				
G141	WASHROOM, STAFF	100348	1	DISPENSER	SOAP				
G141	WASHROOM, STAFF	100349	1	DISPENSER	TOILET TISSUE				
G142	MEDICAL STORAGE	100176T	1	LAMP	UVA BOX		30149	20133	G153E
G142	MEDICAL STORAGE	100322T	1	SHELVING	METAL	914 W	30150	20132	G153E
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30150	20139	G153E
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30150	20134	G153E
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30150	20135	G153E
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30150	20136	G153E
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30150	20138	G153E
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30148	20131	G152
G142	MEDICAL STORAGE	100484T	1	SHELVING	STORAGE		30150	20137	G153E
G146	MEDICAL X-RAY	100102	4	APRON	LEAD	1S, 2M, 1XL			
G146	MEDICAL X-RAY	100353	1	DISPENSER	GLOVE BOX	FOUR			
G146	MEDICAL X-RAY	100347	1	DISPENSER	PAPER TOWEL				
G146	MEDICAL X-RAY	100348	1	DISPENSER	SOAP				
G146	MEDICAL X-RAY	100180	1	HAND SANITIZER	WATERLESS				
G146	MEDICAL X-RAY	100139	1	RACK	APRON (5)				
G146	MEDICAL X-RAY	100112	1	RADIOGRAPHIC UNIT	GENERAL RAD	See 12 50 00			
G146	MEDICAL X-RAY	100054T	1	SPHYGMOMANOMETER	WALL MOUNTED		30019	20011	
G146	MEDICAL X-RAY	100109	1	STOOL	FOOT	W/HAND RAIL	0		
G158A	STAFF LOUNGE	100418T	1	BOOKCASE	5 SHELF		30159	20151	G154
G158A	STAFF LOUNGE	100608T	1	CHAIR	DINING/KITCHEN		30156	20147	G154
G158A	STAFF LOUNGE	100608T	1	CHAIR	DINING/KITCHEN		30156	20150	G154
G158A	STAFF LOUNGE	100608T	1	CHAIR	DINING/KITCHEN		30156	20145	G154
G158A	STAFF LOUNGE	100608T	1	CHAIR	DINING/KITCHEN		30156	20146	G154
G158A	STAFF LOUNGE	100347	1	DISPENSER	PAPER TOWEL				

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G158A	STAFF LOUNGE	100348	1	DISPENSER	SOAP				
G158A	STAFF LOUNGE	100195T	1	REFRIGERATOR	FULL SIZE		30155	20144	G154
G158A	STAFF LOUNGE	100702T	1	TABLE	MEETING		30154	20143	G154
G164	SOILED SUPPLY	100353	1	DISPENSER	GLOVE BOX	FOUR			
G164	SOILED SUPPLY	100347	1	DISPENSER	PAPER TOWEL				
G164	SOILED SUPPLY	100348	1	DISPENSER	SOAP				
G172	DENTAL OPERATORY	100315T	1	CABINET	FILE LATERAL	3 DRAWER	30114	20098	G142
G172	DENTAL OPERATORY	101001T	1	CART	DENTAL		30128	20109	G142
G172	DENTAL OPERATORY	100387T	1	CHAIR	DENTAL	ASSISTANT	30115	20099	G142
G172	DENTAL OPERATORY	100945T	1	CHAIR	DENTAL	W/LIGHT & NEW UTILITY CENTER	30117	20100	G142
G172	DENTAL OPERATORY	100945	1	CHAIR UTILITY CENTER	DENTAL	MODIFICATION TO EXISTING CHAIR			
G172	DENTAL OPERATORY	100494T	1	CHAIR	DENTIST		30119	20101	G142
G172	DENTAL OPERATORY	100106T	1	CLEANER	ULTRASONIC		30123	20105	G142
G172	DENTAL OPERATORY	100098	1	CONTAINER	SHARPS	ENCLOSED			
G172	DENTAL OPERATORY	100907T	1	DEML			30127		G142
G172	DENTAL OPERATORY	100353	1	DISPENSER	GLOVE BOX	FOUR			
G172	DENTAL OPERATORY	100347	1	DISPENSER	PAPER TOWEL				
G172	DENTAL OPERATORY	100352	1	DISPENSER	PPE				
G172	DENTAL OPERATORY	100348	1	DISPENSER	SOAP				
G172	DENTAL OPERATORY	100656T	1	GRINDER			30120	20102	G142
G172	DENTAL OPERATORY	100180	1	HAND SANITIZER	WATERLESS				
G172	DENTAL OPERATORY	100966T	1	MIXER			30122	20104	G142
G172	DENTAL OPERATORY	100104T	1	RADIOGRAPHIC UNIT			30116	20110	G142
G172	DENTAL OPERATORY	100910T	1	SHIELD	LEAD		30112	20095	G142
G172	DENTAL OPERATORY	100579T	1	VIBRATOR / MIXER			30121	20103	G142
G172	DENTAL OPERATORY	100095T	1	VIEWBOX	1 PANEL		30113	20096	G142
G172	DENTAL OPERATORY	100942T	1	VIEWBOX	DENTAL		30113	20097	G142
G172A	DENTAL REPROCESS	100650T	1	AUTOCLAVE			30126	20108	G142
G172A	DENTAL REPROCESS	100347	1	DISPENSER	PAPER TOWEL				
G172A	DENTAL REPROCESS	100348	1	DISPENSER	SOAP				

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G172A	DENTAL REPROCESS	100903T	1	PERI PRO			30124	20106	G142
G172A	DENTAL REPROCESS	100083T	1	READER			30132	20111	G142
G172A	DENTAL REPROCESS	100164T	1	WATER PURIFIER			30125	20107	G142
G175	MECHANICAL	100410	1	COMPRESSOR	AIR	W/SOUND COVER			
G175	MECHANICAL	100251	1	VACUUM SYSTEM	DENTAL				
G177	WASHROOM INMATE	100347A	1	DISPENSER	PAPER TOWEL	TAMPER PROOF			
G177	WASHROOM INMATE	100348A	1	DISPENSER	SOAP	TAMPER PROOF			
G177	WASHROOM INMATE	100349A	1	DISPENSER	TOILET TISSUE	TAMPER PROOF			
G178	EXAM ROOM 1	100661T	1	BATH	SILICA		30004	20000	G146
G178	EXAM ROOM 1	100775T	1	CHAIR	OPHTHALMIC	C/W LIGHT	30008	20004	G146
G178	EXAM ROOM 1	100574T	1	CHAIR	VISITOR		30026	20018	G146
G178	EXAM ROOM 1	100098	1	CONTAINER	SHARPS	ENCLOSED			
G178	EXAM ROOM 1	100497A	1	DIAGNOSTIC PANEL	W/MOUNTING HARDWARE ONLY				
G178	EXAM ROOM 1	100353	1	DISPENSER	GLOVE BOX	FOUR			
G178	EXAM ROOM 1	100347	1	DISPENSER	PAPER TOWEL				
G178	EXAM ROOM 1	100348	1	DISPENSER	SOAP				
G178	EXAM ROOM 1	100180	1	HAND SANITIZER	WATERLESS				
G178	EXAM ROOM 1	100154T	1	LAMP	SLIT		30006	20002	G146
G178	EXAM ROOM 1	100760T	1	LENSMETER			30003	19999	G146
G178	EXAM ROOM 1	100686T	1	PHOROPTER			30009	20005	G146
G178	EXAM ROOM 1	100258T	1	PROJECTOR	CHART		30007	20003	G146
G178	EXAM ROOM 1	100220T	1	SCOPE	OTOSCOPE/RETINOSCOPE	WALL MOUNTED	30042	20029	G146
G178	EXAM ROOM 1	100221T	1	SPHYGMOMANOMETER	MOBILE		30020	20012	G146
G178	EXAM ROOM 1	100174T	1	STAND	INSTRUMENT	OPHTHALMIC W/SLIT LAMP	30005	20001	G146
G178	EXAM ROOM 1	100513T	1	STAND	MAYO	W/TRAY	30022	20014	G146
G178	EXAM ROOM 1	100225T	1	TABLE	OVERBED		30023	20015	G146
G179	TREATMENT ROOM	100319	1	BOARD	WHITE, MAGNETIC				
G179	TREATMENT ROOM	100574T	1	CHAIR	VISITOR		30050	20037	G145
G179	TREATMENT ROOM	100098	1	CONTAINER	SHARPS	ENCLOSED			
G179	TREATMENT ROOM	100497A	1	DIAGNOSTIC PANEL	W/MOUNTING HARDWARE ONLY				

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G179	TREATMENT ROOM	100353	1	DISPENSER	GLOVE BOX	FOUR			
G179	TREATMENT ROOM	100347	1	DISPENSER	PAPER TOWEL				
G179	TREATMENT ROOM	100352	1	DISPENSER	PPE				
G179	TREATMENT ROOM	100348	1	DISPENSER	SOAP				
G179	TREATMENT ROOM	100180	1	HAND SANITIZER	WATERLESS				
G179	TREATMENT ROOM	100386T	1	LIGHT	EXAM	CEILING	30040	20027	G145
G179	TREATMENT ROOM	100338T	1	MONITOR	NIBP W/THERMOMETER	W/O STAND	30035	20025	G145
G179	TREATMENT ROOM	100502	1	SCALE	PATIENT	ELECTRONIC W/HEIGHT			
G179	TREATMENT ROOM	100219T	1	SCOPE	OTOSCOPE/OPHTHALM OSCOPE	WALL MOUNTED	30018	20010	G145
G179	TREATMENT ROOM	100054T	1	SPHYGMOMANOMETER	WALL MOUNTED		30041	20028	G145
G179	TREATMENT ROOM	100803T	1	STOOL	PADDED	W/WHEELS	30051	20038	G145
G179	TREATMENT ROOM	100850	1	STRETCHER	CHAIR				
G179	TREATMENT ROOM	100066T	1	SUCTION	TRANSPORT		30043	20030	G145
G179	TREATMENT ROOM	100225T	1	TABLE	OVERBED		30045	20032	G145
G180	TREATMENT ROOM	100319	1	BOARD	WHITE, MAGNETIC				
G180	TREATMENT ROOM	100838	1	CART	OXYGEN CYLINDER				
G180	TREATMENT ROOM	100508T	1	CENTRIFUGE	BENCHTOP		30046	20033	G145
G180	TREATMENT ROOM	100098	1	CONTAINER	SHARPS	ENCLOSED			
G180	TREATMENT ROOM	100497	1	DIAGNOSTIC PANEL	C/W SPHYGMANOMETER,	OTO/OPHTHALMOSCOPE			
G180	TREATMENT ROOM	100353	1	DISPENSER	GLOVE BOX	FOUR			
G180	TREATMENT ROOM	100347	1	DISPENSER	PAPER TOWEL				
G180	TREATMENT ROOM	100352	1	DISPENSER	PPE				
G180	TREATMENT ROOM	100348	1	DISPENSER	SOAP				
G180	TREATMENT ROOM	100180	1	HAND SANITIZER	WATERLESS				
G180	TREATMENT ROOM	100015T	1	INCUBATOR	OVEN, SINGLE DOOR		2	19998	G146
G180	TREATMENT ROOM	100261	1	MONITOR	NIBP W/SPO2/THERMOMETER	W/HEADWALL MOUNT			
G180	TREATMENT ROOM	100218T	1	REFRIGERATOR	UNDERCOUNTER		30047	20034	G145
G180	TREATMENT ROOM	100536T	1	SCALE	PATIENT	DIGITAL	30103	20086	HALL

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G180	TREATMENT ROOM	100187T	1	STRETCHER	EMERGENCY	STRYKER	30014	20009	G146
G180	TREATMENT ROOM	100225	1	TABLE	OVERBED				
G181	EXAM ROOM 2	100319	1	BOARD	WHITE, MAGNETIC				
G181	EXAM ROOM 2	100098	1	CONTAINER	SHARPS	ENCLOSED			
G181	EXAM ROOM 2	100497	1	DIAGNOSTIC PANEL	C/W SPHYGMANOMETER,	OTO/OPHTHALMOSCOPE			
G181	EXAM ROOM 2	100353	1	DISPENSER	GLOVE BOX	FOUR			
G181	EXAM ROOM 2	100347	1	DISPENSER	PAPER TOWEL				
G181	EXAM ROOM 2	100348	1	DISPENSER	SOAP				
G181	EXAM ROOM 2	100180	1	HAND SANITIZER	WATERLESS				
G181	EXAM ROOM 2	100338T	1	MONITOR	NIBP W/THERMOMETER	W/O STAND	30001	19997	G143
G181	EXAM ROOM 2	100054	1	SPHYGMOMANOMETER	RAIL MOUNTED	W/BASKET & MOUNTING			
G181	EXAM ROOM 2	100390	1	STOOL	PHYSICIAN	PNEUMATIC			
G181	EXAM ROOM 2	100850	1	STRETCHER	CHAIR				
G181	EXAM ROOM 2	100066T	1	SUCTION	TRANSPORT		30013	20008	G143
G182	EXAM ROOM 3	100319	1	BOARD	WHITE, MAGNETIC				
G182	EXAM ROOM 3	100647T	1	CABINET	FILE, STANDARD	4 DRAWER	30091	20051	G143
G182	EXAM ROOM 3	100574T	1	CHAIR	VISITOR		30095	20055	G143
G182	EXAM ROOM 3	100098	1	CONTAINER	SHARPS	ENCLOSED			
G182	EXAM ROOM 3	100497	1	DIAGNOSTIC PANEL	C/W SPHYGMANOMETER,	OTO/OPHTHALMOSCOPE			
G182	EXAM ROOM 3	100353	1	DISPENSER	GLOVE BOX	FOUR			
G182	EXAM ROOM 3	100347	1	DISPENSER	PAPER TOWEL				
G182	EXAM ROOM 3	100348	1	DISPENSER	SOAP				
G182	EXAM ROOM 3	100180	1	HAND SANITIZER	WATERLESS				
G182	EXAM ROOM 3	100261	1	MONITOR	NIBP W/SPO2/THERMOMETER	W/HEADWALL MOUNT			
G182	EXAM ROOM 3	100502T	1	SCALE	PATIENT	W/HEIGHT BAR	30082	20045	G143
G182	EXAM ROOM 3	100846	1	SCOPE	OTOSCOPE/OPHTHALMOSCOPE	W/MOUNTING FOR DIAGNOSTIC PANEL			

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G182	EXAM ROOM 3	100803T	1	STOOL	PADDED	W/WHEELS	30099	20059	G143
G182	EXAM ROOM 3	100850	1	STRETCHER	CHAIR				
G183	SPECIALTY TREATMENT ROOM	100319	1	BOARD	WHITE, MAGNETIC				
G183	SPECIALTY TREATMENT ROOM	100036T	1	CART	EMERGENCY	ADULT (RED)	30104	20087	HALL
G183	SPECIALTY TREATMENT ROOM	100036T	1	CART	EMERGENCY	ADULT (RED)	30030	20021	G145
G183	SPECIALTY TREATMENT ROOM	100098	1	CONTAINER	SHARPS	ENCLOSED			
G183	SPECIALTY TREATMENT ROOM	100283T	1	DEFIBRILLATOR	AED		30111	20092	HALL
G183	SPECIALTY TREATMENT ROOM	100497	1	DIAGNOSTIC PANEL	C/W SPHYGMANOMETER,	OTO/OPHTHALMOSCOPE			
G183	SPECIALTY TREATMENT ROOM	100353	1	DISPENSER	GLOVE BOX	FOUR			
G183	SPECIALTY TREATMENT ROOM	100347	2	DISPENSER	PAPER TOWEL				
G183	SPECIALTY TREATMENT ROOM	100352	1	DISPENSER	PPE				
G183	SPECIALTY TREATMENT ROOM	100348	2	DISPENSER	SOAP				
G183	SPECIALTY TREATMENT ROOM	100180	1	HAND SANITIZER	WATERLESS				
G183	SPECIALTY TREATMENT ROOM	100386	1	LIGHT	EXAM	CEILING MOUNT			
G183	SPECIALTY TREATMENT ROOM	100392T	1	MONITOR	ECG	W/STAND	30012	20007	G146
G183	SPECIALTY TREATMENT ROOM	100261T	1	MONITOR	NIBP	W/STAND	30011	20006	G146
G183	SPECIALTY TREATMENT ROOM	100054	1	SPHYGMOMANOMETER	RAIL MOUNTED	W/BASKET & MOUNTING			
G183	SPECIALTY TREATMENT ROOM	100265	1	STOOL	W/O CASTERS	ADJUSTABLE W/PADDING			
G183	SPECIALTY TREATMENT ROOM	100644	1	STRETCHER	BARIATRIC				
G183	SPECIALTY TREATMENT ROOM	100066	1	SUCTION	TRANSPORT				
G183	SPECIALTY TREATMENT ROOM	100227T	1	THERMOMETER	DIGITAL		30031	20022	G146

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G184	OXYGEN STORAGE	100394T	1	CART	TANK	CYLINDER	30146	20128	G151
G184	OXYGEN STORAGE	100394T	1	CART	TANK	CYLINDER	30145	20126	G151
G184	OXYGEN STORAGE	100394T	1	CART	TANK	CYLINDER	30145	20127	G151
G184	OXYGEN STORAGE	100599T	1	HOLDER	TANK		30147	20129	G151
G184	OXYGEN STORAGE	100599T	1	HOLDER	TANK		30147	20130	G151
G184	OXYGEN STORAGE	100322T	1	SHELVING	METAL	914 W	30144	20125	G151
G185	ADMIN OFFICE	100959	1	SHELVING	HIGH DENSITY				
G186	STAFF WASHROOM	100347	1	DISPENSER	PAPER TOWEL				
G186	STAFF WASHROOM	100348	1	DISPENSER	SOAP				
G186	STAFF WASHROOM	100349	1	DISPENSER	TOILET TISSUE				
G186D	ADMIN OFFICE	100335T	1	AV COMMUNICATION	W/STAND		30138	20117	G155
G186D	ADMIN OFFICE	100197	2	BOARD	WHITE, MAGNETIC				
G186D	ADMIN OFFICE	100359T	1	CABINET	5 DRAWER	LATERAL	30139	20118	G155
G186D	ADMIN OFFICE	100647T	1	CABINET	FILE, STANDARD	4 DRAWER	30140	20119	G155
G186D	ADMIN OFFICE	100347	1	DISPENSER	PAPER TOWEL				
G186D	ADMIN OFFICE	100348	1	DISPENSER	SOAP				
G186D	ADMIN OFFICE	100155T	1	PRINTER	MULTIFUNCTIONAL		30137	20116	G143
G186D	ADMIN OFFICE	100155T	1	PRINTER	MULTIFUNCTIONAL		85		G143
G186D	ADMIN OFFICE	100202T	1	STAND	ROLLING		30141	20121	G155
G187	NURSING STATION	100197	2	BOARD	WHITE, MAGNETIC				
G187	NURSING STATION	100647T	1	CABINET	FILE, STANDARD	4 DRAWER	30102	20084	G159
G187	NURSING STATION	100203T	1	PRINTER	LEXMARK	MULTIFUNCTIONAL	30066	20067	G159
G187B	DISPENSARY	100197	1	BOARD	WHITE, MAGNETIC	48 x 36			
G187B	DISPENSARY	100423T	1	CART	SUPPLY	S/S W/DRAWERS	30056	20043	G159
G187B	DISPENSARY	100098	1	CONTAINER	SHARPS	ENCLOSED			
G187B	DISPENSARY	100353	1	DISPENSER	GLOVE BOX	FOUR			
G187B	DISPENSARY	100347	1	DISPENSER	PAPER TOWEL				
G187B	DISPENSARY	100348	1	DISPENSER	SOAP				
G187B	DISPENSARY	100180	1	HAND SANITIZER	WATERLESS				
G187B	DISPENSARY	100218T	1	REFRIGERATOR	UNDERCOUNTER		30054	20041	G159
G187B	DISPENSARY	100285T	1	SAFE	NARCOTIC		30055	20042	G159

ROOM	ROOM DESC	ITEM ID	QTY	ITEM NAME	DESCRIPTION	FEATURES	PICT #	VNO	SOURCERM
G187C	CORRIDOR	100040T	1	BIN	SHREDDER		30084	20046	G143
G187C	CORRIDOR	100209T	1	CART	CHART	LARGE	30059	20060	G159
G187C	CORRIDOR	100209T	1	CART	CHART	LARGE	30059	20062	G159
G187C	CORRIDOR	100207T	1	CART	CHART	MEDIUM	30062	20063	G159
G187C	CORRIDOR	100207T	1	CART	CHART	MEDIUM	30063	20064	G159
G187C	CORRIDOR	100208T	1	CART	CHART	MEDIUM	30060	20061	G159
G187C	CORRIDOR	100365T	1	SHREDDER			30067	20068	G159
G188A	FILE STORAGE	100833	7	SHELVING	FILE	HEALTH RECORDS (SIZED PER DRAWINGS)			
G190	SECURITY OFFICE	100353	1	DISPENSER	GLOVE BOX	FOUR			
G190	SECURITY OFFICE	100180	1	HAND SANITIZER	WATERLESS				
G191	DISPENSARY	100480T	1	REFRIGERATOR	BLOOD	SINGLE DOOR	30086	20047	G159

Notes:

- 1.) Item ID numbers with the suffix "T" are existing pieces of equipment to be relocated.
- 2.) See 12 52 00 New Equipment List for new equipment make, model or specification.
- 3.) See 12 53 00 Existing Equipment Photos, All picture numbers (PICT #) are prefaced by PC0 in the format PC0#####

QTY.	ITEM ID #	ITEM NAME	DESCRIPTION	DESC2	MANUFACTURER	CATALOGUE#
4	100102	APRON	LEAD, FRONTAL	1S, 2M, 1XL	COOK	TFA-4, Hook & Loop Closures, Elastic Cross Back Support & shoulder strap
5	100197	BOARD	WHITE, MAGNETIC	48 x 36		Anodized Aluminum Mitered Frame, Hangers & Marker tray
5	100319	BOARD	WHITE	36 X 24		Mitered Frame, Hangers & Marker tray
1	100838	CART	OXYGEN CYLINDER		SafTcart	SCAMDE2
1	100410	COMPRESSOR	AIR	W/SOUND COVER	AIRSTAR	AS10
8	100098	CONTAINER	SHARPS	ENCLOSED	TYCO HEALTHCARE	8967Y
4	100497	DIAGNOSTIC PANEL	C/W SPHYGMANOMETER,	OTO/OPHTHALMOSCOPE	WELCH ALLYN	767 MODEL 76791-MX
2	100497A	DIAGNOSTIC PANEL	W/MOUNTING HARDWARE	FOR WELSH ALLYN SPOT Vital Signs® Lxi Device	WELCH ALLYN	Mounting for Spot Vital Signs® LXi Device
4	100352	DISPENSER	PPE		BOWMAN	LD-070 w/ MP-085
11	100353	DISPENSER	GLOVE BOX	FOUR	ULINE	H-4180
16	100347	DISPENSER	PAPER TOWEL		As per Specification 10 28 10	
1	100347A	DISPENSER	PAPER TOWEL	TAMPER PROOF	As per Specification 10 28 10	
16	100348	DISPENSER	SOAP		As per Specification 10 28 10	
1	100348A	DISPENSER	SOAP	TAMPER PROOF	As per Specification 10 28 10	
1	100349	DISPENSER	TOILET TISSUE		As per Specification 10 28 10	
1	100349A	DISPENSER	TOILET TISSUE	TAMPER PROOF	As per Specification 10 28 10	

QTY.	ITEM ID #	ITEM NAME	DESCRIPTION	DESC2	MANUFACTURER	CATALOGUE#
10	100180	HAND SANITIZER	WATERLESS	228 x 127 x 76, 1 liter	Compatible with existing product, Coordinate with departmental representative.	
1	100386	LIGHT	EXAM	CEILING MOUNT	AMICO	MIRA 65 WITH SINGLE CEILING MOUNT
2	100261	MONITOR	NIBP W/SPO2/THERMOMETER	W/HEADWALL MOUNT	WELSH ALLYN	Spot Vital Signs® LXi Device
1	100139	RACK	APRON (5)		GENERAL ELECTRIC	#E3053G
1	100112	RADIOGRAPHIC UNIT	GENERAL RAD	DR	SEE SPECIFICATION	
1	100502	SCALE	PATIENT	ELECTRONIC W/HEIGHT	SCALETRONIC	5002
1	100846	SCOPE	OTOSCOPE/OPHTHALMOSC OPE	W/MOUNTING FOR DIAGNOSTIC PANEL	WELSCH ALLYN	71641-M
7	100833	SHELVING	FILE	HEALTH RECORDS	See Drawings	
1	100959	SHELVING	HIGH DENSITY		See 10 56 26	
2	100054	SPHYGMOMANOMETER	RAIL MOUNTED	W/BASKET & MOUNTING	TYCOS/BAUM/ WELCH ALLYN	7670-01
1	100109	STOOL	FOOT	W/HAND RAIL	PEDIGO	P-10-A
1	100265	STOOL	W/O CASTERS	ADJUSTABLE W/PADDING	BLICKMAN	7714-PSS
1	100390	STOOL	PHYSICIAN	PNEUMATIC	J.B. CALL	JBC 1210
1	100644	STRETCHER	BARIATRIC		STERIS	PRIME
3	100850	STRETCHER	CHAIR	GRAY,	STRYKER	5050
1	100066	SUCTION	TRANSPORT		LAERDAL	#79-00-10
1	100225	TABLE	OVERBED		HILLROM	634
1	100251	VACUUM SYSTEM	DENTAL		VACSTAR	VS20
1	100945	DENTAL UTILITY CENTER	DENTAL	MODIFICATION TO EXISTING CHAIR	FOREST DENTAL	3900 CHAIR COMPONENT



PC030001



PC030002



PC030003



PC030004



PC030005



PC030006



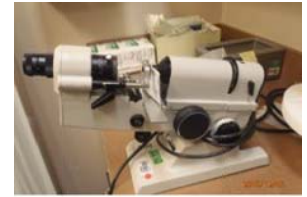
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PC030014



PC030018



PC030019



PC030020



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PC030045



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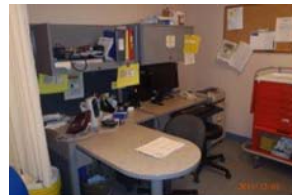
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PC030054



PC030055



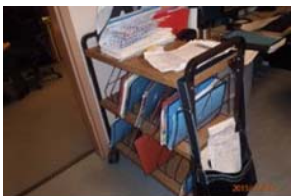
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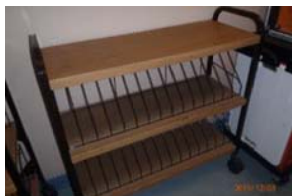
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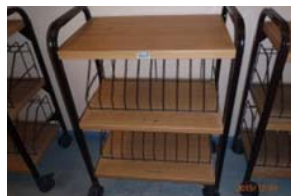
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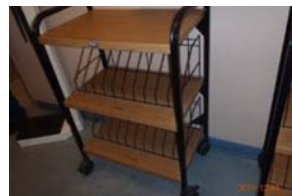
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PC030065



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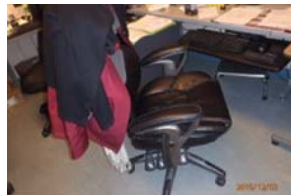
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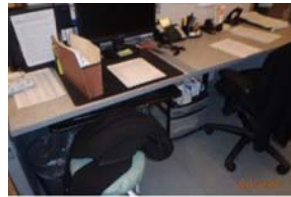
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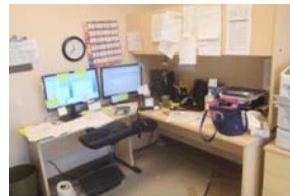
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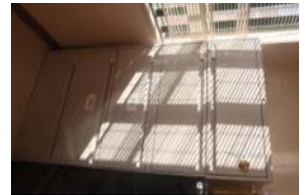
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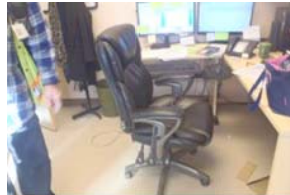
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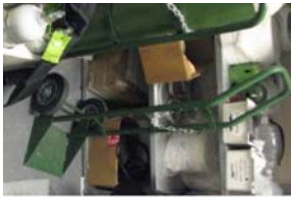
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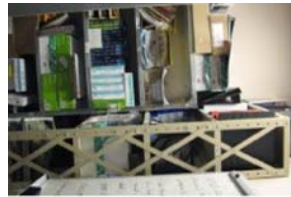
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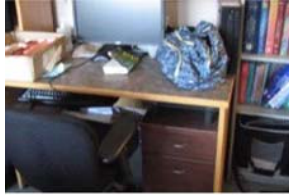
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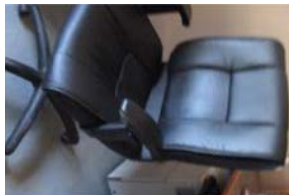
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Part 1 General

1.1 SUMMARY

- .1 Location of radiation protection includes, but is not necessarily limited to the following:
 - .1 Lead radiation protection in walls, doors, frames and windows of rooms containing imaging equipment or treatment rooms.

1.2 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 08 11 00 – Metal Doors and Frames
- .4 Section 08 14 16 – Flush Wood Doors
- .5 Section 08 71 00 – Door Hardware
- .6 Section 08 80 50 – Glazing
- .7 Section 09 21 16 – Gypsum Assemblies
- .8 Section 09 22 16 – Non-Structural Metal Framing
- .9 Divisions 21, 22 and 23 – Mechanical: Protection of mechanical penetrations through radiation protected wall systems.
- .10 Division 25, 26, 27 and 28 – Electrical: Protection of electrical penetrations through radiation protected wall systems.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI/SDI A250.7-1997 (R2002), Nomenclature for Standard Steel Doors and Steel Frames
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM A653/A653M-06, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM B29-03, Standard Specification for Refined Lead
 - .3 ASTM B749-03, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products
 - .4 ASTM C1396/C1396M-04, Standard Specification for Gypsum Board
- .3 Canadian Steel Door Manufacturers Association (CSDMA):
 - .1 Manufacturing Specifications for Doors and Frames
 - .2 Dimensional Standards for Commercial Steel Doors and Frames
 - .3 Canadian Fire Labelling Guide for Steel Doors and Frames

- .4 National Council on Radiation Protection and Measurement (NCRP&M):
 - .1 Report #49, Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies up to 10 MeV
 - .2 Report #147 Structural Shielding Design for Medical X-Ray Imaging Facilities
- .5 Federal Specification QQL-201F Grade C, Sheet Lead.
- .6 Federal specification DD-G-451, Lead Glass.

1.4 SUBMITTALS

- .1 Submit manufacturer's data sheets on each product to be used, including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals.
 - .1 Indicate dimensions, description of materials and finishes and general construction.
 - .2 Indicate layout of radiation-protected areas.
 - .3 Indicate lead thickness or lead equivalencies of components.

1.5 QUALITY ASSURANCE

- .1 Qualifications: Firm with minimum of 5 years successful experience manufacturing radiation protection products similar to those specified for this Project.
- .2 Radiation Protection Survey: Employ registered X-Ray physicist, certified by Canadian College of Physicists in Medicine, for testing specified radiation protective Work and to conduct radiation protection survey of facility after radiation shielding materials are installed.
 - .1 Take radiation measurements and indicate evaluation of measurements in report. Submit report to Departmental Representative upon completion of report.
 - .2 Take radiation measurements in locations indicated by Departmental Representative.
- .3 Design of work of this Section to be determined by the Contractor's physicist.
- .4 Refer to British Columbia Center for Disease Control (CDC) for radiation shielding consultants and radiation shielding guidelines.
- .5 Radiation Protection Work: Comply with applicable requirements of the National Council on Radiation Protection and Measurement (NCRP147) and Health Canada Safety Code 35.
- .6 Provide radiation protection in walls, doors, ceilings and windows as required and appropriate to protect staff and patients from x-rays.

- .7 Provide radiation shielding barriers, mobile or fixed, modular and transparent barriers to protect medical personnel and the public, where necessary by providing a full body shield. Provide units with distortion-free, lead-glass windows.
- .8 Single Source Responsibility: Obtain radiation protection materials and accessories produced as standard products from single manufacturer regularly engaged in production of X-Ray shielding materials, equipment, and accessories.

1.6 MOCK-UPS

- .1 Provide a mock-up for evaluation of preparation techniques and application workmanship.
 - .1 Finish areas designated by Departmental Representative.
 - .2 Do not proceed with remaining work until workmanship, color, and sheen are approved by Departmental Representative.
 - .3 Rework mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Comply with manufacturer's instruction for receiving, handling, storing, and protecting materials.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store materials in original packaging, protected from exposure to harmful environmental conditions, including static electricity, and at temperature and humidity conditions recommended by manufacturer.
- .4 Exercise care to prevent edge damaged materials.

1.8 SITE CONDITIONS

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.
- .2 Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.
- .2 Do not dispose of unused materials into landfill. Divert materials to municipal hazardous materials depot by approved methods.
- .3 Divert unused lead to approved waste carrier for disposal and/or recycling.
- .4 Collect and separate for disposal packaging material for recycling in accordance with Construction Waste Management Plan.

Part 2 Products

2.1 MATERIALS

- .1 Lead Sheets: 99.9 percent pure unpierced virgin rolled lead, free from dross, oxide inclusions, scale, laminations, blisters, and cracks.
 - .1 Sheet Lead shall meet or exceed the Federal Specification QQL-201 F Grade C and ASTM B749 Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products, see NCRP reports #33, #35 and #49.
 - .1 Thickness: As determined by Radiation Protection Survey, to 2.1 m above floor level if not indicated but not less than 0.8 mm thick.
 - .2 Variation in sheet thickness: Not to exceed 3 percent.
 - .3 Thickness: Refer to Nuclear Medicine Shielding Summary.
 - .1 1.6 mm.
 - .2 2.4 mm.
 - .3 3.2 mm.
 - .2 Radiation-Shielded Wood Doors: To ANSI/NWMA Industry standard for wood doors and NCRP Report #49.
 - .1 Flush veneered construction using single layer of sheet lead in center of door. Laminate wood cores under hydraulic pressure on each side of lead. Bond cores using poured lead dowels at edges.
 - .2 Extend sheet lead lining to door edges providing X-Ray absorption equal to partition in which door occurs.
 - .3 Edge Strips: Minimum thickness of 51 mm each edges of door.
 - .1 Same species as wood face veneer.
 - .2 Glue strips to core before face veneer is applied.
 - .3 Extend vertical edge strips full height of door and bevel 3 mm for each 51 mm of door thickness.
 - .4 Door Facing: Refer to Section 08 14 16 – Flush Wood Doors.
 - .5 Glazing Stops: Secure glass with hardwood stops of same species as face veneer. Secure stops to door with wood screws.
 - .6 Lead shielding equivalent to shielding required in walls.
 - .3 Lead-Lined Hollow Metal Door Frames: 16 gauge (1.5 mm) welded steel frames with throat to match wall thickness and 51 mm face. Provide angle iron spot welded at 152 mm on center, and anchor bolts to secure frame if lead thickness is 3 mm or greater.
 - .1 Door Frame Supports: 57 mm steel angle iron.
 - .2 Astragal for Double Doors:
 - .1 Commercial shielded astragal; or
 - .2 50 x 3 mm metal strip x door height c/w lead rubber 50 mm attached to inside surface with double adhesive tape.
 - .4 Radiation Shielding Leded Acrylic: Clear leaded transparent acrylic containing 30% lead by weight. Lead equivalency to 1.60 mm or as required by design. Lead acrylic only used for low lead equivalency.

- .5 Leaded Glass: To Federal Specification DD-G-451. Protection equal to wall lead shielding or as required by design. Lead equivalence measured at 150kVp for x-rays.
 - .1 1.6 mm equivalent clear lead glass.
 - .2 2.4 mm equivalent clear lead glass.
- .6 Lead-Lined View Window Frames: 16 gauge (1.5 mm) welded steel frames adjustable from 108 mm to 152 mm wall thickness. Design window frames to accept any thickness of radiation shielding leaded glass, radiation shielding X-Ray safety glass, or radiation shielding leaded acrylic.
 - .1 Provide radiation protection equivalent to that provided by sheet lead in partition in which view window is installed.
 - .2 Provide 13 mm removable stops.
 - .3 Provide frames with voice transmission slots.
- .7 Radiation Shielding Glass/Acrylic X-Ray Barriers: Mobile full body radiation shielding barriers complying with the following requirements:
 - .1 Frames: 16 gage (1.5 mm) steel.
 - .2 Casters: Heavy duty type.
 - .3 Face: Stainless Steel
 - .4 Window Frames: Fabricated from steel to match finish.
 - .5 Leaded Acrylic: Radiation shielding leaded acrylic.
 - .1 Acrylic Size: size indicated by 1.60 mm Lead Equivalency.

2.2 ACCESSORIES

- .1 Screw Fasteners: Type S Bugle Head, length as required.
- .2 Lead Strips: 51 mm wide, unless indicated otherwise, by same thickness as lead laminated on gypsum board.
- .3 Lead Discs: 9.5 mm diameter lead discs for use with screw heads.
- .4 Cassette Transfer Cabinets: Conforming to MIL-C-3673 (DM) Radiation Shielded.
- .5 Adhesive: Acceptable to manufacturer and capable of adhering lead sheets where required. Adhesive VOC content to comply with content limits of the state of California's South Coast Air Quality Management District (SCAQMD) Rule #1168.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
- .2 Verify that steel framing is not less than 0.9 mm with studs spaced not more than 406 mm on center, unless noted otherwise.

- .3 Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LEAD SHIELDING

- .1 Comply with Occupation Health and Safety requirements for handling of lead shielding.
- .2 Position lead sheet against substrate with longer dimension running vertically.
- .3 Sheet width maximum 1219 mm. Install with all joints occurring over a vertical support.
- .4 Overlap all joints minimum 50 mm.
- .5 Install sheets with continuous support along upper edge and with additional attachment points at maximum 1219 mm vertically on each framing support. Turnout top of sheet minimum 50 mm over horizontal support.
- .6 Fasten lead to supporting studs with a hard washer for stress relieving.
- .7 At wall corners overlap lead sheet minimum 50 mm.
- .8 Extend lead overlap on all door and window frames to prevent 'line of sight' openings for radiation to pass through.
- .9 Install interlocking lead bricks to locations indicated. Mechanically fasten lead bricks to steel studs with ties or straps.

3.3 INSTALLATION OF LEAD-LAMINATED GYPSUM BOARD

- .1 Comply with manufacturer's recommendations.
- .2 Adhere lead strips on face of studs at joints in lead-laminated gypsum board, including inside and outside corners. Use 50 mm wide strips by same thickness as sheet lead laminated on gypsum board.
- .3 Shim studs and other framing members as necessary to provide flat, flush finished surfaces.
- .4 Install lead-laminated gypsum board on framing with screws spaced not more than 203 mm on center along edges of board and 305 mm on center in field of board.
- .5 Adhere lead discs to fastener heads. In each case, use method that provides continuous radiation shielding.
- .6 Where lead-laminated gypsum board is final substrate, apply joint treatment on fasteners and joints per Section 09 21 16.
- .7 Where second layer of gypsum board occurs over lead-laminated gypsum board, comply with Section 09 21 16 for application of second layer.

3.4 INSTALLATION OF DOORS AND DOOR FRAMES

- .1 Lead-Lined Frames: Install lead-lined steel door frames per Section 08 11 00. Comply with NAAMM HMMA 840 unless otherwise indicated. Set frames accurately in position, plumb, and braced securely until permanent anchors are set.
- .2 Secure door frames with steel stud anchors if lead lining is below 3 mm thick.

- .3 Door Frame Supports (utilize if lead thickness is 3 mm or greater):
 - .1 Run steel angle supports full height on each door frame jamb to structure above.
 - .2 Spot-weld supports at 152 mm along jambs and at corners of jambs and head frame.
 - .3 Anchor frame to substrate with fasteners appropriate for substrate.
 - .4 Apply coat of asphalt mastic or paint to lead lining in door frames where lead will come in contact with masonry or grout.
- .4 Install minimum 4 - 14 ga x 50 mm anchors per jamb of doors located adjacent to hinge on hinge jamb, and at corresponding heights on strike jamb.
- .5 In metal stud construction, use wall anchors attached to studs with screws.
- .6 Lap lead lining of frames over lining in walls at least 25 mm.
- .7 Line inside of frames with lead of thickness not less than that required in doors and walls in which frames are used. Form lead to match frame contour, continuous in each jamb and across head, lapping stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least 25 mm.
- .8 Lead-Lined Doors:
 - .1 Install lead-lined wood doors in accordance with Section 08 14 16.
 - .2 Install doors in frames level and plumb, aligned with frames and with uniform clearance at edges.
 - .3 Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. Coordinate with requirements of Section 08 71 00 for other installations requirements.
- .9 Touch up damaged finishes with compatible coating after sanding smooth.

3.5 INSTALLATION OF WINDOWS FRAMES

- .1 Set unleaded side of frame plumb and square in wall opening on control room side of wall with shims.
- .2 Set leaded side of frame plumb and square in wall opening on X-Ray side of wall.
- .3 Compress sides together against faces of wall.
- .4 Install setting blocks, shims, and glazing tape in glazing channel to prevent galls from touching steel frame.
- .5 Install radiation resistant glazing in telescopic frame.
- .6 Place steel stops in position and mark location of stop and frame retaining holes on steel frame.
- .7 Remove glazing and drill holes in steel frame.
- .8 Place glazing and stops and hand drive setting screws.
- .9 Installation of Lead-Plastic/Glass:
 - .1 Do not remove protective masking paper until the panel has been mounted and is in position.

- .2 Roll the paper edges enough to accommodate the hardware thickness prior to final positioning.
- .3 Allow 1% for acrylic expansion and shrinkage in length and width.
- .4 Do not fix leaded acrylic in place with screws and bolts unless 1% clearance is allowed in the form of slots for fasteners.
- .5 Ensure minimum 9 mm overlap between sheet and frame.

3.6 INSTALLATION OF PENETRATING ITEMS

- .1 At penetrations of lead linings; provide lead shields to maintain continuity of protection.
- .2 Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.
- .3 Cut wall penetration covers from lead sheet of equal or greater thickness than backing on adjacent wall panels. Cut wall penetration covers to size required to cover wall penetrations with laps 25 mm minimum wide as indicated on penetration detail drawings.
- .4 Adhesive-apply lead sheet penetration covers on penetrating boxes and raceways and return penetration covers to backside of lead-backed wall panels with 25 mm minimum laps.
 - .1 Do not use penetrating fasteners unless indicated otherwise.
- .5 Outlet Boxes and Conduit: Install between studs using steel telescoping mounting brackets. Cover or line with lead sheet lapped over adjacent lead lining at least 25 mm. Wrap conduit with lead sheet for 250 mm in from box.
- .6 Ducts that penetrate the ceiling slab closer than 8 m from the centre of the room will require sheet lead wrapping.

3.7 ACCESSORY INSTALLATION

- .1 Comply with manufacturer's recommendations.
- .2 Wherever lead protection is penetrated, cut, or punctured, assure continuity of shielding by use of sheet lead, lead plugs or other approved method.
- .3 Install sheet lead lining within steel door frames to provide radiation protection to levels or levels required to match adjacent wall protection.
- .4 Wrap electrical outlet boxes, view window frames, and other penetrations through lead barrier material with sheet lead to provide radiation protection to levels indicated or levels required to match adjacent wall protection. Lap lead minimum 20 mm at all joints
- .5 At large openings, pipe chases etc apply lead on the rear side of the studs. Overlap the lead minimum 100 mm to the lead lining at the front of the studs at all edges.
- .6 At concrete columns larger than 200 mm in size, overlap the lead on the concrete by 100 mm from the adjacent wall.
- .7 At pipe or wiring penetrations of the floor or ceiling shield the hole with lead sheet.

- .1 Cut a piece of lead sheet 200 mm larger than the hole in all directions. Make a hole in the centre of the sheet to fit the penetrating pipe or conduit tightly.
- .2 Make a cylindrical collar from lead sheet to cover the pipe or conduit to a height of 100 mm above/below the floor. Flare one end to make a flange to overlap the sheet already installed and secure the lead in place.

3.8 FIELD QUALITY CONTROL

- .1 Design and install radiation protection under supervision of an independent physicist hired by Project Co.
- .2 Maintain a complete record of radiation protection installation, including written reports and complete photo documentation.
- .3 Field Inspection: Engage qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports prior to application of gypsum board.
- .4 Correct deficiencies in, or remove and replace, radiation protection that inspection reports indicate does not comply with specified requirements.
- .5 Testing: After radiology equipment has been installed and placed in operating condition, engage radiation health physicist to test radiation protection.
- .6 Correct deficiencies in, or remove and replace, radiation protection that testing indicates does not comply with specified requirements, including finishes and other Work covering defective Work.

3.9 ADJUSTING

- .1 Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.10 CLEAN-UP

- .1 As work proceeds and at the completion of the work clean up and remove from site all debris and left over materials resulting from the work of this Section.
- .2 Dispose of waste materials in conformance with Construction Waste Management Plan.
- .3 Leave exposed surfaces ready for site finishing.

3.11 PROTECTION

- .1 Lock radiation-protected rooms once door hardware is installed. Limit access to only those persons performing Work in radiation-protected rooms or as directed by Contractor.
- .2 Tape temporary paper signs on radiation-resistant walls with the following text:
 - .1 "Do not mount equipment on this wall without covering penetrating fasteners with lead sheet of thickness required by contract documents".

END OF SECTION

PART 1 GENERAL

1.1 Related Work

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

1.2 Reference Standards

- .1 Perform work in accordance with the recommendations and requirements of:
 - .1 National Fire Protection association, NFPA 10 – Standard for Portable Fire Extinguishers.
 - .2 National Building Code of Canada 2005.

1.3 Shop Drawings and Product Data

- .1 Submit shop drawings and product data for the extinguishers and extinguisher cabinets.

1.4 Maintenance Data

- .1 Provide maintenance data for incorporation into the Mechanical Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.1 Products

- .1 FE-1 Recessed Cabinet with Extinguisher (finished areas):
 - .1 229 mm wide x 610 mm high x 152 mm deep cabinet
 - .2 full length semi-concealed piano hinges for 180 degree swing
 - .3 flush stainless steel door latch with no exposed fasteners
 - .4 22 gauge steel tub
 - .5 16 gauge steel door and trim with optional 5 mm clear tempered glass (-G-T)
 - .6 grey prime coated finish ready for field painting
 - .7 4.5 kg ABC dry chemical multipurpose fire extinguisher
 - .8 Standard of Acceptance:
N.F.E. model CE-950-3-2-R-G-T extinguisher cabinet
- .2 FE-2 Wall Mount Bracket with Extinguisher (service areas):
 - .1 Powder coated Steel wall bracket for 4.5 kg extinguisher
 - .2 4.5 kg ABC dry chemical multipurpose fire extinguisher

PART 3 EXECUTION

3.1 Installation

- .1 Install fire extinguishers in cabinets at locations as indicated on architectural drawings.
- .2 Coordinate locations of fire extinguisher cabinets with the framing trades in order to facilitate recessed and semi-recessed installations.
- .3 Mount fire extinguishers and cabinets such that the top of the extinguisher is at 1220 mm above the floor.
- .4 Install fire extinguisher cabinet doors, glazing panels and fire extinguishers in the cabinets prior to the project substantial completion review by the Departmental Representative.

3.2 Identification

- .1 Identify fire extinguishers in accordance with the recommendations of NFPA 10.
- .2 Attach a tag or label to all fire extinguishers, indicating the month and year of installation, with space for recording subsequent service dates.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 ANSI/NFPA 13-2007, Installation of Sprinkler Systems.
 - .2 ANSI/NFPA 25-2007, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriter's Laboratories of Canada (ULC).
- .4 Fire Commissioner of Canada FC 403, "Sprinkler System".

1.3 Samples

- .1 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Signs.

1.4 Design Requirements

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.
- .2 The "Authority Having Jurisdiction" is Fire Protection Engineering Services of Human Resources and Skills Development Canada (HRSDC).
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in sprinkler systems.
- .6 Design systems for earthquake protection for buildings in seismic zone applicable.

- .7 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13.
 - .2 Uniformly space sprinklers on branch.
- .8 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
- .9 Water Supply:
 - .1 Base hydraulic calculations on static and residual pressures indicated on drawings. For design purpose, the available water supply pressures shall be de-rated by a 10% safety factor.

1.5 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – Shop Drawings, Product Data and Samples.
 - .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 - Shop Drawings, Product Data and Samples.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data and Samples.
 - .2 Shop drawings: submit drawings stamped sealed and signed by professional engineer registered or licensed in Province of B.C. Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.
 - .6 Reinforcement.
 - .7 Assembly details.
 - .8 Accessories.
 - .3 Drawings: Sprinkler heads and piping system layout.
 - .1 Prepare detail working drawings of system layout in accordance with NFPA 13 using full size contract drawings.
 - .2 Show data essential for proper installation of each system.

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- .3 Show details, plan view, elevations, and sections of systems supply and piping.
 - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings.
 - .4 Design Data:
 - .1 Calculations of sprinkler system design.
 - .2 Indicate type and design density of each system.
 - .3 Assurance of Professional Design and Commitment for Field Review.
 - .1 Provide Assurance commitment letters (Schedules B-1 and B-2) at the commencement of the project, in accordance with the building code and for Building Permit application.
 - .2 Provide Assurance of Professional Field Review and Compliance (Schedule C-B) at the completion of the project.
 - .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 01 50 - Closeout Submittals in accordance with ANSI/NFPA 20.
 - .2 Manufacturer's Catalog Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Sprinkler heads.
 - .3 Pipe hangers and supports.
 - .4 Mechanical couplings.
 - .3 Field Test Reports:
 - .1 Preliminary tests on piping system.
 - .2 Formal tests and inspections
 - .4 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings (prints) of each system for record purposes.
 - .2 Submit drawings in AutoCAD and PDF digital file versions with title block similar to full size contract drawings.
 - .5 Operation and Maintenance Manuals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 - Closeout Submittals.

- .2 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual specified in Section 01 01 50 - Closeout Submittals in accordance with ANSI/NFPA 13.

1.6 Quality Assurance

- .1 Qualifications:
 - .1 Installer: company or person specializing in sprinkler systems with documented experience.
 - .2 All work shall be carried out by Sprinkler Pipe Fitters who carry a "Certificate of Qualification" for this trade as issued by the B.C. Province Ministry of Labour.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & Safety Requirements.
- .3 Inspections and Tests:
 - .1 All inspections, examinations and tests required by the "Authorities and Agencies having jurisdiction" specified shall be arranged and paid for by the fire protection contractor, as necessary to obtain complete and final acceptance of the fire protection system.
 - .2 Provide Contractor's Material and Test Certificates and all required test papers as may be requested by all parties having jurisdiction and duly witnessed by Departmental Representative, showing proof of:
 - .1 Underground hydrostatic test of 1400 kPa.
 - .2 Flushing of underground main through 100mm drain pipe.
 - .3 Hydrostatic test of overhead piping @ 1400 kPa.
 - .4 Verification of all alarm and trouble devices installed under this contract.
 - .3 Provide the services of the Professional Engineer who designed the fire protection systems for "Field Review" of the installation. Construction period review reports shall be submitted during the construction period.
 - .4 If welding is required, the Contractor shall submit a copy of the welder's certification to the Departmental Representative for record purposes prior to starting work.

1.7 Maintenance

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

- .2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.8 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Underground Pipe and Fittings

- .1 Underground water pipe shall be PVC pipe conforming to AWWA Standard C900-75 "Poly (Vinyl Chloride) (PVC) Pressure Pipe 4 through 12 inch (100 through 300mm) for water", CSA B137.3 ULC CEx448, and UNI-B-3-80. The pipe is to be Class 150psi (Dimensional Ratio (DR)-18 with cast iron outside diameter) and integral bell gasket joint. Gaskets are to be bonded into the ring groove prior to shipment. Underground fittings shall have joints and pressure rating compatible with pipe used. Risers shall be cement lined ductile iron conforming to AWWA Specification 50.
- .2 All underground piping for fire mains shall be installed, clamped and anchored and flushed and hydrostatically pressure tested according to requirements of NFPA 13 and NFPA 24 latest Editions. Flushing shall be done through 100mm minimum diameter piping.
- .3 At all changes in direction and at tees, ells, plugs, caps, bends, and hydrants, anchor mains as per NFPA 24 latest Edition. Pipe clamps and tie rods, thrust blocks, or other approved methods or devices may be used. Continuously threaded rod shall not be used for underground applications.

2.2 Pipe, Fittings & Valves

- .1 Pipe:
 - .1 Piping shall meet or exceed one of the following standards:
 - .1 Black and Hot-Dipped Galvanized Welded and Seamless Steel Pipe – ASTM A795
 - .2 Welded and Seamless Steel Pipe – ANSI/ASTM A53
 - .3 Wrought Steel Pipe – ANSI B36.19M
 - .4 Elec.-Resistance Welded Steel Pipe – ASTM A135
 - .2 All thickness for pressures up to 2070 kPa shall be as follows:
 - .1 Joined by shop welding or roll grooving:
 - .1 Up to and incl. 125mm – Schedule 10
 - .2 150mm – 3.40mm
 - .3 200mm, 250mm – 4.78mm
 - .2 Joined by threaded fittings or cut grooves:
 - .1 up to 200mm – Schedule 40
 - .2 200mm and larger – Schedule 30
- .2 Fittings and joints to ANSI/NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .2 Copper tube: screwed, soldered, brazed.
 - .3 System piping 50mm and smaller shall be Schedule 40 and joined with threaded fittings in accordance with NFPA 13. Larger sizes shall be Schedule 10 and joined by welding or groove joining methods in accordance with NFPA 13.
 - .4 All grooved products shall be of one manufacturer. All grooved end fittings shall be of “full flow” design and manufactured from ductile iron conforming to ASTM A-536. Grooved coupling shall be designed with angle bolt pads to provide a rigid joint except where flexibility is required. “Flush cap” or “flush seal” gaskets shall be used with couplings in dry pipe systems.
 - .5 Cast iron floor and ceiling plates with set screws shall be provided whenever pipe passes through walls, floors and partitions. In finished areas, plates shall be chrome plated.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, O. S. & Y. gate.
 - .3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve; OS & Y gate.
 - .4 Swing check valves.

- .5 Ball drip.
- .6 All water supply and zone isolation valves shall be monitored with tamper switches. Electric wiring for control and alarm components will be provided Under Division 16.
- .7 Valves controlling water supply and alarm shut-off shall be of O. S. & Y. type with rising stem or approved gear operated butterfly valves with supervisory switch. Where a grooved piping system is installed, grooved end isolation/control valves may be used. Valves shall be supervised by a factory installed double throw/double pole switch.
- .8 All O. S. & Y. gate vales shall be monitored with tamper switches. Electric wiring for control and alarm components shall be provided under Division 16.
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services.
 - .2 Hanger standards shall conform to Section 3-10 of NFPA 13. Use "C" clamps complete with lock nuts and restraining straps. Hangers shall be supplied and installed in accordance with NFPA 13. C-type clamps used to attach hangers to the building structure shall be equipped with lock nuts and retaining straps.
 - .3 Sway bracing shall be installed as per Section 3-5.3.5 of NFPA 13.

2.3 Backflow Prevention

- .1 Provide a double check valve assembly as indicated on the Fire Protection Drawings.
- .2 Backflow prevention stations shall be listed by Underwriter's Laboratories Canada (U.L.C.).
- .3 Backflow prevention stations shall be in complete accordance with CSA B64.10-M88 "Selection, Installation, Maintenance and Field Testing" and American Water Works Association - Western Canada Section and Pacific Northwest Section - 1990 Fifth Edition.
- .4 Complete testing of all reduced pressure principle backflow prevention devices shall be carried out under this Section prior to final acceptance of fire protection systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

2.4 Sprinkler Heads

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.
- .2 All sprinklers in suspended ceiling areas shall be chrome finish recessed type with chrome flush type escutcheon plates. All sprinklers in open ceiling areas shall be of brass finish upright or pendent types. All sidewall sprinklers shall be chrome finish horizontal type.

- .3 Sprinkler shall be protected from mechanical injury by standard guards where necessary. The proximity of sprinklers to heating units shall be taken into consideration in determining the temperature rating.
- .4 Adjacent to each sprinkler alarm valve, provide one (1) 12-sprinkler capacity Underwriters approved cabinet complete with various type and temperatures of sprinklers in ratio to the numbers installed of each type along with a standard sprinkler wrench.

2.5 Supervisory Switches

- .1 General: to ANSI/NFPA 13 and ULC listed for fire service.
- .2 Valves:
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Pressure or flow switch type:
 - .1 With normally open and normally closed contacts and supervisory capability.
 - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
 - .3 Connect into building fire alarm system.
 - .4 Connection of switch: Section 28 31 02 – Multiplex Fire Alarm System.

2.6 Pressure Gauges

- .1 Provide pressure gauges at the following locations:
 - dry pipe valve
 - compressor
 - pump suction and discharge
 - top of all standpipe risers
- .2 Pressure gauges shall be ULC listed stem mount or wall mount type with Bourdon phosphor bronze tube, brass socket, 6 mm lower connection, aluminum case in black enamel finish, chrome removable slip ring, stainless steel rotary type movement, minimum 90mm dial of 1% of full scale range and pressure range to suit application, with lever handle cock and brass 6 mm NPT snubber to suit service.

2.7 Flow Switches

- .1 Provide alarm indication for each system or zone indicated. Flow switches shall be vane-type with retard for pipes 50mm or larger; without retard for smaller pipe sizes.
- .2 All zones shall have a flow switch, an isolation valve and an integral test and drain.

2.8 Fire Department Connection

- .1 Provide connections approximately 1.5 m above finish grade, location as indicated.

- .2 To ANSI/NFPA 13 and ULC S543 listed, Siamese type.
- .3 Polished bronze exposed of approved two-way type with 63.5 mm National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.
- .4 Thread specifications: compatible with local fire department.

2.9 Pipe Sleeves

- .1 Provide pipe sleeves where piping passes through walls, floors, and roofs.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
 - .1 Firmly pack space with mineral wool insulation.
 - .2 Seal space at both ends of sleeve or core-drilled hole with [plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.
 - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.
 - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other than Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide 0.61 mm thick galvanized steel sheet.

2.10 Escutcheon Plates

- .1 Provide split hinged type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
- .2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.11 Spare Parts Cabinet

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Construct to sprinkler head manufacturer's standard.

2.12 Inspector's Test Connection

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

- .2 Provide test connection piping to location where discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.13 Signs

- .1 Attach properly lettered and approved metal signs to each valve and alarm device to ANSI/NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

PART 3 EXECUTION

3.1 Manufacturer's Instruction

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

3.2 Water Connection

- .1 Connect sprinkler system supply line to City water main and run service line into the building system.
- .2 Lay underground supply pipe to local authority standards at minimum 1200 mm (48") depth of bury or below frost line, whichever is greater.
- .3 Install frost-proof casing around riser from the underground main to protect against freezing.

3.3 Above Ground Piping Systems

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
 - .2 Perform welding in shop; field welding will not be permitted.
 - .3 Conceal piping in areas with suspended ceiling.

3.4 Pipe Installation

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

- .4 Inspect piping before placing into position.
- .5 Install spare parts cabinet as indicated.
- .6 Valve identification:
 - .1 Identify drain valve and auxiliary valves.

3.5 Disinfection

- .1 Disinfect new piping.
- .2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.
- .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.
- .4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.6 Field Painting

- .1 Clean, pre-treat, prime, and paint new systems including piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
 - .1 Piping in Finished Areas:
 - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
 - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
 - .3 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.
 - .2 Piping in Unfinished Areas:
 - .1 Finish painting not required in spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces

where walls or ceiling are not painted or not constructed of a pre-finished material.

- .2 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals.

3.7 Field Quality Control

.1 Site Test, Inspection:

- .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
- .2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

- .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
- .2 Flush piping with potable water in accordance with NFPA 13.
- .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
- .4 Test alarms and other devices.
- .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

- .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
- .2 Submit written request for formal inspection at least 15 days prior to inspection date.
- .3 Repeat required tests as directed.
- .4 Correct defects and make additional tests until systems comply with contract requirements.
- .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
- .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .7 Altered and relocated sprinkler system to be inspected and tested in conformance with NFPA 125.

3.8 Placing In Service

- .1 When the entire fire protection system has been completed to the satisfaction of the Departmental Representatives and when operating and maintenance instructions have been provided, the Fire Protection Contractor shall, in the presence of the

Departmental Representative, demonstrate the complete operation and maintenance required to the operating personnel. A complete operational test conducted on the entire installation for the purpose of verification of compliance with all applicable standards and codes shall be carried out.

- .2 Three copies of a complete operating manual shall be provided, which must include the following:
 - .1 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and trouble shooting instructions.
 - .2 Valve schedule for all valves including location, service type and normal position for all systems.
 - .3 Schematic showing the location of each excess pressure pump breaker, inspectors test valves, low point drains and flow switches where applicable.
 - .4 Warranties and certificates.
 - .5 Manufacturer's operating and maintenance manuals.
 - .6 Description of the operation of each system and the function of each piece of equipment.
 - .7 Lubrication schedule for all lubricated equipment including recommended lubricants.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|-------------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 23 05 05 | Installation of Pipework |
| .3 | Section 23 07 19 | Thermal Insulation for Piping |

1.2 References

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-02, Cast Bronze Threaded Fittings, Classes 125 and 250
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 307-03 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - .2 ASTM B 88M-03, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American Water Works Association (AWWA).
 - .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .2 MSS-SP-71-1997, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-80-2003, Bronze Gate, Globe, Angle and Check Valves.
- .6 National Sanitation Foundation (NSF).
 - .1 NSF 61, Drinking Water System Components.

1.3 Submittals

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

1.4 Health and Safety

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

1.5 Waste Management and Disposal

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

1.6 Quality Assurance

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

PART 2 PRODUCTS

2.1 Piping

- .1 Domestic hot, cold and hot recirculation water systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B 88M to NPS 4 size.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B 88M, in long lengths and with no buried joints.
- .2 Water service pipe NPS6 or large in building shall be Ductile Iron, minimum Pressure Class 350 designed and manufactured in accordance with ANSI/AWWA C150/A21.50 and C151/A21.51. All pipe shall be cement –mortar lined in accordance with ANSI/AWWA C104/A2.4 and grooved to BS 4772/2531 standards.
- .3 Underground water supply piping 100mm or larger shall be AWWA C900 PVC pressure pipe with compatible fittings. Provide concrete thrust blocks for joint restraint at changes of pipe direction.

2.2 Fittings

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 to NPS 4: roll grooved to CSA B242.
- .6 NPS 6 and larger: fittings shall be British Standard/ISO cement-mortar lined and bituminous coated ductile iron fittings conforming to ASTM A-536 with Grade "M" Flushseal gaskets suitable for a temperature range of 20°F to + 200°F.

2.3 Joints

- .1 Rubber gaskets, 1.6mm thick: to ANSI/AWWA C111/A21.11.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy or brazing.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 Gate Valves

- .1 NPS2 and under, soldered:
 - .1 Rising stem: to MSSSP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.
- .2 NPS2 and under, screwed:
 - .1 Rising stem: to MSSSP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.
- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSSSP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS & Y bronze trim.
- .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
 - .1 Non-rising stem: to MSSSP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.5 Globe Valves

- .1 NPS2 and under, soldered:
 - .1 To MSSSP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.
 - .2 Lockshield handles: as indicated.

- .2 NPS2 and under, screwed:
 - .1 To MSSSP-80, Class150, 1MPa, bronze body, screwed over bonnet, renewable composition disc.
 - .2 Lockshield handles: as indicated.

2.6 Swing Check Valves

- .1 NPS 2 and under, soldered:
 - .1 To MSSSP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, re-grindable seat.
- .2 NPS2 and under, screwed:
 - .1 To MSSSP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, re-grindable seat.
- .3 NPS2-1/2 and over, flanged:
 - .1 To MSSSP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap.

2.7 Ball Valves

- .1 NPS2 and under, screwed:
 - .1 Class150.
 - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle.
- .2 NPS2 and under, soldered:
 - .1 To ANSI B16.18, Class150.
 - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

2.8 Drain Valves

- .1 Drain valves shall be provided with cap and chain.
- .2 Drain and hose valves 20mm (3/4") and smaller:
 - .1 Sediment Faucets.
 - .2 Ball valves.

2.9 Plumbing Piping

- .1 Water supply piping under concrete slabs or in walls shall be encased in standard weight flexible polyethylene pipe one size larger than copper tubing. All joints to be wrapped in plastic wrapping tape.

2.10 Dielectric Unions

- .1 Insulating dielectric unions and flange unions shall be installed when adapting between dissimilar metallic pipe for domestic water supply piping, and domestic

water storage tanks. Elsewhere, unions and adaptors for copper piping shall be cast brass pressure fittings.

2.11 Expansion Joints

- .1 Domestic and industrial water: Annular close pitch corrugated metal hose with Type 316L stainless steel butt welded tube. Type 304 single stainless steel outer brain, flanged, welded or screwed ends. Suitable for 1034 kPa working pressure and 50mm traverse.

2.12 Strainers

- .1 NPS 2 and under: Full pipeline size, 250 lb. SWP bronze, with screwed ends and a removable plug type screen retainer.
- .2 NPS 2-1/2 and over: Full pipeline size, 250 lb. SWP semi-steel, with flanged ends and a bolted screen retainer.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .3 Assemble all piping using fittings manufactured to ANSI standards.
- .4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .5 Install CWS piping below and away from HWS and HWR and all other hot piping so as to maintain temperature of cold water as low as possible.
- .6 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.
- .7 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .8 When grooved fittings are used, contractors shall provide proof of training on site by the mechanical coupling manufacturer, or manufacturer's representative prior to the start of installation.

3.2 Valves

- .1 Isolate equipment, fixtures and branches with gate or ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 Pressure Tests

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

3.4 Pre- Start-Up Inspections

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.5 Disinfection

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative's approval.

3.6 Performance Verification

- .1 Timing: Starts after:
 - .1 Pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .3 Sterilize HWS and HWR systems for Legionella control.
 - .4 Verify performance of temperature controls.
 - .5 Verify compliance with safety and health requirements.
 - .6 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .7 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results for Mechanical
- .3 Section 23 05 05 Installation of Pipework

1.2 References

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B 32-03, Specification for Solder Metal.
 - .2 ASTM B 306-02, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C 564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .2 CAN/CSA-B125-01, Plumbing Fittings.

1.3 Submittals

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

1.4 Health and Safety

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

1.5 Waste Management and Disposal

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

PART 2 PRODUCTS

2.1 Copper Tube and Fittings

- .1 Above ground sanitary storm and vent, Copper Type DWV to: ASTM B 306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: tin-lead, 50:50, type 50A or lead free, tin-copper alloy 95:5, type TA to ASTM B 32.

2.2 Cast Iron Piping and Fittings

- .1 Buried sanitary storm and vent, cast iron (minimum NPS 2) to: CAN/CSA-B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C 564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.
 - .2 Above ground sanitary storm and vent: Cast iron to CAN/CSA-B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 ABS Piping

- .1 Drainage piping under the building, provided that such piping does not pass through any fire separations, may be as follows, at the contractor's option:
 - .1 Underground sanitary drainage piping under building, 150mm in diameter and smaller shall be certified to the current version of CSA B181.1, ABS Drain, Waste and Vent Pipe and Fittings. Piping shall be solid wall in construction. Cell core piping is not acceptable.

PART 3 EXECUTION

3.1 Installation

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

- .3 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with 150 mm of clean washed sand.
- .4 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

3.2 Testing

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

3.3 Performance Verification

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
 - .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

PART 1 GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 The supply and installation of Plumbing Specialties and Accessories.
- .2 Products Installed but not Supplied Under this Section:
 - .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
 - .2 Equipment installed by others.
 - .1 Connect with unions.
 - .3 Equipment not installed.
 - .1 Capped for future connection by others.

1.2 Related Section

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results for Mechanical
- .3 Section 23 08 01 Performance Verification Mechanical Piping Systems

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 126-95(2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B 62-93, Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
- .3 Canadian Standards Association (CSA)
 - .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
 - .2 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Plumbing and Drainage Institute (PDI)
 - .1 PDI-WH201-92, Water Hammer Arresters Standard.
- .5 National Sanitation Foundation (NSF).
 - .1 NSF 61, Drinking Water System Components.

1.4 Submittals

- .1 Submittals in accordance with Section 01 01 50 - General Instructions.
- .2 Indicate, for all plumbing specialties and accessories:
 - .1 Dimensions, construction details, roughing-in dimensions.

1.5 Closeout Submittals:

- .1 Submit maintenance data in accordance with Section 01 01 50 – General Instructions.
- .2 Include:
 - .1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.6 Health and Safety

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

1.7 Delivery Storage and Disposal

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan
 - .3 Fold up metal banding, flatten and place in designated area for recycling.

1.8 Quality Assurance

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

PART 2 PRODUCTS

2.1 Cleanouts

- .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access covers:
 - .1 Wall access: face or wall type, polished nickel bronze or stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor access: round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

- .1 Plugs: bolted bronze with neoprene gasket.
- .2 Cover for unfinished concrete floors: cast iron round gasket, vandal-proof screws.
- .3 Cover for terrazzo finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws
- .4 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
- .5 Cover for carpeted floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.2 Water Hammer Arrestor

- .1 Copper construction, bellows type: to PDI-WH201.

2.3 Back Flow Preventer

- .1 To CSA-B64 Series.
- .2 Application: as indicated.

2.4 Vacuum Breaker

- .1 To CSA-B64 Series.

2.5 Pressure Regulator

- .1 Capacity and performance:
- .2 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B 62.
- .3 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A 126, Class B.
- .4 Semi-steel spring chambers with bronze trim.

2.6 Trap Seals Primer

- .1 Brass, with integral vacuum breaker, NPS1/2 solder ends, NPS1/2 drip line connection.

2.7 Strainers

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.8 Hose Bibbs and Sediment faucets

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.9 Circulation Pumps

- .1 Provide circulating pumps where indicated, designed for quiet operation and guaranteed by the manufacturer for the intended operation.
- .2 Hot water circulating pumps shall be suitable for pumping 100°C water.
- .3 All pumps shall be fitted with mechanical shaft seals.
- .4 Domestic water pumps shall be all bronze construction.

2.10 Gas Meter

- .1 Provide a dedicated, measurement Canada grade, pulsed gas meter to monitor the gas consumption serving the building. Install the new meter in the gas line inside the building serving all gas fired equipment. Provide isolation valves at the inlet and outlet of meter, and provide a valved, full size bypass for servicing. Provide an Analog Input point and connect to the DDC system for monitoring. Gas meters shall have a maximum allowable operating pressure of 1208 kPa and a flow capacity of 28.3 m³/hr, and provided with optional LF pulser.

PART 3 EXECUTION

3.1 Installation

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

3.2 Cleanouts

- .1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.3 Water Hammer Arrestor

- .1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.4 Back Flow Preventers

- .1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest drain and/ or service sink.

3.5 Hose Bibbs and Sediment Faucets

- .1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.6 Trap Seal Primers

- .1 Install for all floor drains and elsewhere, as indicated.

- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.
- .3 Install soft copper or plastic tubing to floor drain.

3.7 Performance Verification:

- .1 General:
 - .1 In accordance with Section 23 08 01 – Performance Verification Mechanical Piping Systems.
- .2 PV procedures:
 - .1 Vacuum breakers, backflow preventers: operation under all conditions.
 - .2 Thermostatic controls: Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

PART 1 GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 The supply and installation of Plumbing Fixtures and Trim.
- .2 Products Installed but not Supplied Under this Section:
 - .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
 - .2 Equipment installed by others.
 - .1 Connect with unions.
 - .3 Equipment not installed.
 - .1 Capped for future connection by others.

1.2 Related Section

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results for Mechanical

1.3 References

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-B45 Series 02, Plumbing Fixtures.
 - .2 CAN/CSA-B125-01, Plumbing Fittings.
 - .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.
- .2 National Sanitation Foundation (NSF).
 - .1 NSF 61, Drinking Water System Components.

1.4 Submittals

- .1 Submittals in accordance with Section 01 01 50 - General Instructions.
- .2 Indicate, for all fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.

1.5 Closeout Submittals:

- .1 Submit maintenance data in accordance with Section 01 01 50- General Instructions.

- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.6 Health and Safety

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

1.7 Delivery Storage and Disposal

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan
 - .3 Fold up metal banding, flatten and place in designated area for recycling.

1.8 Quality Assurance

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

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.
- .7 Fixture Schedule:

WC-1 Accessible Water Closet with Sensor Flush Valve

'Low Consumption' Toilet, floor mounted, vitreous china, EverClean™ antimicrobial surface which inhibits the growth of stain and odor causing bacteria, mold and mildew, elongated syphon jet flush action bowl, 2-1/8" (54mm) fully glazed internal trapway, 10" x 12" (254mmx 305mm) large water surface, 6L (1.6 gal.) per flush, 1-

1/2" (38mm) top spud with condensate channel and bolt caps, for use with flush valve. Provide Floor Flange, flange bolts and gasket.

Toilet Seat, elongated heavy duty solid plastic with Anti- Microbial Compound (to inhibit the growth of bacteria), open front with cover, reinforced stainless steel self-sustaining check hinge, posts, washers and nuts.

WC-2 Accessible Water Closet with Sensor Flush Valve

16-1/2" (420mm) HIGH' Toilet, floor mounted, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria, mold and mildew, elongated syphon jet flush action bowl, 2-1/8" (54mm) fully glazed internal trapway, 10" x 12" (254mm x 305mm) large water surface, high efficiency 4.2 LPF (1.1 GPF) to low consumption 6 LPF (1.6 GPF), 1-1/2" (38mm) top spud with condensate channel and bolt caps, for use with exposed flush valve. (Minimum MaP Test Rating: 1000 grams.) Electronic 'No Touch' Flush Valve Unit, C.P. low consumption, 6 LPF (1.6 GPF) factory set flow, quiet action, diaphragm type with filtered by-pass, infrared proximity sensor and courtesy flush over-ride button, solenoid flush controller, circuitry, in S.S. wall access plate, vacuum breaker, seat bumper and back-check angle stop. Sensor mounting to clear toilet seat. 120/24 VAC 50 VA Transformer. (5 VA Power required for each flush valve). Centoco #820STS Toilet Seat, elongated heavy duty solid plastic open front with cover, reinforced stainless steel check hinge, posts, washers and nuts. Provide Floor Flange, flange bolts and gasket.

L-1 Accessible Lavatory with Sensor Faucet

S.S. Basin, three hole 4" (102mm) centers, 19" x 23-1/2" x 5-5/8" (480mm x 600mm x 140mm) deep, wall hung, 18 Ga. (1.2mm), grade 18-8 type 304 stainless steel, satin finish, integral overflow, with side wall brackets and wall hanger bracket. Stainless Steel Semi-Pedestal, to cover exposed piping as per local codes. Electronic 'No Touch' Faucet, Hard-Wired C.P. 4" (102mm) C.C., solid cast brass body with integral proximity sensor, with vandal-resistant 1.9 LPM (0.5 GPM) flow spray outlet, control module, solenoid, strainer, tempered water supplied by thermostatic mixing valve with back checks and service stops housed in 12" (305mm) Sq. recessed metal box with 13" (330mm) Sq. V.P. S.S. face, located in wall under basin. Flexible conduit from control module to faucet and solenoid provided. Power requirement 15 VA. Provide tee, adaptors and flexible copper tubing to suit installation. Transformer, 120/24 VAC 50 VA. Basin Drain, C.P., cast brass 1 pc. top, offset open grid with 17ga. (1.5mm), 1-1/4" (32mm) tailpiece. Provide S.S. Supply with escutcheon (to connect box to faucet). 'p' Trap, C.P., polished, cast brass adjustable body, 1-1/4" (32mm) with cleanout plug, seamless brass wall bend and escutcheon. Sanitary covering, of PVC, vandal-resistant flexible seamless construction, anti-microbial, to exposed piping (to protect against heat/contusions) as per local codes.

L-2 Accessible Lavatory with Manual Faucet

Basin, 4" (102mm) centres, 21-1/4" x 22" x 5 - 7-1/2" (540mm x 559mm x 127 191mm) deep, wall hung, vitreous china, rear overflow, for concealed arm support. Faucet, C.P. 4" (102mm) C.C., solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, aerator vandal-resistant, 5.7 LPM (1.5 GPM) flow aerator outlet and cast brass lever handles. Basin Drain, C.P., cast brass 1 pc. top, open grid with 17ga. (1.5mm), 1-1/4" (32mm) tailpiece. Supplies, C.P., polished brass, rigid horizontal nipple 3/8" (9.5mm) x 3" (75mm) long I.P.S., heavy all brass angle stops, with V.P. loose key, escutcheons and S.S. braided flexible risers. 'P' trap, C.P., polished, cast brass adjustable body, 1-1/4" (32mm) with cleanout plug, seamless brass wall bend and escutcheon. Basin Carrier, with steel pipe legs, block base feet support, concealed arms and pedestal plate. (For narrow wall installation provide 'Z' type sleeve for arms.) Sanitary covering, of PVC, vandal-resistant flexible seamless construction, anti-microbial, to exposed piping (to protect against heat/contusions) as per local codes.

S-1 Single Basin Counter Mounted Sink

S.S. Sink, 3 hole, 8" (203mm) centers, 20-9/16"x 20-1/8" x 7" (522mm x 511mm x 178mm) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, single compartment, satin finished rim and bowl, self-rimming, 1-1/2" (38mm) tailpiece, sound deadening and mounting kit, 3-1/2" (89mm) crumb cup strainer with 1-1/2" (38mm) tail piece. Faucet, C.P. 8" (203mm) C.C., deck mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 9" (229mm) long swing spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow aerator outlet and cast brass 4" (102mm) blade handles. Thermostatic mixing valve, lead free brass body construction, tamper resistant locking nut, built-in check valves and strainer, under counter 4-port body, set max. temperature at 43°C. Supplies, C.P., polished brass, rigid horizontal nipples 3/8" (9.5mm) x 3" (75mm) long I.P.S., heavy all brass angle stops with V.P. loose key, escutcheons, and flexible copper risers. 'P' trap, C.P. polished cast brass adjustable body, 1-1/2" (38mm) with cleanout plug, seamless brass wall bend and escutcheon.

S-2 Double Basin Counter Mounted Sink

S.S. Sink, 3 hole, 8" (203mm) centers, 15-13/16" x 29-1/4" x 7" (400mm x 740mm x 178mm) deep, counter mounted, back ledge, 18GA. (1.2mm) grade 18-10 type 304 stainless steel, double compartment, satin finished rim and bowl, self-rimming, with crumb cup strainers 1-1/2" (38mm) tailpiece, located center back, sound deadening and mounting kit, 3-1/2" (89mm) crumb cup strainer with 1-1/2" (38mm) tail piece. Faucet, C.P. 8" (203mm) C.C., deck mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 9" (229mm) long swing spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow aerator outlet and cast brass 4" (102mm) blade handles. Thermostatic mixing valve, lead free brass body construction, tamper resistant locking nut, built-in check valves and strainer, under counter 4-port body, set max. temperature at 43°C. Supplies, C.P., polished brass, rigid horizontal nipple 3/8" (9.5mm) x 5" (127mm) long I.P.S., heavy all brass angle stops, with V.P. loose key, escutcheons and flexible copper risers. 'P' trap, C.P. polished cast brass adjustable body, 1-1/2" (38mm) with cleanout plug, seamless brass wall bend and escutcheon.

S-3 Single Basin Counter Mounted Sink with Under Counter Interceptor

S.S. Sink, 3 hole, 8" (203mm) centers, 20-9/16"x 20-1/8" x 7" (522mm x 511mm x 178mm) deep, counter mounted, back ledge, grade 18-8 type 302 stainless steel, single compartment, satin finished rim and bowl, self-rimming, 1-1/2" (38mm) tailpiece, sound deadening and mounting kit, 3-1/2" (89mm) crumb cup strainer with 1-1/2" (38mm) tail piece. Faucet, C.P. 8" (203mm) C.C., deck mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 9" (229mm) long swing spout with vandal-resistant, 5.7 LPM (1.5GPM) flow aerator outlet and cast brass 4" (102mm) blade handles. Thermostatic mixing valve, lead free brass body construction, tamper resistant locking nut, built-in check valves and strainer, under counter 4-port body, set max. temperature at 43°c. Supplies, C.P., polished brass, rigid horizontal nipples 3/8" (9.5mm) x 3" (75mm) long I.P.S., heavy all brass angle stops with V.P. loose key, escutcheons, and flexible copper risers. 305mm diameter x 305mm high sediment interceptor, all duco coated steel, 1-1/2" (38mm) drain and escutcheon. 4 1/2" (114 mm) clearance above interceptor for basket removal.

S-4 Service Floor Mop Sink

Mop Sink, 24" x 24" x 10" (610mm x 610mm x 254mm) deep, floor mounted, precast terrazzo and Integral Cast Brass Drain with S.S. strainer 3" (75mm) outlet. Hose Faucet, C.P. 8" (203mm) C.C., wall mounted, solid cast brass lead free body, 1/4 turn ceramic disc valve cartridges, cast brass lever handles, body mounted vacuum breaker, integral stops, 36" (915mm) hose and hanger. Bumper Guards, aluminum. S.S. Mop Hanger, triple. Mop Sink Drain Gasket, connection for 3" (75mm) pipe. S.S. Back Splash Panels, number of panels to suit installation. Provide 'P' trap. Thermostatic mixing valve, lead free brass, body construction, tamper resistant locking nut, built-in check valves and strainer, under counter 4-port body, set max. temperature at 38°c. install valves recessed in wall in a security type access box (0.90mm galv. Frame with back mounting flange and front reinforcing hemmed edge) 305mm x 305mm c/w type 304 stainless steel cover secured with vandal-resistant screws.

S-5 Single Basin Wall Hung Sink

Basin 14" (102mm) centres, 20 1/2" x 18 1/4" x 8 1/8" (521mm x 464mm x 206mm) deep, wall hung, vitreous china, splash back, front overflow, self-draining deck, for concealed arm support. Sink Faucet, C.P. 4" (102mm) C.C. deck mounted, solid cast brass lead free body with 1/4 turn ceramic disc cartridges, 3-1/2" (89mm) reach gooseneck spout, vandal resistant 8.3 LPM (2.2 GPM) max. flow aerator outlet and cast brass lever handles. Thermostatic mixing valve, lead free brass, body construction, tamper resistant locking nut, built-in check valves and strainer, under counter 4-port body, set max. temperature at 38°c. install valves recessed in wall in a security type access box (0.90mm galv. Frame with back mounting flange and front reinforcing hemmed edge) 305mm x 305mm c/w type 304 stainless steel cover secured with vandal-resistant screws. Basin Drain, C.P., cast brass 1 pc. top, open grid less overflow holes and 17ga. (1.5mm), 1-1/4" (32mm) tailpiece with double gasket. (Supplies,) C.P., polished brass, rigid horizontal nipple 3/8" (9.5mm) x 5" (127mm) long I.P.S., heavy all brass angle stops, with V.P. loose key, escutcheons and flexible copper risers. 'p' Trap, C.P., polished, cast brass adjustable body, 1-1/4" (32mm) with cleanout plug, seamless brass wall bend and escutcheon. Conceal arms and steel pipe legs, welded to block base feet support.

EW- 1 Emergency Eye/Face Wash Mounted at Sink

Emergency Eye/face wash, polished CP brass, counter mounted next to sink, eye/face wash head swing down from storage to operational position, volume regulator, water flow is activated by swinging down over sink, identification sign. All exposed piping to be chrome plated. Tempered 1/2" (12.7mm) connection and escutcheon.

Emergency Supply Fixture For Eyewash/ Facewash, Thermostatic mixing valve, all brass and stainless steel design, with liquid-filled thermal motor, inlet check valves, safety shut-off should cold water supply fail, hot water failure will allow cold water flow through both the fixed and variable by-pass, 1/2" (12mm) NPT inlets and outlets. Tempered water set at 85 deg. F (29 deg. C). Haws 9205. Surface mounted S.S. cabinet, type 304 with no. 4 finish, hinged door lockable to accept mixing valve.

FD-1 Floor Drain

Floor Drain, all duco coated, 9" (220mm) dia. cast iron body, reversible flashing clamp with seepage openings, no-hub outlet, round strainer, vandal-proof screws for penal application, trap primer connection 1/2" (13mm).

FD-2 Floor Drain

Floor Drain, all duco coated cast iron body, reversible flashing clamp with seepage openings oval Funnel (8-1/4" x 3-1/4") , trap primer connection 1/2" (13mm) , vandal Proof Screws.

FD-3 Floor Drain

Floor Drain, all duco coated, 9" (220mm) dia. cast iron body, reversible flashing clamp with seepage openings, no-hub outlet, round strainer with twenty-eight (28) 10mm diameter holes equally spaced radially, vandal-proof screws for penal application, trap primer connection 1/2" (13mm).

RD-1 Roof Drain

Roof Drain, all duco coated 12" (305mm) cast iron body, flashing clamp with seepage openings , sump receiver, underdeck clamp, extension solid (height to suit roof construction), aluminum dome, waterproofing flange to be provided by contractor.

RD-2 Roof Drain

Roof Drain. Clamp-Tite spun copper drain small bowl TPO, 4" (102mm) flange, 12" (305mm) copper extension pipe, aluminum mounting ring embedded in drain bowl with no bolt protruding through drain body, aluminum clamping ring and die-cast aluminum high-rise strainer fastened with stainless steel bolts. Meets CSA B272 and B79 standards.

TP Trap Primer

Electronic trap primer with solenoid actuating device, vacuum breaker, water hammer arrestor and necessary electrical hardware; adjustable frequency and duration of priming and distribution splitter for multiple priming.

HB-1 Exterior Hose Bibb

Box Type Wall Hydrant, 1/4 turn non-drip, ceramic cartridge, 3/4" (19mm) non freeze wall type with bronze nickel face and stainless steel box with full 180 deg hinged locking, cover opening box, self-draining integral vacuum breaker. Operating keys, cylinder lock.

HB-2 Interior Hose Bibb

Hose Valve, C.P. heavy duty rough cast brass body with integral cast flange, vandal-resistant lock shield bonnet with removable wheel handle, 3/4" (19mm) NPT female inlet and hose end vacuum breaker.

PART 3 EXECUTION

3.1 Installation

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
 - .2 Wall-hung fixtures: as indicated measured from finished floor.
 - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.
- .2 All gaps between fixtures, wall and floors are to be sealed with acrylic caulking compound.

3.2 Supplies

- .1 Provide isolation valves or stops for every fixture or appliance connection.
- .2 Provide water hammer arrestors for flush valves and solenoid controlled appliances.

3.3 Adjusting

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

3.4 Performance Verification:

- .1 PV procedures:
 - .1 Aerators: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
 - .3 Wash fountains: operation of flow-actuating devices.
 - .4 Thermostatic controls: Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|---------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 91 00 | Commissioning |
| .3 | Section 23 05 05 | Installation of Pipework |
| .4 | Section 23 05 54 | Mechanical Identification |

1.2 References

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-2011, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-2011, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 307-2012, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - .2 ASTM B 88M-2013, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 Canadian Standards Association (CSA International).
 - .1 CSA B242-05 (R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CSA Z7396.1-09, Medical Gas Pipeline Systems.
- .4 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-2002a, Butterfly Valves.
 - .2 MSS-SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.

1.3 Submittals

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
- .2 For product data, indicate dimensions, construction details and materials for items specified herein.

1.4 Close-out Submittals

- .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.
- .2 Data to include:
 - .1 Description of system and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.7 Waste Management Disposal

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

PART 2 PRODUCTS

2.1 Piping

- .1 Laboratory vacuum piping:
 - .1 Above ground: copper tube, hard drawn, type K: to ASTM B 88M up to NPS 4 size.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B 88M, in long lengths and with no buried joints.

2.2 Fittings

- .1 All fittings for connecting copper tubing shall be wrought copper, brass or bronze fittings made especially for brazed connection, except as provided in the following sentence. Brass piping shall be assembled with screw type brass fittings or with bronze or copper brazing type fittings.
- .2 All joints in the piping, except those permitted to be approved brass flared type gas tubing fittings and those at valves or at equipment requiring screw connections shall be made with silver brazing alloy or similar high melting point (at least 1000°F) brazing metal.
- .3 Screw joints used in shut off valves, including station outlet valves, shall be installed by tinning the male thread with soft solder. Litharge and glycerin or an approved oxygen luting or sealing compound is acceptable.

2.3 Valves

- .1 Valves shall be of bronze body, double seal, full port, union ball-type with Teflon (TFE) seats and Viton seals, "O" ring packing, bronze ball which seals in both directions, blow-out proof stem, having a pressure rating of 2758 kPa.
- .2 Valves shall be operated by a lever handle requiring only a quarter turn from a fully open position to a fully closed position. All valves shall be equipped with type "K" washed and degreased copper pipe stub extensions at both the inlet and outlet sides of the valve port to facilitate installation.
- .3 Valves shall be designed so that it can be "swung-out" during installation to prevent damage due to heat transfer during the brazing operation. A UL listed label showing the appropriate gas services and pressure rating shall be attached to each valve.
- .4 Valves shall be ULC and CRN Listed.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install identification in accordance with Section 23 05 54 – Mechanical Identification, supplemented as specified herein.
- .3 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .4 Assemble all piping using fittings manufactured to ANSI standards.
- .5 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .6 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.

3.2 Valves

- .1 Isolate equipment, fixtures and branches with gate or ball valves.
- .2 Valves shall be designed so that it can be "swung-out" during installation to prevent damage due to heat transfer during the brazing operation. A UL listed label showing the appropriate gas services and pressure rating shall be attached to each valve.

3.3 Disinfection

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.

3.3 Field Quality Control

- .1 Testing and certification of installation will be completed by a certified testing agency and will meet CSA Z7396.1.

3.4 Reports

- .1 In accordance with Section 01 91 00 – Commissioning.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|---------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 91 00 | Commissioning |
| .3 | Section 23 05 05 | Installation of Pipework |
| .4 | Section 23 05 54 | Mechanical Identification |

1.2 References

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-2011, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-2011, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 307-2012, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - .2 ASTM B 88M-2013, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 Canadian Standards Association (CSA International).
 - .1 CSA B242-05 (R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CSA Z7396.1-09, Medical Gas Pipeline Systems.
 - .3 CSA Standard CAN/CSA-Z305.4 Certification of installation.
- .4 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-2002a, Butterfly Valves.
 - .2 MSS-SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.
- .5 National Fire Protection Association.
 - .1 NFPA 99 - Standard for Health Care Facilities.

1.3 Submittals

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

- .2 For product data, indicate dimensions, construction details and materials for items specified herein.

1.4 Close-out Submittals

- .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.
- .2 Data to include:
 - .1 Description of system and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 Quality Assurance

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
- .2 Comply with Federal, Provincial, and Local Codes applicable to this installation. All equipment to be CSA approved and labelled.

1.6 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.

1.7 Waste Management Disposal

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

PART 2 PRODUCTS

2.1 Piping

- .1 Dental air piping:
 - .1 Above ground: copper tube, hard drawn, type K: to ASTM B 88M up to NPS 4 size.
 - .2 Distribution system piping shall be washed and degreased, seamless copper tubing, provided with protective caps at both ends. Where concealed, it shall be soft temper and where exposed, it shall be hard temper. Piping shall not be supported by other piping but shall be supported with pipe hangers suitable for the size of pipe, and of proper strength and quality at proper intervals, so that piping cannot be moved accidentally from the installed position as follows:

12 mm pipe or tubing.....1.8m
20 mm or 25 mm pipe or tubing.....2.4m

- .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B 88M, in long lengths and with no buried joints.

2.2 Fittings

- .1 All fittings for connecting copper tubing shall be wrought copper, brass or bronze fittings made especially for brazed connection, except as provided in the following sentence. Brass piping shall be assembled with screw type brass fittings or with bronze or copper brazing type fittings.
- .2 All joints in the piping, except those permitted to be approved brass flared type gas tubing fittings and those at valves or at equipment requiring screw connections shall be made with silver brazing alloy or similar high melting point (at least 1000°F) brazing metal..
- .3 Screw joints used in shut off valves, including station outlet valves, shall be installed by tinning the male thread with soft solder. Litharge and glycerin or an approved oxygen luting or sealing compound is acceptable.

2.3 Valves

- .1 Valves shall be of bronze body, double seal, full port, union ball-type with Teflon (TFE) seats and Viton seals, "O" ring packing, bronze ball which seals in both directions, blow-out proof stem, having a pressure rating of 2758 kPa.
- .2 Valves shall be operated by a lever handle requiring only a quarter turn from a fully open position to a fully closed position. All valves shall be equipped with type "K" washed and degreased copper pipe stub extensions at both the inlet and outlet sides of the valve port to facilitate installation.
- .3 Valves shall be designed so that it can be "swung-out" during installation to prevent damage due to heat transfer during the brazing operation. A UL listed label showing the appropriate gas services and pressure rating shall be attached to each valve.
- .4 Valves shall be ULC and CRN Listed.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install identification in accordance with Section 23 05 54 – Mechanical Identification, supplemented as specified herein.
- .3 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

- .4 Assemble all piping using fittings manufactured to ANSI standards.
- .5 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .6 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.
- .7 After installation of station outlet valves, each section of the piping system shall be subjected to a test pressure of one and one-half times maximum working pressure, but in no case less than 150 psi, by means of oil-free (water-pumped) nitrogen or air. This test pressure shall be maintained until each joint has been examined for leakage by means of soapy water. All leaks shall be repaired and the section re-tested.
- .8 A 24-hour standing pressure test with oil-free (water-pumped) nitrogen or air at one and one-half times maximum working pressure, but in no case less than 150 psi, shall be made to check the completeness of joint tests. After completion of the final standing pressure test, the system shall be thoroughly flushed with the gas to be used in the system to assure the removal of all nitrogen or air.

3.2 Valves

- .1 Isolate equipment, fixtures and branches with gate or ball valves.
- .2 Valves shall be designed so that it can be "swung-out" during installation to prevent damage due to heat transfer during the brazing operation. A UL listed label showing the appropriate gas services and pressure rating shall be attached to each valve.

3.3 Disinfection

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.

3.3 Field Quality Control

- .1 Testing and certification of installation will be completed by a certified testing agency and will meet CSA Z7396.1.

3.4 Reports

- .1 In accordance with Section 01 91 00 – Commissioning.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Read Division 1 General Instructions in conjunction with these specifications. Division 1 and this section shall form a part of and shall apply to all Mechanical Sections. The most stringent requirements of this and other Mechanical Sections must be adhered to.
- .2 The Mechanical work shall consist of the supply and installation of complete and operable mechanical systems and shall include all necessary labour, plant, materials, and incidentals for the work involved as listed in the following division sections:
 - .1 Section 21 Fire Suppression
 - .2 Section 22 Plumbing
 - .3 Section 23 Heating Ventilation & Air Conditioning

1.2 Submittals

- .1 Submittals: in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .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 In addition to transmittal letter referred to in Section 01 01 50 - General Instructions: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .5 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 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment performance verification test results.
 - .2 Special performance data as specified.
 - .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
 - .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
 - .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.3 Regulations

- .1 Comply with most stringent requirements of NBC, Provincial and Municipal regulations and by-laws, specified standards, codes and this specification. Practices contained in these standards or standards suggested or recommended by reference organizations, are to be taken as minimum requirements.
- .2 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.
- .3 The "Authority Having Jurisdiction" is Fire Protection Engineering Services of Human Resources and Skills Development Canada (HRSDC).
- .4 Drawings and specifications should not conflict with these Regulations but where there are apparent discrepancies, notify the Departmental Representative in writing and obtain clarifications before proceeding with the work.

1.4 Quality Assurance

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

1.5 Definitions

- .1 Definitions used in this Division will have the following meaning:
 - .1 "Concealed": pipes, ducts, etc., in trenches, chases, furred spaces, pipe shafts, or hung ceilings.
 - .2 "Exposed": regarding insulation and painting of piping, ducts, etc., will mean that they are not "concealed", as defined herein.
 - .3 "Piping": includes, in addition to pipe, all fittings, valves, hangers, other accessories which comprise a system.
 - .4 "Provide": to supply and install, complete and ready for use.

1.6 Drawings

- .1 Drawings:
 - .1 Are not intended to show structural details or architectural features.
 - .2 Are not to be scaled.
 - .3 Except where dimensioned, indicate general mechanical layouts only.
- .2 Provide field (shop) drawings to indicate relative position of various services when required by Departmental Representative and obtain approval before commencing work.

1.7 Maintenance

- .1 Furnish spare parts in accordance with Section 01 01 50 – General Instructions as indicated in the detailed product specification clauses.
- .2 Provide access doors for concealed expansion joints, traps, strainers, cleanouts, balance dampers, fire dampers, other parts requiring accessibility for operating and maintenance.
- .3 In suspended panel ceilings, use panel in place of access door; provide in such panel a button or other means of identification and easy removal when necessary.

1.8 Delivery, Storage and Handling

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Access Doors

- .1 Access door size shall be as indicated and where not indicated, make 305mm x 406mm minimum or 610mm x 457mm where persons have to enter. For acoustical ceilings, conform to architectural panel pattern.
- .2 Unless otherwise indicated, access doors shall be hinged, flush type, steel framed panel, 14 gauge minimum, satin finished galvanized steel or type 304 stainless steel, with anchor straps for wet areas, washrooms, and all walls finished in ceramic tile.
- .3 Hinges shall be concealed, spring hinge to allow door to open 175°. Locking devices shall be flush cam type, master key operated, doors and frames shall have prime coated rust inhibiting paint, unless made of stainless steel.
- .4 Where doors are required in fire rated walls, access doors shall be uninsulated and for all fire rated ceilings and walls where maximum temperature rise limitation is applicable, shall be insulated. All fire rated access doors shall have Warnock Hersey or ULC listed 2 hour fire rating and shall be installed in accordance with NFPA 80 and manufacturer's installation instructions.

PART 3 EXECUTION

3.1 Co-ordination

- .1 Co-ordinate work with work of other sections to avoid conflict.
- .2 Locate distribution systems, equipment, and materials to provide minimum interferences and maximum usable space.
- .3 Where interference occurs, Departmental Representative shall approve relocation of equipment and materials, regardless of installation sequence.

3.2 Cleaning

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

3.3 Cutting and Patching

- .1 Make arrangements with General Contractor for all cutting and patching in this work.
- .2 Minimize cutting and patching. Set sleeves and mark openings in concrete or masonry.

3.4 Waterproofing

- .1 Where any work pierces waterproofing including waterproofing concrete, the method of installation shall be as approved by the Departmental Representative before the work is done. Supply and install all necessary sleeves, caulking, roof curbs, and flashing required and make the openings watertight.

3.5 Protection of Work

- .1 Protect equipment and material during construction from the weather, moisture, dust, painting, plastering and physical damage. Clean and return to "as new" condition.
- .2 Mask or grease and cover machined surfaces. Firmly secure covers over equipment openings and open ends of piping, conduit and ductwork as work progresses. Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
- .3 Any equipment that has operating parts, bearings or machined surfaces that show signs of rusting, pitting or physical damage will be rejected.
- .4 Refinish damaged or marred factory finishes to the satisfaction of the Departmental Representative, using equal quality materials.

3.6 Field Quality Control

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Where specified, obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.7 Demonstration

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual and as-built drawings as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections, but shall in no way be less than four (4) hours for the plumbing systems, four (4) hours for the mechanical systems (with the EMCS training time specified separately) and four (4) hours for the fire protection systems.

END OF SECTION

PART 1 GENERAL

1.1 Use of Systems

- .1 Use of new permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:
 - .1 Entire system is complete, pressure tested, cleaned, flushed out.
 - .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
 - .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
 - .4 There is no possibility of damage from any cause.
 - .5 Supply ventilation systems are protected by filters, which shall be inspected daily, changed every week or more frequently as required.
 - .6 Return systems have approved filters over all openings, inlets, outlets.
 - .7 All systems will be:
 - .1 operated as per manufacturer's recommendations or instructions.
 - .2 operated by Contractor.
 - .3 monitored continuously by Contractor.
 - .8 Warranties and guarantees are not thereby relaxed.
 - .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.
 - .10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.
- .2 Filters referred to herein are over and above those specified elsewhere in this specification.
- .3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not Used.

PART 3 EXECUTION

3.1 Not Used

- .1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical
- .3 Section 23 08 02 Cleaning and Start-up of Mechanical Piping Systems

1.2 References

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not Used

PART 3 EXECUTION

3.1 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.

3.2 Clearances

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, or components.

3.3 Pipework Installation

- .1 Protect openings against entry of foreign material.
- .2 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .5 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .6 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400mm above floor in Mechanical Rooms.
- .7 Install dielectric coupling between dissimilar metals.

3.4 Sleeves

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and un-insulated 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 25mm above finished floor.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere: Provide space for firestopping. 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.

3.5 Escutcheons

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

3.6 Cleaning of Piping Systems

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

3.7 Pressure Testing of Equipment and Pipework

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-2001, Energy Code for Buildings Except Low-Rise Residential Buildings.
- .2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)
- .3 Workplace Hazardous Material Information System (WHMIS)

1.3 Section Includes

- .1 Electrical work to conform to Division 26 including the following:
 - .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions.

1.5 Closeout Submittals

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

1.6 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 PRODUCTS

2.1 General

- .1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of 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, 120V, 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°C, 3 phase, 208V, unless otherwise specified or indicated.

2.3 Belt Drives

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
- .3 For motors under 7.5 kW 10HP: 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 10HP 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 to be 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.

2.4 Drive Guards

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2mm thick sheet metal tops and bottoms.
 - .3 38mm dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.

- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

PART 3 EXECUTION

3.1 Installation

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 05 00 Common Work Results – Mechanical
- .4 Section 23 05 13 Common Motor Requirements for HVAC Equipment
- .5 Section 23 08 00 Commissioning of Mechanical Systems

1.2 References

- .1 ANSI/UL 508 Industrial Control Equipment
- .2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)
- .3 Workplace Hazardous Material Information System (WHMIS)

1.3 Section Includes

- .1 Electrical work to conform to Division 26 including the following:
 - .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions.

1.5 Closeout Submittals

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

1.6 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 Warranty:

- .1 The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

PART 2 PRODUCTS

2.1 General

- .1 Furnish complete Variable Frequency Drives (VFD's), as specified herein, for mechanical equipment where noted on drawings, equipment schedules, or specifications.
- .2 All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD shall be housed in a metal NEMA 1 enclosure, or other NEMA type according to the installation and operating conditions at the job site. The VFD's UL listing shall allow mounting in plenum or other air handling compartments. If a NEMA 12 enclosure is required for the plenum rating, the manufacturer must supply a NEMA 12 rated VFD.
- .3 The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor de-rating.
- .4 With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- .5 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- .6 The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel. When these VFDs are to be located in Canada, CSA or C-UL certifications shall apply. Both VFD and option panel shall be manufactured in ISO 9001 certified facilities.
- .7 The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
- .8 The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated

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- current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- .9 The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without de-rating.
 - .10 An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
 - .11 Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
 - .12 An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
 - .13 Galvanic and/or optical isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs, not including either galvanic or optical isolation on both analog I/O and discrete I/O, shall include additional isolation modules.
 - .14 VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
 - .15 Interface Features:
 - .1 Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference.
 - .2 The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
 - .3 The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
 - .16 Bypass:
 - .1 Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the VFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the VFD. This allows the VFD to be given an operational test while continuing to run the motor at full speed in bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in DRIVE or BYPASS mode.

- .2 Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specially designed tool and mechanism while meeting all local and national code requirements for safety.

PART 3 EXECUTION

3.1 Installation

- .1 Install per manufacturer's instructions.
- .2 Install required safety labels.

3.2 Start-up Service

- .1 The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.
- .2 Commissioning:
 - .1 In accordance with Section 01 91 31 – Commissioning (CX) Plan, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Materials and installation for thermometers and pressure gauges in piping systems.

1.2 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical
- .3 Section 23 05 53 Mechanical Identification

1.3 References

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B40.Grade 1A, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2001, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-14.4-[M88], Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5-[M88], Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.4 Submittal

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

1.5 Health and Safety

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

1.6 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Collect, separate and place in designated containers for packaging in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Place materials defined as hazardous or toxic waste in designated containers.
- .5 Ensure emptied containers are sealed, labelled and stored safely for disposal away from children.

PART 2 PRODUCTS

2.1 General

- .1 Design point to be at mid point of scale or range.
- .2 Ranges: as indicated.

2.2 Direct Reading Thermometers

- .1 Industrial, digital, variable angle type.
 - .1 Display: LCD, operate on 35 lux of illumination. No external power needed. Display in Celsius or Fahrenheit with switch.
 - .2 Casing: High impact ABS plastic.
 - .3 Stem: adjustable angle.
 - .4 Socket: comply with industrial standard dimension, fully interchangeable with liquid-in-glass thermometers.

2.3 Thermometer Wells

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass or stainless steel.

2.4 Pressure Gauges

- .1 100 mm dial type: to ASME B40.100, Grade 1A, phosphor bronze bourdon tube having 1.0% accuracy full scale unless otherwise specified.
 - .1 Casing: Stainless Steel.
 - .2 Reading: S.I., or S.I./Imperial.
 - .3 Range: indicate mid-scale under normal operating conditions.
- .2 Provide:
 - .1 Snubber for pulsating operation.
 - .2 Diaphragm assembly for corrosive service.
 - .3 Gasketed pressure relief back with solid front.
 - .4 Bronze stop cock.

PART 3 EXECUTION

3.1 General

- .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.2 Thermometers

- .1 Install in wells on piping. Provide heat conductive material inside well.

- .2 Install in locations as indicated.
- .3 Install wells as indicated for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

3.3 Pressure Gauges

- .1 Install in locations as indicated.
- .2 Use extensions where pressure gauges are installed through insulation.

END OF SECTION

PART 1 GENERAL

1.1 Related Section

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical
- .3 Section 23 05 48 Vibration & Seismic Control for Ductwork, Piping and Equipment

1.2 References

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - .1 Seismic Restraint Manual, Guidelines for Mechanical Systems, 1998.
- .2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME):
 - .1 ANSI/ASME B31.1-01, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM):
 - .1 ASTM A 125-1996, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307-00, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - .3 ASTM A 563-00, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):
 - .1 MSS SP58-1993, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-1996, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-1998, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 National Plumbing Code.

1.3 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 all 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 to be in accordance with MSS SP58.
- .2 Performance Requirements:
- .1 Design supports and hangers to withstand seismic events as specified Section 23 05 48 – Vibration & Seismic Control for Ductwork, Piping and Equipment.

1.4 Submittals

- .1 Submittals: in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .2 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .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.
- .4 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 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.

2.2 Pipe Hangers

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment to concrete.
 - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye [6] mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP69.
- .3 Hanger rods: threaded rod material to MSS SP58.
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .4 Pipe attachments: material to MSS SP58.
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .5 Hanger rod attachment: material to MSS SP58.
 - .1 Use expansion anchor on existing concrete structure.
- .6 Adjustable clevis: material to MSS SP 69, 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.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems per Section 23 05 48 – Vibration and Seismic Controls for HVAC Ductwork, Piping and Equipment.
- .3 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations. Supporting piping from underside of light weight roof deck (without concrete) is not permitted.

3.2 Hanger Spacing

- .1 HVAC piping: in accordance with table below.
- .2 Plumbing piping: in accordance with the most stringent requirements of the table below as well as the following:
 - .1 National. Plumbing Code.
 - .2 Authority Having Jurisdiction.
- .3 Pipe hanger rods shall be sized in accordance to SMACNA Seismic Restraint Manual based on Seismic Hazard Level (SHL). For SHL, see Section 23 05 48 – Vibration and Seismic Controls for HVAC Ductwork, Piping and Equipment.

MAXIMUM HANGER SPACING						
PIPE DIA. NPS	STEEL SCH.40	COPPER L,K Hard Drawn	CAST.I STD.	GLASS	ABS/PVC	PEX
1/2	1.8 m [6'-0"]	1.8 m [6'-0"]			1.2 m [4'-0"]	0.8 m [2'-6"]
3/4 & 1	2.4 m [8'-0"]	2.4 m [8'-0"]			1.2 m [4'-0"]	0.8 m [2'-6"]
1-1/4	2.4 m [8'-0"]	3.0 m [10'-0"]			1.2 m [4'-0"]	0.8 m [2'-6"]
1-1/2 & 2	2.4 m [8'-0"]	3.0 m [10'-0"]	3.0 m [10'-0"]		1.2 m [4'-0"]	0.8 m [2'-6"]
2-1/2, 3, 4 & 5	2.4 m [8'-0"]	3.0 m [10'-0"]	3.0 m [10'-0"]	2.4 m [8'-0"]	1.2 m [4'-0"]	0.8 m [2'-6"]
6 & 8	3.0 m [10'-0"]	3.0 m [10'-0"]	3.0 m [10'-0"]	2.4 m [8'-0"]	1.2 m [4'-0"]	0.8 m [2'-6"]

3.3 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.

3.4 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 13mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 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.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .3 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 National Building Code of Canada (NBC)
- .2 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - .1 Seismic Restraint Manual, Guidelines for Mechanical Systems, 1998.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .2 Provide vibration isolation systems shop drawings complete with performance and product data. Shop drawings shall demonstrate compliance with the National Building Code and shall bear the seal of a Professional Engineer.
- .3 Provide detailed drawings of all seismic restraint systems for ductwork, piping and equipment.

1.4 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 PRODUCTS

2.1 Vibration Isolation System – General

- .1 Performance of vibration isolation systems shall be designed by manufacturer specializing in vibration isolation materials and devices.
- .2 Size and shape of bases type shall be coordinated with submitted equipment.
- .3 Products shall of the same manufacturer unless otherwise noted.

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 Hangers

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, molded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with molded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

2.4 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.

2.5 Flexible Pipe Connectors

- .1 Inner corrugated hose: stainless steel.
- .2 Outer braid: Braided wire mesh stainless steel outer jacket.
- .3 Type of end connection: threaded for 50mm or smaller; flange for 65mm or larger.
- .4 Operating conditions:
 - .1 Working pressure: 1379 kPa
 - .2 Working temperature: 4540 °C

2.6 Seismic Control Measures

- .1 General:
 - .1 Design anchorage and attachment methods for all systems and/or equipment as specified herein.
 - .2 Seismic control systems to work in all directions.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .4 Drilled or power driven anchors and fasteners not permitted.

-
- .5 No equipment, equipment supports or mounts to fail before failure of structure.
 - .6 Supports of cast iron or threaded pipe not permitted.
 - .7 Seismic control measures not to interfere with integrity of firestopping.
 - .8 For equipment mounted on housekeeping pad, specify the minimum distance between anchor bolt and edge of housekeeping pad.
 - .2 Static equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Seismic restraints:
 - .1 Cushioning action to be gentle and steady.
 - .2 Shall never reach metal-like stiffness.
 - .3 Vibration isolated equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Provide seismic restraints in addition to vibration isolation system to resist complete isolator unloading.
 - .4 Piping systems:
 - .1 Provide seismic restraints for all piping in accordance to the latest edition of SMACNA Seismic Restraint Manual as described below:
 - .1 All compressed air piping NPS 1 or larger.
 - .2 Seismic restraints may be omitted for the following conditions:
 - .1 All piping suspended by individual hangers 305mm or less in length, as measured from the top of the pipe to the bottom of the structural support for the hanger.
 - .3 To be compatible with requirements for anchoring and guiding of piping systems.
 - .4 Wet weight of piping shall be to be used for designing seismic restraint systems.
 - .5 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse.
 - .6 Where cable is used for restraining vibration isolated piping systems, install cable with sufficient slack to avoid short-circuiting of vibration isolators.
 - .5 Ductwork systems:
 - .1 Provide seismic restraints for all ductwork in accordance to the latest edition of SMACNA Seismic Restraint Manual as described below:
 - .1 All rectangular ducts with cross sectional areas 0.56m² and larger.
 - .2 All round ducts with diameters 711 mm and larger.

- .2 Seismic restraints may be omitted for the following conditions:
 - .1 All ductwork suspended by hangers 305mm or less in length, as measured from the top of the duct to the bottom of the structural support for the hanger.
- .6 Bracing methods:
 - .1 Approved by Departmental Representative.
 - .2 Structural angles or channels.
 - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 Field Quality Control

- .1 Provide the services of the Professional Engineer(s) who designed the restraint systems for "Field Review" of the installed components, and submit the following to the Departmental Representative:
 - .1 Assurance commitment letter, signed and sealed; provided at the commencement of the project.
 - .2 Signed and sealed shop drawings of seismic restraints for equipment, piping and ductwork; provided prior to installation.
 - .3 Typewritten inspection reports; provided during the construction period.
 - .4 Schedule C-B, signed and sealed; provided after performing "Field Review".

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

1.3 Submittals

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 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.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & Safety Requirements.

1.5 Delivery, Storage, and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.

- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Dispose of unused paint and coating material at official hazardous material collections site approved by Departmental Representative.
 - .3 Do not dispose of unused paint and coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 Manufacturer's Equipment Nameplates

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 System Nameplates

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

	<u>Sizes (mm)</u>	<u>No. of Lines</u>	<u>Height of Letters (mm)</u>
1	10 x 50	1	3
2	13 x 75	1	5
3	11 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Identification for the Preventive Maintenance Support System (PMSS):
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: Size #9.
 - .2 Source and Destination identifiers: Size #6.
 - .3 Terminal cabinets, control panels: Size #5.
 - .3 Equipment elsewhere: Sizes as appropriate.

2.3 Piping Systems Governed by Codes

- .1 Identification:
 - .1 Natural gas and propane: to CSA/CGA B149.1.
 - .2 Sprinklers: to NFPA 13.

2.4 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 over-coating, 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
Hot water heating supply	Yellow	HEATINGSUPPLY
Hot water heating return	Yellow	HEATINGRETURN
Domestic hot water supply	Green	DOM.HWSUPPLY
Domestic HW recirculation	Green	DOM.HWCIRC
Domestic cold water supply	Green	DOM.CWS
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN.VENT
Natural gas and propane	to Codes	
Fire protection water	Red	FIREPROT.WTR
Sprinklers	Red	SPRINKLERS

2.5 Identification Ductwork Systems

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.6 Valves, Controllers

- .1 Plastic tags with 12 mm stamped identification data.
- .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.

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 has been completed.

3.3 Installation

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to the PMSS.

3.4 Nameplates

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 Location of Identification on Piping and Ductwork Systems

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.

- .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 Valves, Controllers

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 Cleaning

- .1 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 General

- .1 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 Company

- .1 Testing and balancing shall be performed by an agency that specializes in this type of work. Provide proof that the agency has successfully completed five projects of similar size and scope
- .2 All work shall be performed by persons with proven ability and thoroughly versed in the type of testing and balancing. Submit names, complete with experience, record and references for review by the Departmental Representative prior to work being carried out.

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 installed equipment and systems so as 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 installed 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 be to satisfaction of authority having jurisdiction.
- .2 TAB of existing equipment already in operation.

1.5 Co-Ordination

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as 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.
- .2 Review specified standards and report to Departmental Representative in writing all 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:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weather-stripping, sealing, caulking.
 - .3 All pressure, leakage, other tests specified elsewhere Division 23.
 - .4 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.10 Application Tolerances

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 5%, minus 5%.
 - .2 Hydronic systems: plus or minus 10%.

1.11 Accuracy Tolerances

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

1.12 Instruments

- .1 Prior to TAB, submit to Departmental Representative list of instruments to be 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 to be in accordance with Associated Air Balance Council Manual.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit a digital PDF version and six (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 manpower and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear 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. Markings not to be eradicated or covered in any way.

1.18 Completion of TAB

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

1.19 Air Systems

- .1 Standard: TAB to be to most stringent of this section or TAB standards of ASHRAE.
- .2 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop, temperatures (dry bulb, wet bulb, dew point, duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .3 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .4 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 Water Systems (HVAC):

- .1 Water circulating systems shall be balanced by means of balancing fittings and tabulated results shall include the following:
 - .1 Differential head across all circulating pumps.
 - .2 Flow and return water temperature to supply and return header for all zones.
 - .3 Water temperature supplied to and returning from each coil and heating element.
- .2 Contractor shall arrange with balancing technician to have water flow through radiation elements checked prior to installation of radiation enclosure.

1.21 Domestic Hot Water Systems

- .1 Meet requirements as specified for liquid systems.
- .2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of heaters, tank, pump, circulator, at controllers, controlled device.
- .3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.22 Other TAB Requirements

- .1 Air terminal units:
 - .1 Check individually for correct operation and factory calibration of air volumes at "maximum" and "minimum" settings. Where calibration or

adjustment is found to be necessary it shall be carried out as part of the balancing procedure. The mechanical contractor and the Departmental Representative shall be informed of the extent of recalibration required.

- .2 Testing of Fire Dampers & Fire Stop Flaps:
 - .1 Conduct a "trip" test on all fire dampers and fire stop flaps to ensure that fire mechanisms function correctly and that dampers attain a fully closed position when tripped.
 - .2 Send a copy of test results tabulating the fire damper location, size, and date of trip test, to the Departmental Representative for record purposes. Copies shall also be inserted in Equipment Maintenance Manuals.
 - .3 Dampers and Flaps which fail to function correctly shall be re-tested after corrective action has been completed. Any fusible links damaged when conducting tests shall be replaced by this Contractor. A signed and dated test label shall be attached to each fire damper upon completion of test and resetting of fire damper.

1.23 CAD Drawings

- .1 CAD drawing files of the heating and ventilating tender drawings will be made available to the Balancing Contractor if requested. An "Authorization to use CAD Drawing File" agreement restricting the use of the CAD files to the preparation of the project balancing reports must be signed prior to obtaining the files.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 Not Used

- .1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results - Mechanical
- .3 Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment

1.2 References

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2004; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B 209M-2002, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C 335-1995, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 411-1997, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C 449/C 449M-2000, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C 547-2000, Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C 553-2000, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C 612-2000a, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C 795-1992, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .9 ASTM C 921-[92(1998) e1], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-1989, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-2001, Thermal Insulation Polyotrene, Boards and Pipe Covering.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

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 defined herein.
- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.4 Submittals

- .1 Submittals: in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .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 - Shop Drawings, Product Data & Samples.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .4 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:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & Safety Requirements.

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

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 as specified herein includes glass fibre, rock wool, slag wool.

- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612. Provide 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 C 553. Provide factory applied vapour retarder jacket to CGSB 51-GP-52Ma as scheduled in PART 3 of this section.
 - .1 Mineral fibre: to ASTM C 553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C 553.
- .5 Evidence shall be provided to the Departmental Representative on the site of ULC listings of all products being used. Duct insulation adhesives and coatings shall be non-toxic as defined by WCB Regulations.

2.3 Jackets

- .1 Canvas:
 - .1 [220] gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
 - .2 Lagging adhesive: Compatible with insulation.
- .2 Aluminum foil laminate:
 - .1 Multi-layer aluminum foil laminate; highly puncture and resistant, non-permeable vapour barrier for complete moisture protection. Inhibits mold growth. UL listed.
 - .2 Total thickness: 0.20 mm.
 - .3 Substrate thickness: 0.15 mm sheet.
 - .4 Finish: Aluminum, stucco embossed.
 - .5 Adhesive: cold weather acrylic adhesive.

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 C 449.
- .4 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .5 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .6 Contact adhesive: quick-setting

- .7 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation.
- .8 Fasteners: 2 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Pre-Installation Requirement

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

3.3 Installation

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers 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: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.
- .7 All ductwork exposed to weather shall have waterproof seams for weathertight construction. Exposed, ducts which are not insulated or finish painted, shall be coated with two applications of bitumastic waterproofing compound to prevent corrosion.

3.4 Duct Insulation Schedules

.1 Insulation types and thicknesses: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular, cold, dual temperature supply air ducts	C-1	Yes	50
Round, cold, dual temperature supply air ducts	C-2	Yes	50
Rectangular, warm air ducts	C-1	No	25
Round, warm air ducts	C-2	No	25
Supply, return and exhaust ducts exposed in space being served			None
Outside air ducts to mixing plenum	C-1	Yes	25
Exhaust ducts between dampers and louvers	C-1	No	25
Rectangular ducts outside	C-1	Special	50
Round ducts outside	C-2	Special	50
Acoustically lined ducts			None

.2 Finish: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	None	None
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results - Mechanical
- .3 Section 23 05 05 Installation of Pipe Work.
- .4 Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment

1.2 References

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2004; Energy Standard for Buildings except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM B 209M-2001, Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].
 - .2 ASTM C 335-1995, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 411-1997, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C 449/C449M-2000, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C 534-2005, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - .6 ASTM C 795-1992(1998), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .7 ASTM C 921-1989(1996), Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88, Surface Burning characteristics of Building Materials and Assemblies.

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 defined herein.
- .2 TIAC Codes:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 Submittals

- .1 Submittals: in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .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 - Shop Drawings, Product Data & Samples.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .4 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:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & Safety Requirements.

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labeled 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 74 19 - Waste Management & Disposal.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

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 as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code A-1: Rigid molded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/CGSB-51.9.
 - .2 Maximum "k" factor: to CAN/CGSB-51.9.

- .4 TIAC Code A-3: Rigid molded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/CGSB-51.9.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/CGSB-51.9.
- .5 TIAC Code C-2: Mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .6 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: flexible closed-cell elastomer to ASTM C534.
 - .2 Jacket: to CGSB 51-GP-52Ma. Required for outdoor application.
 - .3 Maximum "k" factor: 0.27.
 - .4 Vapour transmission: 0.0527 metric perms.
 - .5 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.
- .7 To be formaldehyde free, low VOC; resists mold and mildew.
- .8 Evidence shall be provided to the Departmental Representative on the site of ULC listings of all products being used. Duct insulation adhesives and coatings shall be non-toxic as defined by WCB Regulations.

2.3 Insulation Securement

- .1 Tape: Self-adhesive, aluminum, reinforced, 50mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5mm diameter stainless steel.
- .5 Bands: Stainless steel, 19mm wide, 0.5mm thick.

2.4 Cement

- .1 Thermal insulating and finishing cement:
 - .1 To CAN/CGSB-51.12.
 - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449.

2.5 Vapour Retarder Lap Adhesive

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

2.6 Indoor Vapour Retarder Finish

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

2.7 Outdoor Vapour Retarder Finish

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

2.8 Jackets

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece molded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.
 - .2 Colours: White.
 - .3 Minimum service temperatures: 20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Canvas:
 - .1 220 and 120 gm/m cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
 - .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum foil laminate
 - .1 Multi-layer aluminum foil laminate; highly puncture and resistant, non-permeable vapour barrier for complete moisture protection. Inhibits mold growth. UL listed.
 - .2 Total thickness: 0.20 mm.
 - .3 Substrate thickness: 0.15 mm sheet.
 - .4 Finish: Aluminum, stucco embossed.
 - .5 Adhesive: cold weather acrylic adhesive.

PART 3 EXECUTION

3.1 Pre-Installation Requirement

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry and 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 75mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be 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.

3.3 Removable, Pre-fabricated, Insulation and Enclosures

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

3.4 Installation of Elastomeric Insulation

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

3.5 Piping Insulation Schedules

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

- .4 TIAC Code: A-6.
 - .1 Seals: lap seal adhesive, lagging adhesive.
 - .2 Installation: TIAC Code: 1501-CA; per manufacturer's recommendation.
- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: SS Bands at 300mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 Thickness of insulation to be as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000mm long.
 - .2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Run out	To NPS1	1 ¼-2	2 ½-4	5-6	8 & over
Hot Water Heating	60-94	A-1	25	38	38	38	38	38
Hot Water Heating	< 59	A-1	25	25	25	25	38	38
Domestic HWS/RECIRC		A-1	25	25	25	38	38	38
Domestic CWS		A-3	25	25	25	25	25	25
Refrigerant (hot gas, liquid, suction)	< 4	A-6	25	25	38	38	38	38
RWL and RWP		C-2	25	25	25	25	25	25
Cooling Coil Condensate Drain		A-3	25	25	25	25	25	25

- .7 Finishes:
 - .1 Exposed indoors: Canvas and/or PVC jacket.
 - .2 Exposed in mechanical rooms: Canvas and/or PVC jacket.
 - .3 Concealed, indoors: ASJ, no further finish.
 - .4 Exposed outdoors: Aluminum jacket.

3.6 Cleaning

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 91 00 Commissioning
- .2 Section 23 05 93 Testing, Adjusting and Balancing for HVAC

1.2 Quality Assurance

- .1 The commissioning of mechanical systems shall be executed in accordance with the intent of ASHRAE Standard 1-1996 "Guideline for Commissioning of HVAC Systems"

1.3 General

- .1 Commissioning of the mechanical systems, including the HVAC, and Plumbing and Drainage Systems, shall be carried out by an independent Commissioning Agent acceptable to the Departmental Representative with technicians specifically trained in commissioning procedures.
- .2 The Mechanical Subcontractor shall retain a Commissioning Agent, who shall be active in the commissioning process and actively encourage his own forces and subtrades to work together to achieve optimum system performance for the mechanical systems in a timely manner. Refer to Commissioning Authority Plan for responsibilities of Commissioning Agent.
- .3 It is not intended that this work shall, in any way, replace normal factory start-up service for equipment or relieve the Contractor or his sub-trades of their responsibility for providing first-class installation in satisfactory working order.
- .4 As part of the final commissioning report, submit a Certificate stating that the commissioning procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and finally, that follow-up testing, after the correction of faults and omissions has been completed and recorded.
- .5 Be responsible for the performance and commissioning of all equipment supplied under the Sections of Division 21, 22, 23. Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the contract documents and design intent. It is the activation of the completed installation.
- .6 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.

1.4 Commissioning and Demonstration

- .1 Submit a schedule for the commissioning phase of the work. This schedule shall show:
 - .1 Equipment start-up schedule.
 - .2 Submission dates for the various documents required prior to substantial completion.

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- .3 Timing of the commissioning, testing, balancing, and demonstration process.
 - .2 Commissioning is concluded when the air and water system is balanced and the installation is in full working order and acceptable for use. The work shall include the following:
 - .1 Balancing of the air systems as specified in this section.
 - .2 Set up air diffusers, registers and grilles for optimum distribution/comfort.
 - .3 Plug all air pressure and flow measuring holes.
 - .4 Adjust vibration isolators and earthquake restraints for optimum performance.
 - .5 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations. Forms in Section 23 08 02 shall be used for this purpose.
 - .6 Verification of water tightness of all roof and exterior wall penetrations.
 - .7 Verification that coil drain pan operates.
 - .8 Set up all automatic control valves/dampers and automatic temperature control devices.
 - .9 Set up and test all alarm and protective devices.
 - .10 EMCS:
 - .1 Commissioning of EMCS is primarily responsible by Controls Contractor. Refer to Section 25 05 01 EMCS General Instructions.
 - .2 The Commissioning Agent shall assign one person experienced and qualified in commissioning control systems through practical experience and a comprehensive knowledge of the interactive nature of HVAC systems and DDC controls **to verify** the performance of the control systems by conducting random tests of the control sequences until the Commissioning Agent is satisfied that the controls are performing according to the intended control sequences.
 - .3 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Controls Contractor for the purchase price of the material.
 - .3 In addition to the piping, equipment and systems listed above provide commissioning of all plumbing piping, equipment and systems including the following:
 - .1 Domestic cold water including PRV setpoint.
 - .2 Domestic hot water and recirculation including temperature set points.
 - .3 Domestic tempered water including setpoints.

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- .4 Sanitary waste and venting.
 - .5 Plumbing fixtures including adjustments of all flush valves, and setting temperature limit stops on shower valves.
 - .4 At the conclusion of commissioning, demonstrate the operation of the systems to the Departmental Representative. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to section 25 05 01 EMCS: General Instructions.
 - .5 The verification process shall include the demonstration of the following:
 - .1 The ease of access that has been provided throughout for servicing coils, motors, drives, control dampers and damper operators.
 - .2 Location of and opening and closing of all access panels.
 - .3 Operation of all automatic control dampers and automatic temperature control devices.
 - .4 Operation of all alarm and protective devices.
 - .5 Operation of all equipment and systems under each mode of operation, and failure.
 - .6 At the completion of commissioning, testing, balancing and demonstration submit the following to the Departmental Representative:
 - .1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.
 - .2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.
 - .3 "As-Built" record drawings, as specified.
 - .4 A list of all alarm and protective devices tested, with the final operating settings.
 - .7 Training
 - .1 During "Substantial Performance" review, the Mechanical Contractor, Control Sub-contractor, and other Sub-contractors designated by the Departmental Representative shall provide training to the operating personnel in the proper operation and maintenance of all systems and equipment installed under the contract.
 - .2 It shall be the Mechanical Contractor's responsibility to have the specified equipment manuals prepared, previously approved by the Departmental Representative, and ready for presentation at this meeting.
 - .3 Convene the meeting with the aforementioned parties at the time called for in the substantial performance review. The arrangements shall include written notices to all the parties concerned. Should the equipment manuals, or system installation not be complete and operable at the proper time, he shall then convene the operating instruction meeting at a later date and pay any additional costs including time and traveling expenses for the personnel involved which are attributable to the delay.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 91 00 Commissioning
- .2 Section 22 42 01 Plumbing Specialties and Accessories
- .3 Section 23 05 93 Testing, Adjusting and Balancing for HVAC

1.2 Potable Water Systems

- .1 When cleaning is completed and system filled:
 - .1 Verify performance of equipment and systems as specified elsewhere in Division 22.
 - .2 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 recharge air chambers. Repeat for each outlet and flush valve.
 - .3 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

1.3 Wet Sprinkler System

- .1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 21.
- .2 Verification of controls, detection devices, alarm devices is specified Division 28.

1.4 Sanitary and Storm Drainage Systems

- .1 Buried systems: Perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.
- .2 Ensure that traps are fully and permanently primed.
- .3 Ensure that fixtures are properly anchored, connected to system.
- .4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.
- .5 Cleanouts: Refer to Section 22 42 01 - Plumbing Specialties and Accessories.
- .6 Roof drains:
 - .1 Refer to Section 22 42 01 - Plumbing Specialties and Accessories.
 - .2 Remove caps as required.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not Used.

PART 3 EXECUTION

3.1 Not Used

- .1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results-Mechanical
- .3 Section 23 05 93 Testing Adjusting and Balancing for HVAC
- .4 Section 23 25 00 HVAC Water Treatment Systems

1.2 References

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

1.3 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 - General Instructions. Include product characteristics, performance criteria, and limitations.
 - .2 Quality assurance submittals: submit following in accordance with Section 01 01 50 - General Instructions.
 - .1 Instructions: submit manufacturer's installation instructions.

1.4 Quality Assurance

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & 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.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Cleaning Solutions and Chemicals

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.
- .4 Cleaning solutions shall be provided by the supplier of chemicals for water treatment under Section 23 25 00 – HVAC Water Treatment Systems.

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 Cleaning of Hydronic Systems

- .1 Timing:
 - .1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist. Install cross upstream per manufacturer's recommendation. Install plugs in unused connections.
- .4 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations to be used. Include Material Safety Data Sheets (MSDS).
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water to be used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
 - .1 Systems to be free from construction debris, dirt and other foreign material.
 - .2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers to be clean prior to initial fill.

- .6 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic System:
 - .1 Fill system with water, ensure air is vented from system.
 - .2 Provide drain connections to drain system in one hour. All drains for chemical treatment shall be piped to the nearest floor drain. After initial flushing has been completed, clean all strainer screens.
 - .3 System pumps may be used for circulating cleaning solution provided that pumps are dismantled and inspected, worn parts repaired with new gaskets and seals install. Submit used seals.
 - .4 Add cleaners and chemicals to closed systems at concentration levels recommended by the Chemical Specialist.
 - .5 For heating hot water systems, apply heat while circulating, raise temperature slowly to 70°C and maintain at 70°C for a minimum of 12 hours. Remove heat and continue to circulate until temperature is below 38°C.

3.3 Start-up of Hydronic Systems

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
 - .5 Clean out strainers repeatedly until system is clean.
 - .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.
 - .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
 - .8 Repeat with water at design temperature.
 - .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
 - .10 Bring system up to design temperature and pressure slowly over a 48 hour period.
 - .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .12 Adjust pipe supports, hangers, springs as necessary.
 - .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

- .14 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .15 Check operation of drain valves.
- .16 Adjust valve stem packings as systems settle down.
- .17 Fully open all balancing valves (except those that are factory-set).
- .18 Check operation of over-temperature protection devices on circulating pumps.
- .19 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 05 05 Installation of Pipe Work

1.2 References

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5-96, Pipe Flanges and Flanged Fittings.
 - .2 ASME B18.2.1-96, Square and Hex Bolts and Screws.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 47/A47M-[99], Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A53M-[01], Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- .3 Canadian Standards Association (CSA)
 - .1 CSA W47.1-92(R1998), Certification of Companies for Fusion Welding of Steel Structures.
- .4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
 - .1 CAN/CGA B149.1-05, Natural Gas and Propane Installation Code.

1.3 Submittals

- .1 Submit product data in accordance with Section 01 01 50 - General Instructions.
- .2 Indicate on manufacturer's catalogue literature following: valves.

1.4 Closeout Submittals

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

1.5 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Pipe

- .1 Steel pipe: to ASTM A 53/A53M, Schedule 40, seamless as follows:
 - .1 NPS 1/2 to 2, screwed.
 - .2 NPS 2 1/2 and over, plain end.
- .2 Underground gas piping: High Density polyethylene pipe meeting the requirements of CSA Standard B-137.4M, "Polyethylene Piping System for Gas Service."
- .3 Epoxy coated steel pipe risers designed for connection to plastic service piping for NPS 2 (50mm) size and smaller.

2.2 Jointing

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.
- .4 Underground Piping shall be joined by heat fusion, electrofusion, or mechanical methods in accordance with CSA Standard Z662 and the manufacturer's instructions.

2.3 Fittings

- .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
 - .3 Welding: butt-welding fittings.
 - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A 47/A47M.
 - .5 Bolts and nuts: to ASME B18.2.1.
 - .6 Nipples: schedule 40, to ASTM A 53/A53M.

2.4 Valves

- .1 Provincial Code and CSA Standard B-137.1 approved, lubricated type.
- .2 All valves used shall match existing and labeled to match existing nomenclature.
- .3 Provide seismic actuated shut off valve at building wall.

PART 3 EXECUTION

3.1 Piping

- .1 Install piping in accordance with applicable Provincial Codes.
- .2 Install in piping accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.

3.2 Valves

- .1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.
- .3 Provide shutoff valve and insulated union for di-electric isolation of building gas piping.

3.3 Tracer Wires:

- .1 All underground plastic gas piping shall have a tracer wire 14-gauge stranded copper wire, mounted on the top surface of the pipe, secured with plastic straps at two meter intervals.
- .2 Wire to be bonded to steel supply main at connection with plastic run.
- .3 Wire to be run up the transition riser and taped to the steel pipe
- .4 Continuity of tracer wire to be checked.

3.4 Warning Tape:

- .1 All underground natural gas lines shall have a warning tape. Underground warning tape (plain tape only) buried 300mm below grade above pipe.

3.5 Field Quality Control

- .1 Test system in accordance with CAN/CGA B149.1, CAN/CGA B149.2 and requirements of authorities having jurisdiction.

3.6 Purging

- .1 Purge after pressure test in accordance with CAN/CGA B149.1, CAN/CGA B149.2.

3.7 Pre-Start-Up Inspections

- .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
- .2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.8 Reports

- .1 In accordance with Section 01 91 31 – Commissioning (CX) Plan.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results - Mechanical
- .3 Section 23 05 05 Installation of Pipework
- .4 Section 23 05 93 Testing, Adjusting and Balancing for HVAC
- .5 Section 23 08 01 Performance Verification of Mechanical Piping
- .6 Section 23 08 02 Cleaning and Start-up of Mechanical Piping Systems

1.2 References

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME-[04], Boiler and Pressure Vessel Code.
- .2 American Society for Testing and Materials, (ASTM).
 - .1 ASTM A 47/A 47M-[99], Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 278M-[01], Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (345 degrees C).
 - .3 ASTM A 516/A 516M-[96(e1)], Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .4 ASTM A 536-[84(1999) e1], Specification for Ductile Iron Castings.
 - .5 ASTM B 62-[93], Specification for Composition Bronze or Ounce Metal Castings.
- .3 Canadian Standards Association (CSA International).
 - .1 CSA B51-[03], Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 Submittals

- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions.
- .2 Closeout Submittals:
 - .1 Submit maintenance data in accordance with Section 01 01 50 – General Instructions.

1.4 Quality Assurance

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

1.5 Delivery Storage and Handling

- .1 Waste Management and Disposal.
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
 - .4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Diaphragm Type Expansion Tank

- .1 Steel pressurized diaphragm type expansion tank. Expansion tank shall be vertical or horizontal as indicated.
- .2 Capacity and size as indicated.
- .3 Diaphragm sealed in elastomer suitable for 115°C operating temperature.
- .4 Working pressure: 862 kPa with ASME stamp and certification.
- .5 Air pre-charged to 84 kPa.
- .6 Supports: provide supports with hold down bolts and installation templates incorporating seismic restraint systems.

2.2 Automatic Air Vent

- .1 Disc vent: with built-in check valve, NPT 1/8 connection. Rated at 345 kPa working pressure.
- .2 Float vent: brass body, stainless steel float, NPT 3/4 connection, with built-in check valve. Rated at 1,034 kPa working pressure and 121°C operating temperature.
- .3 High capacity vent: cast iron body, stainless steel float and NPS 3/4 connection. Rated at 1,034 kPa working pressure and 121°C operating temperature.

2.3 Combination Low Pressure Relief and Reducing Valve

- .1 Adjustable pressure setting: 206 kPa relief, 55 to 172 kPa reducing.
- .2 Low inlet pressure check valve.
- .3 Removable strainer.

2.4 Strainer

- .1 NPS 1/2 to 2: Y-type, bronze body to ASTM B 62, screwed connections, 304 stainless steel screen with 20 mesh perforations.
- .2 NPS 2 1/2 to 12: Y-type, cast iron body to ASTM A 126 Class B, flanged connections, 304 stainless steel screen with 20 mesh perforations.
- .3 NPS 2 to 12: T-type, cast iron body to ASTM A126 Class B, flanged connections, 304 stainless steel screen with 0.063 perforations for NPS 2 to 4, and 0.125 perforations for NPS 6 and larger.
- .4 Working pressure: 1,034 kPa.
- .5 Provide blow-down valve with capped hose adapter fitting and chain.

2.5 Primary/Secondary Header

- .1 Provide combination air separator and manifold that creates an independent primary and secondary hydronic circuits. Furnished with purge valve at the bottom of the vessel and an air automatic vent at the top of the vessel.
- .2 Construction: steel.
- .3 Connection: ANSI 150 class flange.
- .4 Insulation: polyurethane foam.

PART 3 EXECUTION

3.1 General

- .1 Install as indicated and to manufacturer's recommendations.
- .2 Run drain lines and blow off connections to terminate above nearest drain.
- .3 Maintain proper clearance to permit service and maintenance.
- .4 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 Strainer

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump unless suction diffuser is provided.
- .4 Install ahead of each automatic control valve and as indicated.

3.3 Air Vents

- .1 Install at high points of systems.
- .2 Install gate valves at the inlet of float vents and high capacity float vents.
- .3 Applications:
 - .1 Disc vent: radiators and convectors.
 - .2 Float vent: pipe mains.
 - .3 High capacity vent: air separator.

3.4 Expansion Tank

- .1 Adjust expansion tank pressure as indicated.
- .2 Install lock-shield type valve at inlet to tank.

3.5 Pressure Safety Relief Valve

- .1 Run discharge pipe to terminate above nearest drain.

3.6 Performance Verification

- .1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results - Mechanical
- .3 Section 23 05 05 Installation of Pipework
- .4 Section 23 05 93 Testing, Adjusting and Balancing for HVAC
- .5 Section 23 08 01 Performance Verification of Mechanical Piping
- .6 Section 23 08 02 Cleaning and Start-up of Mechanical Piping Systems

1.2 References

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3-1998, Malleable Iron Threaded Fittings.
 - .3 ASME B16.5-2003, Pipe Flanges and Flanged Fittings.
 - .4 ASME B16.9-2001, Factory-Made Wrought Buttwelding Fittings.
 - .5 ASME B18.2.1-2003, Square and Hex Bolts and Screws (Inch Series).
 - .6 ASME B18.2.2-1987(R1999), Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 47/A47M-1999, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A53M-2002, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A 536-1984(1999), Standard Specification for Ductile Iron Castings.
 - .4 ASTM B 61-2002, Standard Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B 62-2002, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM E 202-2000, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .3 American Water Works Association (AWWA).
 - .1 AWWA C111-2000, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242-M1980 (R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CAN/CSA W48-2001, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-2004, Butterfly Valves.
 - .2 MSS-SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-1997, Cast Iron Swing Check Valves Flanged and Threaded Ends.
 - .4 MSS-SP-80-2003, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 Submittals

- .1 Submit shop drawings in accordance with Section 01 01 50 - General Instructions.

1.4 Quality Assurance

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

1.5 Delivery Storage and Handling

- .1 Waste Management and Disposal.
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
 - .4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.6 Maintenance

- .1 Extra Materials.
 - .1 Provide following spare parts:
 - .1 Valve seats: one for every ten valves, each size. Minimum one.
 - .2 Discs: one for every ten valves, each size. Minimum one.
 - .3 Stem packing: one for every ten valves, each size. Minimum one.

- .4 Valve handles: two of each size.
- .5 Gaskets for flanges: one for every ten flanges.

PART 2 PRODUCTS

2.1 Pipe

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 To NPS 10: Schedule 40.
 - .2 NPS 12 and over: 10 mm wall thickness.

2.2 Pipe Joints

- .1 NPS 2 and under: screwed fittings to ANSI/ASME B1.20.1.
- .2 NPS 2-1/2 and over: welding fittings and flanges to ANSI/ASME D1.1, ANSI/ASME Section 9 and CAN/CSA W48.
- .3 Pipe thread: taper.
- .4 Flanges: weld neck, raised face to AWWA C111.
- .5 Orifice flanges: slip-on, raised face.
- .6 Flange gaskets: to AWWA C111.
- .7 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .8 Nipples: extra heavy black steel.

2.3 Fittings

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ASME B16.1, Class 125.
 - .2 Steel: to ASME B16.5.
- .3 Butt-welding fittings: steel, to ASME B16.9.
- .4 Unions: malleable iron, to ASTM A 47/A47M and ASME B16.3.
- .5 Fittings for roll grooved piping: malleable iron to ASTM A 47/A47M; ductile iron to ASTM A 536.

2.4 Valves

- .1 Gate valves: to MSS-SP-70 and MSS-SP-80:
 - .1 NPS 2 and under: Class 150 to MSS-SP80. Rising stem, threaded, union bonnet and solid wedge. Body, bonnet and wedge shall be of bronze ASTM B-62. Stem shall be of dezincification-resistant silicon bronze ASTM B-371 or low-zinc alloy B-99.
 - .2 NPS 2-1/2 and over: Class 150 to MSS-SP70. OS&Y, flanged, bolted bonnet, solid wedge, iron body, bronze trimmed, with body and bonnet conforming to ASTM A126 Class B cast iron.

- .2 Drain valves:
 - .1 Ball type, Class 150 to MSS-SP-110, 2-piece cast bronze body, threaded, full port, anti-blowout stem, stainless steel ball and stem, 20mm hose connection with cap and chain.
- .3 Swing check valves:
 - .1 NPS 2 and under: Class 150 to MSS-SP-80. Swing type, Y-pattern, threaded, bronze body to ASTM B-62, renewable TFE seat and disc, regrinding type, dezincification-resistant.
 - .2 NPS 2-1/2 and over: Class 125 to MSS-SP-71. Swing type, flanged, cast iron to ASTM A126 Class B, renewable bronze seat disc.
- .4 Silent check valves:
 - .1 NPS 2 and under: Class 125 to MSS-SP-80. Inline lift type, threaded, bronze body to ASTM B-584, TFE disc, stainless steel stem, spring, disc holder and seat screw, dezincification-resistant.
 - .2 NPS 2-1/2 and over: Class 125 to MSS-SP-71. Globe style, flanged, cast iron to ASTM A126 Class B, renewable bronze seat (bonded with Buna-N) and disc, stainless steel spring.
- .5 Ball valves:
 - .1 NPS 2 and under: Class 150 to MSS-SP-110. Cast bronze, 2-piece body, threaded, full port, anti-blowout stem, 316 stainless steel stem and ball (vented), TFE packing, RTFE thrust washers and seat rings, 50mm extended blowout stem for insulated piping, lever handle with position indicator.

2.5 Strainer

- .1 Description: Y-type with strainer baskets of material and perforations suitable for steam or water service, as required. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality.
- .2 NPS 2 and under: Full pipeline size, 250 lb. SWP bronze, with screwed ends and a removable plug type screen retainer.
- .3 NPS 2-1/2 and over: Full pipeline size, 250 lb. SWP semi-steel, with flanged ends and a bolted screen retainer.
- .4 Screens: Stainless steel or monel screen with 20 mesh screen opening.
- .5 Provide a blowdown valve with a drain line to discharge above an approved receptor on the blowdown connection of the strainer. Where strainers occur above ceilings, provide a blowdown valve with NPS 3/4 capped hose adapter fitting.

2.6 Dielectric Coupling

- .1 NPS 2 and under: Screwed, Schedule 40 electro zinc plated ASTM A120/A53 casing with inert self-cleaning thermoplastic liner, 300 PSI WP at 225°F.
- .2 NPS 2-1/2 and over: Flanged with isolation gaskets, washers and sleeves, 300 lb. WOG.

2.7 Balancing Fittings, for TAB:

- .1 Sizes: Calibrated balancing valves, as specified this section.
- .2 NPS 2 and under: Globe type, Y-pattern, bronze body, EPDM O-ring and NPT connections.
- .3 Flow measuring valve shall be fitted with meter readout ports with check valves and caps, digital handwheel with memory stop indicator, NPS 20 hose connection, and a nameplate bearing manufacturer's name and calibrated nameplate.
- .4 Furnished with preformed rigid polyurethane insulation.

PART 3 EXECUTION

3.1 Piping Installation

- .1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.
- .3 Slope piping in direction of drainage and for positive venting.
- .4 Use eccentric reducers at pipe size change installed to provide positive drainage and positive venting.
- .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .6 Assemble piping using fittings manufactured to ANSI standards.
- .7 Install dielectric couple between dissimilar metals.

3.2 Valve Installation

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install isolation valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .3 Install check valves on discharge of pumps and as indicated. Provide silent check valves in vertical pipes with downward flow and swing check valves horizontal pipes.
- .4 Install chain operators on valves NPS 2-1/2 and over where installed more than 2400mm above finished floor in mechanical room(s).

3.3 Cleaning, Flushing, & Start-Up

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 Testing

- .1 Test system in accordance with Section 23 08 01 - Performance Verification – Mechanical Piping Systems.

3.5 Balancing

- .1 Balance water systems to within plus or minus 5% of design output.
- .2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.6 Performance Verification

- .1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Materials, equipment selection, installation and start up for hydronic system pumps.

1.2 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 05 13 Common Motor Requirements for HVAC Equipment
- .4 Section 23 05 48 Vibration & Seismic Controls for HVAC Piping & Equipment
- .5 Section 23 08 00 Commissioning of Mechanical Systems

1.3 References

- .1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).
 - .1 Standard 90.1-2001 Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 Electrical Equipment Manufacturers Advisory Council (EEMAC).
- .3 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-B214-[01], Installation Code for Hydronic Heating Systems.
- .4 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA MG 1-[2003], Motors and Generators.

1.4 Submittals

- .1 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.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 - General Instructions.
- .3 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

- .4 Submit product data of pump curves for review showing point of operation.
- .5 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 00 – General Instructions.

1.5 Health and Safety

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

1.6 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

1.7 Extra Materials

- .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.
- .2 Furnish following spare parts:
 - .1 One pump seal and casing gasket for each size and type of pump.

PART 2 PRODUCTS

2.1 Equipment Selection

- .1 Do component selection and sizing to CAN/CSA-B214.

2.2 In-Line Circulator

- .1 Volute: cast iron, radially split, with flanged connection.
- .2 Impeller: cast bronze.
- .3 Shaft: alloy steel with copper or bronze sleeve bearing, integral thrust collar.
- .4 Seal assembly: mechanical.
- .5 Coupling: flexible self-aligning.
- .6 Design pressure: 860 kPa .

2.3 Vertical In-Line Pump

- .1 Volute: cast iron, radially split, with tapped openings for draining and gauge connections, complete with vent line or internally flushed. Provide base ring tapping for floor mounted support as specified herein. Flanged connections.
- .2 Impeller: cast bronze, enclosed type, dynamically balanced, keyed to shaft and secured in place.
- .3 Shaft: alloy steel or stainless steel with bronze sleeve bearing, integral thrust collar.
- .4 Seal assembly: mechanical.
- .5 Coupling: closed coupled. Split coupled where noted.
- .6 Design pressure: 1,200 kPa.
- .7 Provide floor mounted support for pumps with 10 HP motor and larger.

PART 3 EXECUTION

3.1 Installation

- .1 Do Work in accordance with CAN/CSA-B214.
- .2 In-line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions and per manufacturer's recommendation. Install with bearing lubrication points accessible.
- .3 Vertical in-line pump: provide support for pipe elbows, suction diffuser and pump discharge combination valve at pump suction and discharge. Install floor mounted support where specified in this Section.
- .4 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- .5 Pipe drain tapping to floor drain.
- .6 Install volute venting pet cock in accessible location.
- .7 Check rotation prior to start-up.
- .8 Install pressure gauge test cocks.

3.2 Start-Up

- .1 General
 - .1 In accordance with Section 01 91 00 - Commissioning (CX) Plan, Section 23 08 00 – Commissioning of Mechanical Systems, and supplemented as specified herein.
 - .2 In accordance with manufacturer's recommendations.
- .2 Procedures:
 - .1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

- .2 After starting pump, check for proper, safe operation.
- .3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
- .4 Check base for free-floating, no obstructions under base.
- .5 Run-in pumps for 12 continuous hours.
- .6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
- .7 Eliminate air from scroll casing.
- .8 Adjust water flow rate through water-cooled bearings.
- .9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
- .10 Adjust alignment of piping and conduit to ensure true flexibility at all times.
- .11 Eliminate cavitation, flashing and air entrainment.
- .12 Adjust pump shaft seals, stuffing boxes, glands.
- .13 Measure pressure drop across strainer when clean and with flow rates as finally set.
- .14 Replace seals if pump used to degrease system or if pump used for temporary heat.
- .15 Verify lubricating oil levels.

3.3 Performance Verification

- .1 General
 - .1 In accordance with Section 01 91 00 - Commissioning (CX) Plan, Section 23 08 00 – Commissioning of Mechanical Systems, and supplemented as specified herein.
- .2 Exclusions:
 - .1 This paragraph does not apply to small in-line circulators.
- .3 Assumptions: these PV procedures assume that:
 - .1 Manufacturer's performance curves are accurate.
 - .2 Valves on pump suction and discharge provide tight shut-off.
- .4 Net Positive Suction Head (NPSH):
 - .1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.
 - .2 Measure using procedures prescribed in the Standard.
 - .3 Where procedures do not exist, discontinue PV, report to Departmental Representative and await instructions.

- .5 Multiple Pump Installations - Series and Parallel:
 - .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.
- .6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.
- .7 Commissioning Reports: In accordance with Section 01 91 00 - Commissioning (CX) Plan, Section 23 08 00 – Commissioning of Mechanical Systems, reports supplemented as specified herein. Reports to include:
 - .1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
 - .2 Pump performance curves (family of curves).

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

- .1 Materials, components, equipment and chemicals for installation of complete HVAC water treatment system.

1.2 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results-Mechanical
- .3 Section 23 08 02 Cleaning & Startup of Mechanical Piping Systems

1.3 References

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME Boiler and Pressure Vessel Code, Section VII-[2004].
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 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 - Shop Drawings, Product Data & Samples.

.2 Shop Drawings:

- .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.

.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.

.4 Closeout Submittals:

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

- .2 Include following:
 - .1 Log sheets as recommended by manufacturer.

1.4 Quality Assurance

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & 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.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Manufacturer

- .1 Equipment, chemicals, service provided by one supplier.

2.2 Chemical Feed Piping

- .1 Schedule 40 black steel.

2.3 Shipping/Feeding Chemical Containers

- .1 High density molded polyethylene, with liquid level graduations, cover.

2.4 Water Treatment for Closed Systems

- .1 Bypass pot feeder: 7.6 L capacity, constructed of heavy duty cast iron or welded steel suitable for 1,380 kPa working pressure, with quick opening cap and complete with NPS 3/4 connections. Isolation valves shall be installed on the inlet, outlet and drain.
- .2 Sidestream filter: Steel construction using a 250mm x 30 micron filter cartridge, with a minimum flow rate of 35 litres/minute. A flow indicator with stainless steel impeller shall be installed in conjunction with the sidestream filter. Connections shall be NPS 3/4 and all isolation valves shall be installed per manufacturer's instructions. Include 10 filter cartridges.
- .3 Totalizing make-up water meter: Cast bronze body, NPS 3/4 connections, thermoplastic rotor and gear train, rated at 1,206 kPa maximum operating pressure. Provide an analog input point and connect to the DDC system for monitoring.
- .4 Provide corrosion coupon, coupon holder and cross.

2.5 Chemicals

- .1 Closed System Treatment (Hot Water, Chilled Water): Use a Borated Nitrite-Molybdate based corrosion inhibitor. Maintain levels at 200 to 400ppm. The use of Nitrite only, Molybdate only or Sulphite will not be accepted.
- .2 Cleaning solutions: as indicated in Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .3 Provide one year supply.

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 HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.3 Chemical Feed Piping

- .1 Install crosses at changes in direction. Install plugs in unused connections.

3.4 Cleaning of Mechanical System

- .1 Provide copy of recommended cleaning procedures and chemicals for approval by Departmental Representative.
- .2 Thoroughly flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.
- .3 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .4 Drain and flush system[s] until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .5 Disposal of cleaning solutions to be approved by authority having jurisdiction.

3.5 Water Treatment Services

- .1 Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:

- .1 Initial water analysis and treatment recommendations.
- .2 System start-up assistance.
- .3 Operating staff training.
- .4 Visit plant every 30 days during period of operation and as required until system stabilizes and advise on treatment system performance.
- .5 Provide necessary recording charts and log sheets for one year operation.
- .6 Provide necessary laboratory and technical assistance.
- .7 Provide clear, concise, written instructions and advice to operating staff.

3.6 Field Quality Control

- .1 Start-Up
 - .1 Start up water treatment systems in accordance with manufacturer's instructions.
- .2 Commissioning
 - .1 Commissioning Agency: to be installing water treatment sub-contractor.
 - .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After start-up and before TAB of connected systems.
 - .3 Pre-commissioning Inspections: verify:
 - .1 Presence of test equipment, reagents, chemicals, details of specific tests performed, and operating instructions.
 - .2 Suitability of log book.
 - .3 Currency and accuracy of raw water analysis.
 - .4 Required quality of treated water.
 - .4 Commissioning procedures - applicable to Water Treatment Systems:
 - .1 Establish, adjust as necessary and record automatic controls and chemical feed rates.
 - .2 Monitor performance continuously during commissioning of connected systems and until acceptance of project.
 - .3 Establish test intervals, regeneration intervals.
 - .4 Record on approved report forms commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
 - .5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
 - .6 Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set

-
- during commissioning (more often as required until system stabilizes at required level of performance).
- .7 Advise Departmental Representative in writing on matters regarding installed water treatment systems.
 - .5 Commissioning procedures - Closed Circuit Hydronic Systems:
 - .1 Analyze water in system.
 - .2 Based upon an assumed rate of loss approved by Departmental Representative, establish rate of chemical feed.
 - .3 Record types, quantities of chemicals applied.
 - .6 Training:
 - .1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.
 - .2 Train O&M personnel in softener regeneration procedures.
 - .7 Certificates:
 - .1 Upon completion, furnish certificates confirming satisfactory installation and performance.
 - .8 Commissioning Reports:
 - .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, other data required by Departmental Representative.
 - .9 Commissioning activities during Warranty Period:
 - .1 Check out water treatment systems on regular basis and submit written report to Departmental Representative.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results-Mechanical
- .3 Section 23 05 93 Testing Adjusting and Balancing for HVAC

1.2 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Dispose of unused cleaning solutions at official hazardous material collections site approved by the Departmental Representative.
- .3 Do not dispose of unused cleaning solutions into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.
- .4 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .5 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.3 Scope

- .1 All air systems installed by this contract shall be cleaned by a Cleaning Contractor.
- .2 The Cleaning Contractor shall visit the site in the case of existing systems or shall review the drawings and specifications of new systems, in order to be fully acquainted with the scope of work and requirements before tendering. No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site or inspect the contract documents.
- .3 The following air systems shall be cleaned, as applicable:
 - .1 Relief
 - .2 Supply
 - .3 Return
 - .4 Exhaust
 - .5 Air Conditioning
- .4 All components within each system shall be thoroughly cleaned to the Departmental Representative's satisfaction and shall include but not be limited to the following:
 - .1 Intake exhaust and relief louvres
 - .2 Bird screens
 - .3 Auto dampers
 - .4 Filter frames
 - .5 Coils
 - .6 Fans & motors - complete assembly
 - .7 All plenum surfaces
 - .8 Terminal heating/cooling coils

- .9 Supply air grilles, registers and diffusers
- .10 Ductwork
- .11 Mixing boxes, air terminal units
- .12 Return, exhaust and relief air grilles and diffusers.

1.4 Qualifications

- .1 Cleaning shall be performed by a cleaning service company with high capacity cleaning equipment designed specifically for the work involved, executed by personnel specifically trained for the application.

PART 2 PRODUCTS

2.1 Cleaning Equipment

- .1 Cleaning shall generally by high capacity power vacuum.
- .2 High pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise.

PART 3 EXECUTION

3.1 Cleaning HVAC Systems

- .1 The Cleaning Contractor shall provide access as required for the work and shall reseal and make good any duct or insulation damaged in the process of this work.
- .2 Remove cheesecloth from grilles, etc., let over from the temporary use of the air systems.
- .3 Air systems must not be shut down without prior approval from the Departmental Representative.
- .4 The Cleaning Contractor shall be responsible for removing and replacing filter media. In new buildings this Contractor will remove the temporary filters and replace with new after cleaning the systems. In existing buildings this Contractor may re-use existing filter media (cleaned if possible) or new media will be provided by the Departmental Representative.
- .5 The Cleaning Contractor shall mark balancing damper positions before cleaning and return them to their original position when cleaning is completed unless the system is to be balanced.
- .6 Re-install any grilles, registers and diffusers which may have been removed for cleaning purposes.

3.2 Report

- .1 After completion of the work, the Contractor shall provide four copies of a certificate stating that all systems have been cleaned as specified and that all access panels for all cleaning openings are in place. This certificate shall be placed in the Operating and Maintenance Manuals.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results - Mechanical
- .3 Section 23 07 13 Thermal Insulation for Ducting

1.2 References

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 480/A 480M-2003c, Standard Specification for General Instructions for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A 635/A 635M-2002, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .3 ASTM A 653/A 653M-2003, 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 Agency (NFPA)
 - .1 NFPA 90A-1999, Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B-1999, Installation of Warm Air Heating and Air Conditioning Systems.
 - .3 NFPA 91-1995, Standard for Exhaust System for Air Conveying of Vapours, Gases, Mists, and Non-combustible Particle Solids.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
 - .2 SMACNA HVAC Duct Leakage Test Manual, 1985, Technical Research Update-92.

- .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.
- .7 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 Submittals

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets for the following:
 - .1 Sealants.
 - .2 Adhesive
 - .3 Duct tape.
 - .4 Duct liners.

1.4 Quality Assurance

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health & Safety Requirements.

1.5 Delivery Storage and Handling

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Seal Classification

.1 Classification as follows:

Pressure Class	Maximum Pressure (Pa)	SMACNA Class	Seal
High Pressure	1,000	[A]	
Medium Pressure	750	[B]	
Low Pressure	500	[B]	

.2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 Ductwork - General

- .1 Duct dimension noted on drawings are clear inside dimensions. Insulation thickness shall be as noted on the drawings.
- .2 All seams, joints and raw edges shall be sealed and covered with glassfab.
- .3 Insulation shall be applied with mechanical fasteners and suitable adhesives. Duct insulation adhesive and coatings shall be non-toxic as defined by WCB Regulations.
- .4 Round duct: with spiral seams. Sections shall be joined with a RT1 slip joint, screw fastened and sealed with no visible duct sealant to interfere with finish painting.
- .5 Exposed round duct shall be installed in a neat workmanlike manner parallel to building walls and roof with no sags or misalignment, and shall be true and round.
- .6 Ductwork downstream of low-pressure single duct air terminal units shall be constructed to 500 Pa low pressure duct.
- .7 Ductwork upstream of single duct air terminal units shall be constructed to 1,000 Pa medium pressure duct.

2.3 Fittings

- .1 Fabrication: to SMACNA. Fittings shall be 2 gauges heavier than connecting ductwork.
- .2 Radius elbows:
 - .1 Rectangular: Centre-line radius equal to 1.5 times width of duct, with single thickness turning vanes.
 - .2 Round: Centre-line radius equal to 1.5 times diameter. 5-gore for 300mm and larger; die-stamped for 254mm and smaller.

- .3 Mitered elbows, rectangular:
 - .1 To 400mm: with single thickness turning vanes.
 - .2 Over 400mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: 45° entry on branch.
 - .2 Round main and branch: enter main duct at 45° or with conical connection. The use of spin-in collars is not acceptable.
- .5 Transitions:
 - .1 Diverging: 20° maximum angle.
 - .2 Converging: 30° maximum angle.
- .6 Offsets: full radius elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.
- .8 Elbows in autoclave exhaust shall be un-vaned, smooth radius construction with centre-line equal to 1.5 times width of duct.

2.4 Galvanized Steel

- .1 Lock forming quality: to ASTM A 653, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.
- .4 Applications:
 - .1 All supply and exhaust ductwork unless otherwise noted.

2.5 Hangers and Supports

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500mm.
- .2 Hangers, hanger configuration and attachment to structure: to SMACNA.

2.6 Duct Liner

- .1 Fibrous glass duct liner: air stream side faced with FSK facing.
- .2 Rigid:
 - .1 Use on flat surfaces.
 - .2 25mm or 50mm thick fibrous glass rigid board duct liner.
 - .3 Density: 36 kg/m³
 - .4 Thermal resistance: RSI-0.76 for 25mm, RSI-1.53 50mm .
- .3 Flexible:
 - .1 Use on round or oval surfaces.
 - .2 25mm or 50mm thick fibrous glass blanket duct liner as indicated.

- .3 Density: 24 kg/m³.
- .4 Thermal resistance: RSI-0.74 for 25mm , RSI-1.47 50mm .
- .4 Fasteners shall be weld pins with metal retaining clips and square head.
- .5 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.7 Sealant

- .1 Oil resistant, polymer-based duct sealant. Temperature range of -23°C to 65°C. ULC listed and comply with NFPA 90A and NFPA 90B.
- .2 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.8 Adhesive

- .1 Water-based vinyl copolymer adhesive. Temperature range of -23°C to 71°C. ULC listed and comply with NFPA 90A and NFPA 90B. Adhesive shall be non- toxic as defined by W.C.B. Regulations.
- .2 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.9 Duct Tape System

- .1 Two part system combined of treated woven fibreglass tape and liquid sealant/adhesive. ULC listed and comply with NFPA 90A and NFPA 90B.
- .2 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

PART 3 EXECUTION

3.1 General

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA, and as indicated.

- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- .7 All openings in ductwork shall be sealed with temporary duct cover during construction. Failure to maintain duct cleanliness will require the inside of all air ducts, plenums and equipment in the air stream to be cleaned with an industrial vacuum cleaner before system balancing is started.
- .8 Apply protective galvanize coating to galvanized ductwork and accessories which have been welded.
- .9 Apply duct sealer to all joints of metal ducts, connections to diffusers, plenums and flexible duct.
- .10 Provide medium pressure duct for the following:
 - .1 Ductwork serving systems with air terminal units, extending from the air handling unit discharge to the inlet of air terminal units.
 - .2 As indicated.
- .11 The use of plastic duct tape is not permitted.
- .12 Thermal insulation to Section 23 07 13 – Thermal Insulation for Ducting.

3.2 Hangers

- .1 Strap hangers: Install in accordance with SMACNA.
- .2 Rectangular duct: Extend strap hanger down on both sides of duct, turn under bottom 25mm minimum. On each strap provide two sheet metal screws on the side and one in the bottom.
- .3 Angle hangers: complete with locking nuts and washers.
- .4 Hanger spacing: to SMACNA.
- .5 Seismic restraint to Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

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.
 - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425mm on centres.

- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.
- .4 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply two coats of sealer over tape.
- .5 Replace damaged areas of liner.
- .6 Protect leading and trailing edges of duct sections with sheet metal nosing having 15mm overlap and fastened to duct.
- .7 Provide 50mm liner for ductwork exposed to weather which is not insulated

3.4 Sealing and Taping

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results - Mechanical

1.2 References

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 1995 and Addendum No. 1, 1997.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2009, Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2009, Installation of Warm Air Heating and Air Conditioning Systems.
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S110-M86 (R2001), Fire Tests for Air Ducts.
 - .2 UL 181-1996, Factory Made Air Ducts and Connectors.

1.3 Submittals

- .1 Submittals in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: manufacturer's field reports specified.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan (WMP).
 - .5 Divert unused materials from landfill to recycling facility as approved by Departmental Representative.

PART 2 PRODUCTS

2.1 General

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

2.2 Flexible Duct

- .1 General:
 - .1 UL-181 listed and labeled as Class I air duct, and complies with NFPA 90A and 90B.
- .2 Non-metallic, Insulated:
 - .1 Constructed of CPE liner duct permanently bonded to a spring steel wire helix and with factory applied fibreglass insulation, lower permeability vapour barrier and laminate jacket for low and medium pressure systems.
 - .2 Maximum rated pressure: 1,000Pa positive, 250Pa negative.
 - .3 Operating temperature: -29 to 121 °C
 - .4 Thermal resistance: RSI-0.74
 - .5 Application: cold air supply duct.

- .3 Non-metallic, un-insulated:
 - .1 Constructed of supporting helix of coated spring steel wire permanently bonded to a coated woven fiberglass.
 - .2 Maximum rated pressure: 2,500Pa positive, 250Pa negative.
 - .3 Operating temperature: -18 to 121 °C
 - .4 Application: warm air supply duct.

2.3 Flexible Duct Connectors

- .1 Frame: galvanized sheet metal frame 0.66mm thick with fabric clenched by means of double locked seams.
- .2 Fabric:
 - .1 Indoor: Fire resistant, self extinguishing, neoprene coated fibreglass fabric, temperature rated at -40°C to 90°C, thickness of 0.63mm
 - .2 Outdoor: Fire resistant, self extinguishing, DuPont Hypalon coated fibreglass fabric, temperature rated at -40°C to 120°C, thickness of 0.61mm.

2.4 Access Doors in Ducts

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm thick complete with sheet metal angle frame and 25mm thick rigid fibreglass 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.

2.5 Turning Vanes

- .1 Factory-made, single or double thickness as specified elsewhere, with trailing edge. Vanes shall be constructed of same material as duct, 0.55 mm.
- .2 Rails shall be fabricated of same material as duct, 0.66m . Vanes shall be attached to rails using fasteners.

2.6 Instrument Test Ports

- .1 Alloy casting with screw-in cap, neoprene gasket, 18 mm inside diameter opening for pitot tube or velometer.

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 Duct
 - .1 Provide flexible duct connecting air outlets as indicated. Flexible duct with integral volume damper is not acceptable.
 - .2 Install flexible duct fully extended, without tight bends and kinks. The radius at the centre-line shall not be less than one duct diameter. Do not install in compressed state.
 - .3 Length of flexible duct shall within 1,500mm to 2,100mm.
 - .4 Provide support for flexible duct at 1,200mm on centre. Maximum permissible sag is 42 mm/m of spacing between support. A connection to a rigid duct or equipment shall be considered a support joint.
 - .5 Sheet metal strap for flexible duct support shall be minimum 38mm wide.
 - .6 Sheet metal collars to which the flexible ducts are attached shall be minimum 50mm in length.
 - .7 Repair torn or damaged vapour barrier jackets approved duct tape. If the internal core is penetrated, replace the flexible duct.
 - .8 Do not use flexible duct for connecting mixing box and air terminal unit inlets.
- .2 Flexible Duct Connectors
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .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: 75mm
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
 - .3 Access Doors in Ducts
 - .1 Size:
 - .1 610mm x 1520 mm for person size entry.
 - .2 460mm x 460 mm for service.
 - .3 300mm x 200mm for cleaning.
 - .4 As indicated.
 - .2 Locations:
 - .1 Fire dampers and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 On both sides of turning vanes.
 - .7 At the base of all duct risers.
 - .8 At 12,000m intervals in all duct systems, and 6,000mm [intervals in horizontal exhaust ducts for cleaning purposes.
 - .4 Instrument Test Ports
 - .1 Install in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations.

- .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .5 Turning Vanes
- .1 Install in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 1995 and Addendum No. 1, 1997.
 - .2 SMACNA – Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 2002.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN4-S112-M82(R1987), Fire Test of Fire Damper Assemblies.
 - .2 CAN4-S112.2-M84, Fire Test of Ceiling Firestop Flap Assemblies.
 - .3 ULC-S505-1974, Fusible Links for Fire Protection Service.
- .3 National Fire Protection Agency (NFPA)
 - .1 NFPA 90A-1999, Installation of Air Conditioning and Ventilating Systems.

1.3 Submittals

- .1 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 Indicate the following:
 - .1 Volume dampers.
 - .2 Remote control damper regulators.
 - .3 Fire dampers.
 - .4 Fire stop flaps.
 - .5 Smoke dampers.
 - .6 Backdraft dampers.
 - .7 Relief dampers.
- .2 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.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - 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 01 74 19 - Waste Management & Disposal.

1.6 Extra Materials

- .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.
- .2 Provide following:
 - .1 Six (6) fusible links for each type of fire damper.

PART 2 PRODUCTS

2.1 General

- .1 Manufacture to SMACNA standards.

2.2 Single Blade Volume Dampers

- .1 Blade: Of same material as duct. Two gauges heavier than duct but not less than 0.6mm, stiffened.
- .2 Maximum dimension: 305mm height for rectangular ducts.
- .3 Axles: 9.5mm [3/8"] continuous square rod up to 457mm wide duct, and 13mm continuous square rod up to 1,219mm wide duct.
- .4 Linkage: shaft extension with locking quadrant and position indicator.
- .5 Bearings: bronze oilite.
- .6 Frame: of the same material as duct. Complete with angle stop for rectangular duct.

2.3 Multi-Bladed Volume Dampers

- .1 Opposed blades: 1.2mm of same material as adjacent duct, stiffened.
- .2 Maximum blade width: 150mm
- .3 Axles: 9.5mm or 13mm continuous square rod.
- .4 Bearings: bronze oilite.
- .5 Linkage: shaft extension with locking quadrant and position indicator.
- .6 Frame: 51mm or 40 x 13 x 3 mm structural or roll-formed channel, complete with angle stop.

2.4 Remote Control Damper Regulators

- .1 Cable controlled damper regulator for concealed ceiling applications.
- .2 Cable: 1.4mm stainless steel Bowden cable encapsulated in 1.6mm flexible galvanized spiral wire sheath.
- .3 Control kit: die-cast aluminum housing with 76mm diameter chrome-plated cover, with steel rack and pinion gear drive converting rotary motion to push-pull motion.
- .4 Provide hardware kit for damper by others.

2.5 Fire Dampers

- .1 Arrangement B, ULC listed and labelled, meeting requirements of provincial fire authority and NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .2 Frame and integral sleeve shall be of same material as duct with mounting angles furnished by the damper manufacturer. Sleeve thickness to SMACNA and NFPA-90A.
- .3 Top hinged: offset, round or square, interlocking blade type and sized to maintain full duct cross section.
- .4 Fusible link: 74°C replaceable. Gravity-operated for vertical installation and spring-actuated for horizontal installation.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

2.6 Fire Stop Flaps

- .1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.
- .2 Construct of same material as duct, minimum 1.5 mm thick with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps to be held open with fusible link conforming to ULC-S505 and close at [74] °C [or as indicated].

2.7 Smoke Dampers

- .1 Class I leakage rate, with airfoil blades, pressure sensitive blade edge and jamb seals for low leakage, concealed linkage. Both damper and actuator shall be ULC listed and labelled.
- .2 Constructed frame and blades of same material as duct.
- .3 Operation: Normally open position. Damper shall close upon detection of smoke or from remote alarm signalling device.

2.8 Backdraft Dampers

- .1 Multi-blade, gravity-operated, centre pivoted, constructed of same material as duct with nylon bearings.

2.9 Relief Dampers

- .1 Multi-blade, insulated, counter-weight, centre pivoted, constructed of same material as duct with brass bearings, set to open at 12.4 Pa static pressure unless otherwise noted.

PART 3 EXECUTION

3.1 General

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.

3.2 Volume Damper

- .1 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
- .2 Run-outs to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .3 All dampers to be vibration free.
- .4 Attach fluorescent tape to regulator handle for concealed volume dampers.
- .5 Provide remote control damper regulator for volume dampers above inaccessible ceiling where ceiling access panel is not provided, and as indicated.

3.3 Fire Dampers

- .1 Install in accordance to Part 3, Sub-section 3.1.8 of the National Building Code.
- .2 Provide fire damper where duct penetrates through fire-rated floor, wall, or fire separation.
- .3 Provide fire stop flap at fire-rated ceiling assembly.
- .4 Provide access door per Section 23 33 00 – Air Duct Accessories.

3.4 Smoke Dampers

- .1 Provide smoke dampers in the supply and return air streams if the air handling system:
 - .1 serves more than one storey.
 - .2 serves more than one suite in a storey.
- .2 Coordinate with Division 26 for power and Division 28 for interlock/interfaces.
- .3 Provide access door per Section 23 33 00 – Air Duct Accessories.

3.5 Field Quality Control

- .1 Tests:
 - .1 Tests to cover period of not less than 2 days and demonstrate that system is functioning as specified.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 05 13 Common Motor Requirements for HVAC Equipment
- .4 Section 23 05 48 Vibration & Seismic Controls for HVAC Piping & Equipment
- .5 Section 23 08 00 Commissioning of Mechanical Systems
- .6 Section 23 33 00 Air Duct Accessories

1.2 References

- .1 Air Conditioning and Mechanical Contractors (AMCA)
 - .1 AMCA Publication 99-2003, Standards Handbook.
 - .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
 - .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
 - .2 Capacity: flow rate, static pressure, BHP, HP, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
 - .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

- .4 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

1.4 Submittals

- .1 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.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 - General Instructions.
- .3 Provide:
 - .1 Fan performance curves showing point of operation, BHP and efficiency.
 - .2 Sound rating data at point of operation.
- .4 Indicate:
 - .1 Motors and sheaves details.
- .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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .3 Waste Management and Disposal:
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Fans General

- .1 Motors:
 - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
 - .2 For use with variable speed controllers where specified.
 - .3 Sizes as specified.
- .2 Accessories and hardware: as specified.
- .3 Scroll casing drains: as indicated.
- .4 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .5 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for Ductwork Piping and Equipment.
- .6 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 Centrifugal Fans

- .1 Fan wheels:
 - .1 welded steel construction.
 - .2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.
 - .3 Air foil or backward inclined blades, as indicated.
- .2 Bearings: heavy duty grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life (L50) of 200,000 hours.
- .3 Housings:
 - .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel, for smaller wheels, braced, and with welded supports.
 - .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
 - .3 Provide bolted or latched airtight access doors with handles.
- .4 Provide belt driven sets with adjustable motor bed plate and variable pitch driver sheave.

2.3 Cabinet Fans – General Purpose

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Cabinet hung single wheel with centrifugal fan in factory fabricated casing complete with vibration isolators and seismic control measures, motor and other accessories as noted.
- .3 Fabricate casing of zinc coated or phosphate treated steel of 18 gauge reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to CAN/CGSB 1.181.

2.4 In-Line Centrifugal Fans

- .1 Characteristics and construction: as for centrifugal fan wheels.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

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 Fan Installation

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

3.3 Anchor Bolts and Templates

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.4 Field Quality Control

- .1 Commissioning:
 - .1 In accordance with Section 01 91 31 – Commissioning (CX) Plan, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 05 00 Common Work Results – Mechanical
- .4 Section 23 08 00 Commissioning of Mechanical Systems

1.2 References

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASHRAE 51/AMCA 210-1999, Laboratory Methods of Testing Fans for Rating.
 - .2 ANSI/NFPA 90A-1999, Installation of Air Conditioning and Ventilating Systems.
- .2 International Organization of Standardization (ISO)
 - .1 ISO 3741-1999, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.
- .3 Underwriter's Laboratories (UL)

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.4 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 - General Instructions. Include product characteristics, performance criteria, and limitations.

- .2 Test data: to ANSI/AMCA 210.
 - .1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.
 - .2 Sound power level with minimum inlet pressure of 250 Pa in accordance with ISO 3741 for 2nd through 7th octave band.
 - .3 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
 - .2 Indicate the following:
 - .1 Capacity.
 - .2 Pressure drop.
 - .3 Noise rating.
 - .4 Leakage.
 - .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.
 - .4 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Manufactured Units

- .1 Terminal units of the same type to be product of one manufacturer.

2.2 Single Duct VAV Air Terminal Units

- .1 Pressure independent reset to air flow between minimum and maximum air volume.
- .2 Sizes, capacities, differential pressures and sound ratings: as indicated.
- .3 Differential pressure not to exceed 25 Pa at inlet air velocity of 10 m/s.
- .4 Sound ratings of assembly not to exceed 30 NC at 250 Pa.
- .5 Air velocity sensor: pitot rack as standard to manufacturer.
- .6 Complete with:
 - .1 Sound attenuator: as indicated.
 - .2 Reheat coil: as indicated.
- .7 Casing: constructed of 22 gauge galvanized steel, internally lined with 12 mm fibrous glass, to ANSI/NFPA 90A. Mount control components inside protective metal shroud.
- .8 Damper: galvanized steel with peripheral gasket and self lubricating bearings. Air leakage past closed damper not to exceed 2% of nominal rating at 750 Pa inlet static pressure, in accordance with Air Diffusion Council test procedure.
- .9 Controller and transformer for controls by Controls Contractor.

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 ductwork.
- .3 Install with minimum of three duct diameters of straight inlet duct, same size as inlet. Flexible duct is not permitted upstream of air terminal units and mixing boxes.
- .4 Locate so that controls, dampers and access panels are easily accessible.

3.3 Field Quality Control

- .1 Commissioning:
 - .1 In accordance with Section 01 91 31 – Commissioning (CX) Plan, and Section 23 08 00 – Commissioning of Mechanical Systems.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 00 – Cleaning, and Section 23 31 10 - Cleaning of Mechanical Duct Systems.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 Submittals

- .1 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.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- .2 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.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

1.6 Maintenance

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

PART 2 PRODUCTS

2.1 General

- .1 Size as indicated.
- .2 Capacity, pressure drop, terminal velocity, throw, noise level, neck velocity shall conform to intended performances of specified materials.
- .3 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified on architectural reflected ceiling plans.
 - .3 Concealed fasteners.
- .4 Where balancing damper is scheduled, damper shall be of opposed blade type.
- .5 Diffusers, grilles and registers in areas with high humidity shall be of aluminum construction.
- .6 Provide neck transition as required.

2.2 Manufactured Units

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

2.3 Return, Exhaust, and Transfer Grilles and Registers

- .1 Return register, Type RR-1: egg crate, steel, coated steel grille mounted opposed blade damper, 13 mm x 13 mm x 13 mm aluminum grid core, surface mount, countersunk screw holes c/w oval-head screws. Finish: white baked enamel.
- .2 Return registers, Type RR-2 “matching ER-2 verbiage.”
- .3 Exhaust register, Type ER-1: fixed louvre, steel, 32 mm border, 45 degree deflection, 19mm blade spacing, front blades parallel to long dimension, coated steel grille mounted opposed blade damper, surface mounted. Finish: white baked enamel.
- .4 Exhaust register, Type ER-2: Anti-ligature maximum security perforated face grille, all welded dd stitch welded seams, 25mm x 25mm x 5mm hot rolled steel angle frame with security bar, front operated opposed blade damper. Finish: etched and clear lacquer.
- .5 Exhaust grille, Type EG-1: fixed louvre, steel, 32 mm border, 45 degree deflection, 19mm blade spacing, front blades parallel to long dimension, lay-in. Finish: white baked enamel.

2.4 Diffusers

- .1 Supply diffuser, Type SD-1: square plaque diffuser, four-way throw, steel, having fixed pattern, round inlet collar, volume control damper, surface mounted. Finish: white baked enamel.
- .2 Supply diffuser, Type SD-2: square plaque diffuser, four-way throw, steel, having fixed pattern, round inlet collar, volume control damper, T-bar mount. Finish: white baked enamel.
- .3 Supply diffuser, Type SD-3: Anti-ligature maximum security square plaque diffuser, four-way throw, steel, having fixed pattern, round inlet collar, volume control damper, surface mount. Finish: white baked enamel.

2.5 Undercut and Door Grilles

- .1 Type A: 20 mm undercut.
- .2 Type B: door grille, 508 mm x 305 mm, aluminum, 32 mm border, both sides, countersunk screw hole fastening, sight proof. Finish: custom baked enamel finish; colour to be selected by Departmental Representative at shop drawing review.
- .3 Type C: door grille, 508 mm x 406 mm, aluminum, 32 mm border, both sides, countersunk screw hole fastening, sight proof. Finish: custom baked enamel finish; colour to be selected by Departmental Representative at shop drawing review.
- .4 Type D: door grille with fire damper, 457 mm x 356 mm. Finish: custom baked enamel finish; colour to be selected by Departmental Representative at shop drawing review.

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 instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms.
- .5 Paint matte black behind all diffusers, grilles and registers so that no metallic part will be visible from the exposed side.
- .6 Provide security joint sealant on all maximum security perforated face grilles (ER-2).

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .3 Air Movement and Control Association (AMCA)

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 Submittals

- .1 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 Indicate following:
 - .1 Pressure drop.
 - .2 Face area
 - .3 Free area.
 - .4 Beginning point of water penetration.
- .2 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 Test Reports:
 - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Roof Ventilator Hoods

- .1 Application: exhaust fan vent and outdoor air intake vent
- .2 General: Spun aluminum gravity roof ventilator, heavy gauge aluminum windband with rolled bead construction. Rigid galvanized steel internal components with birdscreen. Heavy-gauge aluminum curb cap with spun venturi.

2.2 Louvres

- .1 Louvres shall have free areas as scheduled, be of formed galvanized steel sections and have all welded assemblies. Fitted with screw fastened galvanized 19mm (3/4") mesh, 18 gauge bird-screen on interior. Louvre flanges shall be suitable for type of construction encountered, caulked and weather-tight.

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 around to ensure weather tightness.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Materials, installation and start up for heating boilers.

1.2 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 05 48 Vibration & Seismic Controls for HVAC Piping & Equipment
- .4 Section 23 08 00 Commissioning of Mechanical Systems
- .5 Section 23 21 14 Hydronic Specialties

1.3 References

- .1 American Boiler Manufacturer's Association (ABMA)
- .2 American National Standards Institute (ANSI)
 - .1 ANSI Z21.13-[2004]/CSA 4.9-[2004], Gas-Fired Low-Pressure Steam and Hot Water Boilers.
- .3 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV, [2004].
- .4 Canadian Gas Association (CGA)
 - .1 CAN1-3.1-[77(R2001)], Industrial and Commercial Gas-Fired Package Boilers.
 - .2 CAN/CSA-B149.1-[05], Natural Gas and Propane Installation Code.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA B51-[03], Boiler, Pressure Vessel, and Pressure Piping Code.
- .6 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.4 Submittals

- .1 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.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

-
- .2 Indicate the following:
 - .1 General arrangement showing terminal points, instrumentation test connections.
 - .2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
 - .3 Foundations with loadings, anchor bolt arrangements.
 - .4 Piping hook-ups.
 - .5 Equipment electrical drawings.
 - .6 Burners and controls.
 - .7 All miscellaneous equipment.
 - .8 Flame safety control system.
 - .9 Breeching and stack configuration.
 - .3 Engineering data to include:
 - .1 Boiler efficiency at 25%, 50%, 75%, 100% of design capacity.
 - .2 Radiant heat loss at 100% design capacity
 - .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.
 - .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Health and Safety

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 01 50 – General 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 Remove from site and dispose of packaging materials at appropriate recycling facilities.

PART 2 PRODUCTS

2.1 General

- .1 Packaged boiler:
 - .1 Wall hung boilers complete with burner, controls and boiler trim, hot water connection, fuel connection, electrical hook-up.
 - .2 Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance with, CSA B140.7, CAN1-3.1.
 - .3 Ready for attachment to piping, electrical power, controls, flue gases exhaust.
 - .4 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code.
 - .5 CRN (Canadian Registration Number), to CSA B51.
 - .6 Boiler/burner package to bear ULC, CGA label.
 - .7 Factory start-up and report.
 - .8 Furnished with condensate neutralizing system.
- .2 Anchor bolts and templates:
 - .1 Anchor bolts to be sized to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .3 Trial usage:
 - .1 Departmental Representative may use boilers for test purposes prior to acceptance and commencement of warranty period.
 - .2 Supply labour, materials and instruments required for tests.
- .4 Temporary use by contractor:
 - .1 Contractor may use boilers only after written approval from Departmental Representative.
 - .2 Monitor and record performance continuously. Keep log of maintenance activities carried out.
 - .3 Refurbish to as-new condition before final inspection and acceptance.

2.2 High Efficiency Boilers

- .1 Type:
 - .1 Provide hot water boiler suitable for forced draft with insulated jacket, **natural gas** burning system, controls and boiler trim. Provide boiler complete with supply and return headers and flange connections, size as noted on drawings.
 - .2 Heating capacity: 44 kW input and 41 kW output
 - .3 Combustion efficiency: 96.1% to CSA 4.9-2010

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- .2 Construction:
- .1 Each heating boiler shall be designed with a vertical combustion chamber. Its heat exchanger is to be manufactured with titanium stabilized 316 stainless steel. Heat exchanger performance shall be maximized through a multi-tube, counter-flow tubular design.
 - .2 The pressure vessel shall be rack or wall mounted with free gravity condensate drainage to ensure proper drainage of all condensate.
 - .3 The boiler shall be constructed in accord with CSA 4.9-2010 and the ASME Boiler and Pressure Vessel Code, Section IV and bear the H stamp as per ASME code. The boiler shall carry a CRN# for the Province of BC installation.
 - .4 Boiler enclosure panels shall be made of stainless steel with black powder coat base. Enclosure panels shall be designed for installation after all piping, insulation, and venting has been completed, provided all recommended clearances are respected.
 - .5 The boiler control shall be built in complete with full outdoor reset, multiple load control with relays for four pumps, variable speed signal for system pump or air handler, clear constantly bright LCD display providing plain English information, and serial port for software upgrades. Altitude compensation shall be available via keypad adjustment, for maintenance of full rating plate output to 8,500 ft. without requirement for orifice changes. The boiler shall offer internal multiple boiler staging and rotation control, for management of up to 24 boilers. The boiler control shall be able to accept an external 0-10 VDC or 4-20 mA input signal.
 - .6 Wire and cable entry to boiler control shall be universal to provide for cleanest installation.
 - .7 ASME maximum working pressure 80 psig and ASME maximum water temperature 98.89 C; the boiler will be supplied with a 30 psig Conbraco temperature and pressure relief valve for installation external to the boiler's case, using a ¾" reducing tee. An optional 70 psig Conbraco T&P valve may be specified - for closed loop applications only.
 - .8 Combustion air intake:
 - .1 Where direct vent is specified, provide PVC intake piping.
 - .9 Venting pipe shall be of either:
 - .1 Stainless steel grade 316, 316L or AL 29-4C and shall be able to handle positive pressure and flue gas condensate.
 - .2 System 636 CPVC piping. Grey (high temperature) shall be used.The chimney must be designed by a chimney manufacturer including all connector pieces and condensate drain connections.
- .3 Boiler Trim
- .1 Burner:
 - .1 Supplied with a pre-mix automatic burner designed to burn **natural gas**. Burner operation shall be full modulation.
 - .2 Voltage to the combustion air motor shall be 120 V / 1 PH / 60 Hz.

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- .3 Stainless steel combustion head capable of withstanding temperatures in excess of 800°C.
 - .4 The burner shall fully modulate and have a minimum 5 to 1 turn down ratio for precise load matching.
 - .5 Blower noise not to exceed 85 db (A) measured at one meter from the burner intake port.
 - .6 Burner shall have a control panel mounted directly on/in the boiler housing containing the following:
 - .1 Burner motor starter
 - .2 Overloads or fused disconnect
 - .3 Start/stop switch (may be in LCD controller)
 - .4 Lo fire hold switch (may be in LCD controller)
 - .5 Flame safe guard control (CSA approved)
 - .2 Burner shall come complete with a CGA, and FM approved gas train.
 - .1 Provide combination water pressure and temperature gauge, and ASME rated pressure relief valves.
 - .2 Provide a low water cut-off with manual reset and special retard circuit to automatically prevent burner operation when boiler water falls below safe level. The low water cut off must automatically reset on a resumption of power at the device. The low water cut out shall be a float style device. Probe style low water cut out devices WILL NOT be accepted. Test-N-Check valves shall be installed to the low water cut-offs to enable eased draining of LWCO during annual services checks.
 - .3 All temperature sensors sensing water temperature must be the immersion sensor type. Immersion sensor well shall be filled with heat transfer compound to reduce sensor response lag.
 - .4 Operating temperature controller shall control burner operation to maintain boiler water temperature set point. Controller shall be electronic.
 - .5 Limit temperature controller shall control burner to prevent boiler water temperature from exceeding safe system temperature.
 - .6 Provide a suitable terminal strip point to receive a 0 to 10 Vdc DDC reset signal for each modulating boiler. The provision of the control reset signal shall be supplied under Division 25.
 - .7 Provide boiler air vent tapping.
 - .3 Fuel Burning System
 - .1 General: Burner operation shall be modulating with low fire position for ignition.
 - .2 Burner: Power type with electric ignition and gas pressure regulator.

- .3 Controls: Pre-wired, factory assembled electronic controls on control cabinet with flame scanner or detector, programming control, relays and switches. Provide pre-purge and post-purge ignition and shutdown of burner in event of ignition pilot and main flame failure with manual reset.
- .4 Boiler venting shall be stainless steel or System 636 CPVC supplied and installed as recommended by the boiler manufacturer.
- .4 Condensate Handling System
 - .1 The boiler system shall include a condensate neutralizing system that is gravity drain and self actuating. The neutralizing system shall utilize calcium carbonate (limestone) as its neutralizing agent. The neutralizing system shall be sized to provide one heating season's of neutralizing capacity.
 - .2 The system shall neutralize the acidic condensate to a pH level that is safe for copper piping, building concrete, and the city sewer system.
 - .3 The condensate system (tank/container) must be easily removable with the use of flexible couplings and unions. Do not bolt down condensate system.
 - .4 Acid neutralizer shall be 20 litres capacity or approved equal capable of handling 3 MBH input appliances.
- .5 Interface with Building Management System
 - .1 The boiler system shall be capable of being directly controlled through the DDC interface or through the manufacturer supplied control system. Control of the boilers via DDC shall be limited to boiler module enable/disable, supply water temperature set point control, and alarm monitoring. The control of the boiler module burner, combustion mixture, firing rate, and pump command shall be by the manufacturer's supplied control system.
 - .2 Each module shall receive a hardwired 0 10 VDC reset signal that resets the module supply water temperature set point. The reset signal is to be supplied under Division 25.

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 ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of authority having jurisdiction, except where specified otherwise, and manufacturers recommendations.

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- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
 - .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
 - .4 The low water cut-outs shall be installed using ASME approved cross tees. The use of standard piping elbows and/or tees will NOT be accepted.
 - .5 Pipe hot water relief valves full size to nearest drain.
 - .6 Natural gas fired installations - in accordance with CAN/CSA-B149.1.
 - .7 LP gas installations - in accordance with CAN/CSA-B149.1.

3.3 Field Quality Control

- .1 Commissioning:
 - .1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.
 - .2 Manufacturer to:
 - .1 Certify installation.
 - .2 Start up and commission installation.
 - .3 Carry out on-site performance verification tests.
 - .4 Demonstrate operation and maintenance.
 - .3 Provide Departmental Representative at least 48 hours notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 13 Common Motor Requirements for HVAC Equipment
- .3 Section 23 05 48 Vibration & Seismic Controls for HVAC Piping & Equipment

1.2 References

- .1 Air-Conditioning and Refrigeration Institute (ARI)
 - .1 ARI 360-2000, Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
- .2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2004; Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
 - .2 Capacity: model, size, sound power data and as indicated on schedule.
 - .3 Performance ratings: based on tests performed in accordance with ARI 360.

1.4 Submittals

- .1 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.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 - General Instructions.
- .3 Provide:
 - .1 Sound rating data at point of operation.

- .4 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.
- .5 As part of the shop drawing submission, the Refrigeration contractor shall prepare and include the coil and condensing unit balance curves detailing the S.S. temperature, the estimated line loss, and the system balance point that meets the required total and sensible cooling capacities at the specified ambient temperatures. A refrigerant piping schematic, showing refrigerant pipe sizes, lengths, and refrigerant receiver size requirement, shall also be submitted to confirm installation is in accordance with manufacturer's recommendations, and does not contravene warranty requirements
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in 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 61 10 - Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 General

- .1 Outdoor-mounted, air-cooled condensing unit. All condensing unit components shall be assembled on a common base. Unit shall have a single refrigeration circuit. Unit shall consist of a semi-hermetic reciprocating compressor, an air-cooled coil, propeller-type condenser fans, and a control box. Unit shall discharge supply air upward as shown on contract drawings. Unit shall be used in a refrigeration circuit to match a packaged air-handling unit. The unit shall be completely weatherproofed and include:
 - .1 Compressors
 - .2 Condenser Coils
 - .3 Fans and Motors

- .4 Refrigerant Reservoir
 - .5 Liquid Receivers, shipped for field installation
 - .6 Charging valve
 - .7 All Controls
 - .8 Holding Charge of R407C or R410A
- .2 Unit shall be CSA, ETL/CETL approved and comply with ARI Standard 360.

2.2 Air-Cooled Condensing Units

- .1 Unit Casing:
- .1 Construction: satin coat galvanized sheet metal
 - .2 Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides.
 - .3 Exposed surfaces shall be prime painted, followed by an electrostatically applied enamel finish coat.
 - .4 Cabinets shall be supported on formed galvanized or structural steel channel supports, designed and welded for low deflections.
 - .5 Access doors shall be hinged, weatherproof lift out type with camlock.
 - .6 Integral lifting lugs shall be provided for hoisting.
 - .7 Provide zinc plated coil guards.
- .2 Compressor:
- .1 Fully hermetic scroll type, set on resilient neoprene mounts.
 - .2 Complete with crankcase heaters, internal line break motor protection and internal pressure relief.
 - .3 Compressors shall be high efficiency and matches with liberally sized condenser coils so that the EER rating meet or exceed ASHRAE 90.1 recommendations.
 - .4 Provide separate insulated compressor compartment for optimum sound control; 25mm, 24 kg/m³ density insulation.
- .3 Condenser Fans and Motors:
- .1 Fans: up-flow, direct drive, propeller, ultra-quiet type.
 - .2 Motor: 3 phase, weather resistant type, with integral overload protection and designed specifically for vertical shaft, outdoor application.
 - .3 Fan and motor assemblies shall be mounted on a formed orifice plate for optimum efficiency with minimum noise level.
- .4 Condenser Coils:
- .1 Copper tubing with mechanically bonded aluminum fins.
 - .2 Coils shall be factory tested to 300 psi while immersed in an illuminated water tank.

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- .3 Provide condenser coil guard.
 - .5 Controls:
 - .1 Controls shall include:
 - .1 Compressor and condenser fan motor contactors
 - .2 Control circuit transformer
 - .3 Cooling relays
 - .4 Pump down relays
 - .5 Ambient compressor lockout
 - .6 Fuses
 - .7 Manual reset high pressure controls
 - .8 Automatic reset low pressure controls.
 - .9 Head pressure actuated fan cycling controls.
 - .2 The unit shall be suitable for operation to 10 degrees C ambient by cycling the condenser fans.
 - .3 Provide 5-minute anti-cycle timer on lead compressor and with inter-stage time delay relays on subsequent stages; hot gas bypass controls.
 - .4 All controls with the unit shall be factory pre-wired and housed in a NEMA 3R enclosure.
 - .6 Controls for Interface with Building Management System.
 - .1 The condensing unit shall be enabled/disabled at the DDC.
 - .2 Provide electronic control system to stage the compressors based on discharge air control with reset via signals from DDC. Review controls sequence in Section 25 90 11 – EMCS Sequence of Operation. Incorporate PI control scheme that reduces temperature droop by resetting the set point after each stage is cycled on.
 - .3 Provide an adjustable deadband range between heating and cooling from 2° F to 11° F. While in the range, the outside air dampers shall be in minimum position.
 - .7 Electrical
 - .1 Units shall be furnished with dead-front disconnect.
 - .2 Control enclosure will be NEMA 3R rated for outdoor applications.
 - .3 The manufacturer shall label and number code all wiring and electrical devices in accordance with the unit electrical diagram. The unit shall be labeled and certified to CSA, UL, ETL, or NRTL. The manufacturer is to provide proof of this certification at time of submittal.

2.3 Refrigerant Piping:

- .1 Between condensing unit, compressor section and evaporator, complete with refrigerant metering devices and valves.
- .2 Provide all necessary type "L" hard copper tubing and wrought copper fittings with silver soldered joints as required to complete indicated installation. Gas lines shall be insulated with 20mm thick vapour-sealed elastomeric insulation. Insulation shall be sealed at seams and butt joints with adhesive. Outdoor exposed piping shall be finished with aluminum jacket.
- .3 Provide following specialties for system:
 - .1 Sporlan drier.
 - .2 Sporlan liquid indicator to indicate refrigerant level and excess moisture.
 - .3 Flexible connections to refrigerant lines adjacent to compressor to avoid "grounding" of vibration isolation.
 - .4 Sporlan Take apart thermal expansion valves with adjustable superheat control.
 - .5 Indicated liquid line solenoid valves.
 - .6 Liquid receiver, (Capacity adequate for full pump down to be confirmed by Refrigeration Contractor)
 - .7 Hot gas bypass.
 - .8 Refer to equipment specification clauses for refrigeration accessories that are supplied by the equipment manufacturer.

PART 3 EXECUTION

3.1 Installation

- .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.
- .3 Make piping connections.
- .4 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.2 Refrigeration Piping

- .1 When the system is completely fabricated, the refrigeration Contractor shall leak test with a nitrogen pressure test at 1723 kPa for a minimum of 24 hours, shall evacuate the system down to 500 microns and shall certify the system stayed at 500 microns for 1/2 hour after shutting off the vacuum pump and connection line. When this test passes, he shall fully charge the system with refrigerant and compressor oil.

- .2 Provide 12 months service for all refrigeration system components and fluids at no additional cost to the Departmental Representative. Start of 12 month service period shall be the first summer occasion on which unit is adjusted for cooling conditions.

3.3 Start-up and Commissioning

- .1 Charge refrigerant, start-up and submit written report to Departmental Representative.
- .2 Commissioning:
 - .1 In accordance with Section 01 91 31 – Commissioning (CX) Plan, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .5 Section 01 91 00 Commissioning
- .6 Section 23 05 13 Common Motor Requirements for HVAC Equipment
- .7 Section 23 05 48 Vibration & Seismic Controls for HVAC Piping & Equipment
- .8 Section 23 08 00 Commissioning of Mechanical Systems
- .9 Section 23 63 13 Air-Cooled Condensing Units
- .10 Section 25 30 12 EMCS Field Control Devices

1.2 References

- .1 Air Conditioning and Mechanical Contractors (AMCA)
 - .1 AMCA Publication 99-2003, Standards Handbook.
 - .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
 - .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
 - .1 ANSI/ARI 430-[99], Central Station Air Handling Units.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
- .4 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2004; Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 Shop Drawings and Product Data

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 - General Instructions.
- .2 Indicate the following:
 - .1 Unit configuration including plan and elevations drawn to scale.
 - .2 Fan curve showing point of operation
 - .3 Fan sound power information.
 - .4 Fan vibration isolation detail.

- .5 Motor data.
- .6 Shipping detail and operating weight.
- .7 Detailed total static pressure calculations
- .8 Coil selections.
- .9 VFD
- .10 Unit sound data.
- .3 As part of the shop drawing submission, the Refrigeration contractor shall prepare and include the coil and condensing unit balance curves detailing the S.S. temperature, the estimated line loss, and the system balance point that meets the required total and sensible cooling capacities at the specified ambient temperatures. A refrigerant piping schematic, showing refrigerant pipe sizes, lengths, and refrigerant receiver size requirement, shall also be submitted to confirm installation is in accordance with manufacturer's recommendations, and does not contravene warranty requirements

1.4 Closeout Submittals

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

1.5 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management & Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility.
- .5 Divert unused paint material from landfill to official hazardous material collections site.
- .6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.6 Extra Materials

- .1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.
- .2 Furnish following spare parts:
 - .1 One set of spare filters.

PART 2 PRODUCTS

2.1 Indoor Air Handling Units

- .1 General:
 - .1 Custom, indoor air handling units, fully assembled, consisting of casing, fan section with motor and drive, filter section, mixing section, dampers, heating coil, DX cooling coil, discharge and return air plenums, VFD's (where specified).
 - .2 The remote condensing unit shall be by the same manufacturer as the air handling unit, specified under Section 23 63 13 – Air-Cooled Condensing Units.
 - .3 Manufacturer shall provide installing contractor all required details of fan installation within plenum chambers and with technical start up assistance including check lists of field tests for inclusion in equipment manuals.
- .2 Base:
 - .1 Unit base shall be constructed of structural perimeter channel iron frame with intermediate channel and angle iron supports.
 - .2 Provide 16 gauge steel floor with all seams continuously welded.
 - .3 For units 152 cm and higher, the floor shall have epoxy non-slip impregnated painted finish. Floors to be watertight with drains on both sides of coils.
 - .4 Provide lifting brackets on the unit section bases to accept cable or chain hooks.
- .3 Casing:
 - .1 Walls and roof shall be constructed of double break design 16 gauge galvanized and painted steel panels with overlapped seams gasketed and caulked, not exceeding 610mm.
 - .2 All required holes in casing for controls, electrical, etc. shall have grommets. Seal all openings neatly and airtight. Site sealed openings shall be to a standard set by manufacturer.
 - .3 Floor duct openings shall be supplied with safety grates.
- .4 Access Doors:
 - .1 Provide double neoprene gasketed doors in each equipment section to provide servicing access to all components and to allow for removal of motors and components as required.
 - .2 Doors shall be of insulated double wall construction with continuous closed cell automotive door gasket, heavy duty "Leverlock" door securing handles.
 - .3 All doors shall open against pressure, or shall be fitted with a fail safe stop and manual latch release to permit the door to open partially to relieve fan pressure before manually releasing latch.

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- .4 All access panels to have pad lock and hasp or be key lockable in a manner acceptable to the Departmental Representative to prevent unauthorized access to unit components and controls.
 - .5 Acoustic Liner:
 - .1 All walls, partitions and roof shall be insulated with 50mm , 48 kg/m³ neoprene coated fibre glass insulation secured with fire retardant adhesive.
 - .2 Underside of base shall have 50mm , 48 kg/m³ rigid foam.
 - .3 All edges of insulation shall be covered with metal Z-bar.
 - .4 Provide 24 gauge galvanized steel perforated in all sections to protect insulation.
 - .6 Finish:
 - .1 All metal surfaces shall be pre-painted with vinyl wash primer to ensure paint bond to metal.
 - .2 All uncoated steel shall be painted with red oxide primer.
 - .3 Unit casing shall be undercoated with two component zinc chromate primer and finish painted with electrostatically applied enamel paint.
 - .7 Mixing dampers:
 - .1 Return air: multi-opposed blade, low leakage type.
 - .2 Outdoor and relief air: insulated, multi-opposed blade, low leakage type.
 - .3 Dampers shall be sized to a minimum velocity of 7.62m/sec and a maximum velocity of 10.1m/sec and located to provide efficient air mixing and easy access to linkages and damper operators.
 - .4 Dampers blades shall parallel where needed to eliminate stratification.
 - .5 Damper blades shall be extruded aluminum air foil shaped with synthetic rubber blade and frame seals mechanically fastened.
 - .6 Damper locations shall permit easy access to linkages and damper operators.
 - .8 Fans
 - .1 All fans shall be belt driven c/w fan base, motor, belts, sheaves, inlet bell, inlet and discharge screens (where applicable) and extended grease nipples.
 - .2 Provide neoprene coated flexible connector on fan inlet/outlet.
 - .3 All fans shall be statically and dynamically balanced for quiet operation.
 - .4 Units shall have solid steel fan shafts mounted in heavy duty, self-aligning, L10-80K relubricative ball bearings. Fans with hollow shafts are not acceptable.

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- .5 Plenum fans shall be completely enclosed by expanded metal mesh including fan inlet and outlet, door latches or door screens shall not be considered a suitable substitute.
 - .9 Motors
 - .1 Type: heavy duty, high efficiency, 1800 RPM, T.E.F.C. motors with 1.15 service factor.
 - .2 Motors shall have heavy gauge structural steel base adjustable for motor alignment and belt tensioning by threaded bolt positioners. Extra set of sheaves shall be supplied, if required, when final air balance made. All motors shall be aligned and belts properly tensioned prior to turnover and acceptance by Departmental Representative. V-belt drive shall be suitable for 150% of motor rating. Fan shall be guarded to WCB regulations, and be provided with openings suitable for instrument.
 - .10 Fan Base
 - .1 Fan base shall be formed with structural channel.
 - .2 Fan base shall have spring vibration isolators selected to meet performance as specified in Section 23 05 48 – Vibration & Seismic Controls for HVAC Piping & Equipment, for the required load.
 - .11 Coils
 - .1 Heating and DX cooling coils shall be constructed of seamless copper tubing (minimum 0.025" thickness) and aluminum fins.
 - .2 Coils shall be fully enclosed within the casing and mounted on primed and painted angle iron racks manufactured to facilitate easy removal of coils.
 - .3 Removable coil access panel shall be provided to remove coil through casing wall. Coils shall be sealed to casing to allow no air by-pass.
 - .4 If not scheduled, coils selected by manufacturer shall not exceed 2.5m/sec.
 - .5 Coils shall be ARI rated, pressure tested to 2.4 MPa air under water.
 - .6 For DX coils, evacuate and charge coil with nitrogen and seal before sending to site
 - .12 Drain pans
 - .1 Drain pans shall be provided for coils.
 - .2 Constructed to SMACNA standards, continuously welded 304 stainless steel pans extending to outside of unit at header and return bends.
 - .3 Intermediate drain pans shall be interconnected with 304 stainless steel 32mm drain lines. Provide a 32mm drain pipe from lowest drain pan to exterior of unit through channel with stub suitable for connection.
 - .4 Drain pans must extend upstream and downstream as required to ensure no carry-over and provide access for cleaning.

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- .5 Drain pans shall have sloped bottom for positive drainage.
- .13 Filters
- .1 Provide 50mm thick pleated filter.
 - .2 Filter sections shall have filter racks, and access doors for filter removal and block-offs as required to prevent air bypass around filters.
 - .3 Filter area shall be as scheduled. Where not scheduled, they shall be designed and selected for a face velocity of less than 2.5m/sec.
 - .4 Provide 0-250 Pa. magnehelic gauge for each filter bank, complete with static pressure tappings and tubing. Mount in accordance with manufacturer's instructions.
 - .5 All filter media shall be replaced with new filter media upon turn over and acceptance of job. Provide 1 spare set of filters to the Departmental Representative upon turn over.
- .14 Electrical
- .1 Units equipped with adjustable speed drives shall be factory wired for single point power connection. For units not equipped with adjustable speed drives, the starters and disconnect switches shall be supplied by Division 26.
 - .2 Units shall be furnished with dead-front disconnect, adjustable speed drives (where scheduled), transformers for 24 volt control circuit with fuse protection.
 - .3 Control enclosure will be NEMA 1 rated for indoor applications.
 - .4 All wiring shall be run in EMT conduit.
 - .5 Provide maximum 3 feet of flexible Liquid-tite between EMT and motor.
 - .6 The manufacturer shall label and number code all wiring and electrical devices in accordance with the unit electrical diagram. The unit shall be labeled and certified to CSA, UL, ETL, or NRTL. The manufacturer is to provide proof of this certification at time of submittal.
 - .7 Units 1500mm [60"] and higher shall also have switched marine lights in each fan section as well as the filter section where walk in access is provided for servicing. Marine lights shall be glass globe style with a zinc plated steel wire guard. Provide with 100 watt service duty light bulbs. Wiring from switches to lights and junction box to service outlets to be factory installed. All wiring shall be installed in EMT conduit complete with necessary couplings and connectors. The 120V power supply will be provided separately by electrical trade to allow power to lights and receptacles when the main unit disconnect is off.
 - .8 Provide mounting bracket and factory pre-wire disconnect switch to terminal blocks and motors to terminal blocks.
- .15 Adjustable Speed Drives
- .1 Variable volume units shall incorporate Adjustable Speed Drive controllers in place of magnetic starters.

- .2 ASD's shall be supplied for field mounting on unit.
- .3 The drive shall be accessed through a hinged access door complete with a 5/16" (8mm) hex key latch. The door shall be hinged.
- .4 Variable frequency drives are still to be wired to a single point power connection as noted above.
- .5 Control wiring to ASD and wiring from terminal blocks to ASD's shall be provided by Controls Sub-Contractor.

PART 3 EXECUTION

3.1 Installation

- .1 Provide appropriate protection apparatus.
- .2 Install units in accordance with manufacturer's instructions and as indicated.
- .3 Ensure adequate clearance for servicing and maintenance.
- .4 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.
- .5 Make piping connections.
- .6 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.2 Fans

- .1 Install fan sheaves required for final air balance.
- .2 Install flexible connections at fan inlet and fan outlets.

3.3 Condensate Drain

- .1 Install deep seal P-traps on drip lines.

3.4 Refrigeration Piping

- .1 When the system is completely fabricated, the refrigeration Contractor shall leak test with a nitrogen pressure test at 1723 kPa for a minimum of 24 hours, shall evacuate the system down to 500 microns and shall certify the system stayed at 500 microns for 1/2 hour after shutting off the vacuum pump and connection line. When this test passes, he shall fully charge the system with refrigerant and compressor oil.
- .2 Provide 12 months service for all refrigeration system components and fluids at no additional cost to the Departmental Representative. Start of 12 month service period shall be the first summer occasion on which unit is adjusted for cooling conditions.

3.5 Start-up and Commissioning

- .1 Charge refrigerant, start-up and submit written report to Departmental Representative.
- .2 Commissioning:
 - .1 In accordance with Section 01 91 31 – Commissioning (CX) Plan, and Section 23 08 00 – Commissioning of Mechanical Systems.

3.6 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 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 or charging 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.
- .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 Make
 - .2 Model
 - .3 Serial number
 - .4 Type of halocarbon
 - .5 Halocarbon charging capacity of system (kg or lbs)
 - .6 Factory Halocarbon Charge (kg or lbs)
 - .7 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 Section 01 01 50 General Instructions
- .2 Section 23 05 13 Common Motor Requirements for HVAC Equipment
- .3 Section 23 05 48 Vibration & Seismic Controls for Ductwork, Piping & Equipment
- .4 Section 23 08 00 Commissioning of Mechanical Systems
- .5 Section 23 33 00 Air Duct Accessories

1.2 References

- .1 Air Conditioning and Mechanical Contractors (AMCA)
 - .1 AMCA Publication 99-2003, Standards Handbook.
 - .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
 - .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
 - .2 Capacity: flow rate, static pressure, BHP, HP, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
 - .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
 - .4 Sound ratings: comply with AMCA 301, tested to AMCA 300.
 - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

1.4 Submittals

- .1 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.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
- .3 Provide:
 - .1 Fan performance curves showing point of operation, BHP and efficiency.
 - .2 Sound rating data at point of operation.
- .4 Indicate:
 - .1 Motors and sheaves details.
- .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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

- .1 Health and Safety Requirements: 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 Section 01 01 50 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Waste Management and Disposal:
- .2 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 Manufacturer Basis of Design

- .1 Thermolec model FER

2.2 Construction

- .1 Frame shall be corrosion-resistant and made of galvanized steel of suitable gauge required by CSA/UL.

2.3 Heater

- .1 Heating coil shall be of high grade nickel chromium alloy and shall be insulated by floating ceramic bushings from galvanized steel frame. Coils terminals shall be stainless steel
, insulated by means of non-rotating ceramic bushings.

2.4 Safety Controls

- .1 Hi-limit with damper shutdown and alarm.
- .2 Low-limit with damper shutdown alarm.
- .3 High temperature automatic reset thermal cutout that will reset automatically after cool off.
- .4 Manual reset.

2.5 Components

- .1 Fan Speed controller.
- .2 Duct temperature sensor.
- .3 Fan.
- .4 Damper.
- .5 Built in electronic controller (SCR).
- .6 Current sensor.

2.6 Filters

- .1 Washable filter.

2.7 Air Flow

- .1 Built in temperature sensor controls the heater proportionally to maintain the the pre-set air temperature in the duct.

2.8 Control

- .1 All control components to be provided by unit manufacturer. Unit to be able to be turned on/off by building digital control system.
- .2 The following functions shall be provided or monitored by building automation system:
 - Unit on/off control.
 - Filter high pressure drop alarm.
 - Unit off on low temperature alarm.
 - Discharge temperature monitoring.
 - Unit off on high temperature alarm.

2.9 Make-up air unit MUA-1

- .1 150 mm (6") Ø duct connections.
- .2 2.0 kW electric heating coil
- .3 46 W maximum fan motor power
- .4 600 V / 3 Ph single power connection to unit
- .5 Supply air balanced to 47 L/s at 50 kPa esp.
- .6 Chassis 800mm L x 350mm W x 254mm H

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 Fan Installation

- .1 Install units as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Access doors and access panels to be easily accessible.

3.3 Anchor Bolts and Templates

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 Field Quality Control

- .1 Commissioning:
 - .1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Air Conditioning & Refrigeration Institute (ARI)
 - .1 ARI 410-20-01, Forced-Circulation Air-Cooling and Air-Heating Coils.

1.3 Submittals

- .1 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.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
 - .2 Indicate the following:
 - .1 Equipment, capacity, piping, and connections.
- .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.
- .4 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - 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 01 01 50 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 General

- .1 General: air coil certified by ARI 410.
- .2 Applications: hydronic or direct expansion (DX), as scheduled.
- .3 Capacity, pressure drop, dimensions as scheduled.
- .4 Maximum air velocity:
 - .1 Heating: 3.0 m/s.
- .5 Maximum operating pressure:
 - .1 Hydronic: 1,724 kPa
- .6 Factory tested at 2,172 kPa air pressure under water.

2.2 Construction

- .1 Tube: NPS 5/8 O.D., 0.51mm thick seamless copper with 0.64 thick bends. Water velocity selected at less than 1.2 m/s.
- .2 Fins: 0.2mm thick aluminum, mechanically bonded to tubes. Fin spacing shall not exceed 14 fins per 25.4mm.
- .3 Header: seamless copper with die formed collars for brazing coil tubes, vent and drain connection.
- .4 Casing: minimum 1.6mm channel construction with flanges punched for mounted. Galvanized steel for heating coils and type 304 stainless steel for cooling coils. Provide intermediate tube support at 1,200mm (48") interval.
- .5 Connections: red brass, MPT connections.
- .6 Hydronic and DX coils shall have connections on the same side of header.

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 in accordance with piping layout.
- .3 Arrange coils for counter-flow of air and fluid.
- .4 Provide space for cleaning, servicing or removal of all coils.

- .5 For hydronic coils with vertical headers, arrange water entry at bottom to facilitate air removal.
- .6 Clean finned tubes and comb straight.
- .7 Provide unions at coil connections.
- .8 Provide dielectric fittings at dissimilar metal.
- .9 Clean finned tubes and comb straight.

3.3 Cleaning

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical

1.2 Submittals

- .1 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.
 - .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 - Shop Drawings, Product Data & Samples.
 - .2 Indicate the following:
 - .1 Equipment, capacity, piping, and connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
 - .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.
 - .4 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 10 - 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 01 74 19 - Waste Management & Disposal.

PART 2 PRODUCTS

2.1 Cabinet Unit Heaters

- .1 Cabinet: as indicated, 1.6mm thick steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet.
- .2 Finish with factory applied baked enamel finish. Colour as selected by Departmental Representative.
- .3 Coils: aluminum fins mechanically bonded to copper tubes. Hydrostatically tested to 2.1 MPa.
- .4 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .5 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .6 Capacity: as indicated.

2.2 Horizontal Unit Heaters

- .1 Casing: 1.2mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.
- .2 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 2.1 MPa
- .3 Fan: aluminum blade, direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.
- .4 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor supports.
- .5 Air outlet: four-way adjustable louvres.
- .6 Capacity: as indicated.

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 in accordance with piping layout.
- .3 Maintain sufficient clearance to permit performance of service maintenance.
- .4 Check final locations with Departmental Representative if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .5 Provide manual air vent at high point.

- .6 Unit located below return mains shall be provided with approved means for draining.
- .7 Clean finned tubes and comb straight.

3.3 Cleaning

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

AIR HANDLING UNITS			
Mark		AHU-1	
Service		Expansion	
Supply Fan	Supply Fan Air Flow - L/s (cfm)	1,803	3,820
	Supply Fan External S.P. - Pa (in w.g.)	508	2.03
	Supply Fan Size/Type	APF 165	
	Supply Fan RPM	2,575	
	Supply Fan BHP Horsepower	4.35	7.5
Return Fan	Return Fan Air Flow - L/s (cfm)	1,803	3,820
	Return Fan External S.P. - Pa (in w.g.)	450	1.80
	Return Fan Size/Type	12 / 12 MPFC	
	Return Fan RPM	1,176	
	Return Fan BHP Horsepower	2.36	5
DX Cooling Coil	Rows Fins per Inch	6	12
	Air Flow - L/s (cfm)	1,803	3,820
	Face Area - m2 (sq. ft)	0.71	7.64
	Face Velocity - m2/s (FPM)	42	500
	Air P.D. - Pa (in w.g.)	263	1.05
	Ent. Air Dry Bulb - °C (°F)	26.1	79.0
	Ent. Air Wet Bulb - °C (°F)	19.4	67.0
	Lvg. Air Dry Bulb - °C (°F)	11.4	52.6
	Lvg. Air Wet Bulb - °C (°F)	11.2	52.2
	Total Capacity - kW (MBH)	50.8	173.4
	Sensible Capacity - kW (MBH)	32.4	110.7
Heating Coil	Rows Fins per Inch	1	8
	Air Flow - L/s (cfm)	1,803	3,820
	Face Area - m2 (sq. ft)	0.71	7.64
	Face Velocity - m2/s (FPM)	42	500
	Air P.D. - Pa (in w.g.)	15	0.06
	Ent. Air Temp - °C (°F)	12.8	55.0
	Lvg. Air Temp - °C (°F)	21.6	70.9
	Capacity - kW (MBH)	19.2	65.6
	Water Flow - L/s (gpm)	0.28	4.4
	Water P.D. - kPa (ft.)	18.6	6.2
Power		600 / 3 / 60	
Minimum Outdoor Air - L/s (cfm)		601	1,273
Filter Area - m2 (sq. ft.)			
Weight - kg (lbs.)		2,273	5,000
Notes (see the next page)		1, 2	
Condensing Unit	Mark	CU-1	
	Refrigerant	R-410a	
	Ambient Temp °C (°F)	29.4	85.0
	Condenser Fan - Qty FLA (each)	2	-
	Compressor - Qty RLA (each)	3	-

EER	10.6		
Electrical - FLA MCA MOCP	-	22.1	30
Power	600 / 3 / 60		
Weight - kg (lbs.)	682	1500	

Refer to specification for accessories not scheduled.
Refer to drawings for installation details.

Static pressures noted are external to the unit. Fan total pressure to include all cabinet effects as well as an allowance of 75 Pa for dirty filters. Motors to be sized so normal operating load is not more than 90% of rated motor capacity.

1. Complete with supply and return fans' VFD, single power connection, disconnect and damper actuators.
2. Based on 60.0°C supply water and 43.3°C return water temperature.
3. First stage of cooling provided with hot gas bypass.
4. Merv 8 pre-filters upstream of coils.
5. Merv 14 final filters downstream of supply air fan.

HEAT RECOVERY PIPE				
Mark	HRP-1 O/A		HRP-1 E/A	
Service	AHU-1		EF-2	
Type	Aluminum 11 fpi & 6 Row of 16mm Tube		Aluminum 11 fpi & 6 Row of 16mm Tube	
Air Flow - L/s (cfm)	601	1,273	455	965
Air P.D. - Pa (in w.g.)	144	0.58	142	0.57
Coil Length - mm (in.)	508	20	406	16
Coil Height - mm (in.)	457	18	457	18
Inlet Temperature - °C (°F)	-9.4	15.0	22.2	72.0
Inlet Relative Humidity (%RH)	80%		30%	
Outlet Temperature - °C (°F)	6.2	43.1	2.7	36.9
Outlet Relative Humidity (%RH)	22%		100%	

Notes:

1. Overall unit size is 1092mm L x 533mm H x 254mm W, 57 kg, 49.4% O/A recovery factor, 11.3 kW energy recovery, -13.1°C frost point.
2. Unit provided with duct flanges to connect O/A and E/A ducts too.

EXHAUST FANS										
Mark	EF-1		EF-2		EF-3		EF-4		EF-5	
Type	Centrifugal Sidewall		Centrifugal Roof		Centrifugal Ceiling		Centrifugal Ceiling		Centrifugal Ceiling	
Service	WC's G177 & G186		Med. Inmate Waiting, Nursing		Bio Haz. Soiled Supply		Elec. Rm. G176		Boiler. Rm. G174	
Air Flow - L/s (cfm)	94	200	455	965	94	200	71	150	71	150
External S.P. - Pa (in w.g.)	100	0.400	250	1.000	63	0.250	63	0.250	63	0.250
Power Consumed	1/4 HP		1/2 HP		50W		128W		128W	
Fan RPM	1079		1495		742		1050		1050	
Sones dBA	3.8	45	12	63	3		3		3	
Notes	1, 2, 3, 4, 5		1, 2, 3, 4, 5,11		5, 9, 10		5, 6, 7, 10		5, 7, 9, 10	

Mark	EF-6		EF-7						
Type	Centrifugal Inline		Inline						
Service	Oxygen Storage G184		Crawlspace						
Air Flow - L/s (cfm)	24	50	52	110					
External S.P. - Pa (in w.g.)	63	0.250	100	0.400					
Power Consumed	1/10 HP		80 W						
Fan RPM	1725								
Sones dBA	2.5	39							
Notes	1, 5, 6, 8, 10		10, 12						

Refer to specification for accessories not scheduled. Fans suitable for 120/60/1 power.
 Refer to drawings for installation details.

1. Complete with Vari-Green EC motor, 0-10 VDC input signal.
2. Complete with aluminum housing, backward inclined wheel, birdscreen.
3. Complete with Vari-Green constant airflow control with integral transducer and pitot tube.
4. Complete with Vari-Green transformer 85-277 VAC to 24 VDC, mounted and wired.
5. Complete with gravity operated back draft damper.
6. Complete with fan manufacturer's matching wall discharge terminal hood.
7. Fan to be operated by DDC controls when room temperature exceeds set point.
8. Complete with explosion proof motor.
9. Complete with fan manufacturer's matching roof discharge terminal hood on 305mm high roof curb.
10. Complete with fan manufacturer's speed controller mounted in unit for air balancing.
11. Complete with fan manufacturer's matching 305mm high roof curb and foam curb seal.
12. Complete with UV protected thermoplastic resin housing, external rotor motor, mounting bracket, five (5) year warranty. Interlocked with make-up air unit MUA-1.

CONSTANT AIR VOLUME AIR TERMINAL UNITS (Single Duct)										
Mark	CV- 1		CV- 2		CV- 3		CV- 4		CV- 5	
Service	Wait & Med P-U G170 & G189		Security & Corr. G188 & G173		Exam Rm 2 G181		Dental G172 & G172A		Exam Rm 3 G182	
Model	size 8		size 6		size 6		size 6		size 6	
Air Flow - L/s (cfm) - maximum	189	400	142	300	66	140	177	375	66	140
T.S.P. - Pa (in w.g.)	188	0.75	188	0.75	188	0.75	188	0.75	188	0.75
Entering Air Temperature °C (°F)	12.8	55	12.8	55	12.8	55	12.8	55	12.8	55
Leaving Air Temperature °C (°F)	29.5	85	28.7	84	42.9	109	29.5	85	42.9	109
Heating Cap. - kW (MBH)	3.8	13.0	2.7	9.3	2.4	8.2	3.6	12.2	2.4	8.2
Water Flow - L/s (gpm)	0.05	0.9	0.04	0.6	0.03	0.5	0.05	0.8	0.03	0.5
Notes	1		1		1		1		1	

Mark	CV- 6		CV- 7		CV- 8		CV- 9		CV- 10	
Service	Treatment G179		Treatment G180		Specialty Treatment G183		Clean Supply G185		Admin & Corridor G187D & G187C	
Model	size 6		size 6		size 6		size 6		size 6	
Air Flow - L/s (cfm) - maximum	94	200	94	200	94	200	94	200	142	300
T.S.P. - Pa (in w.g.)	188	0.75	188	0.75	188	0.75	188	0.75	188	0.75
Entering Air Temperature °C (°F)	12.8	55	12.8	55	12.8	55	12.8	55	12.8	55
Leaving Air Temperature °C (°F)	33.9	93	33.9	93	34.4	94	33.9	93	33.4	92
Heating Cap. - kW (MBH)	2.4	8.2	2.4	8.2	2.5	8.4	2.4	8.2	3.5	12.0
Water Flow - L/s (gpm)	0.03	0.5	0.03	0.5	0.04	0.6	0.03	0.5	0.05	0.8
Notes	1		1		1		1		1	

Mark	CV- 11		CV- 12		CV- 13		CV- 14		CV- 15	
Service	File Stor. G187A		Nursing Station G187		Corridor G171		Dispensary G187B		Exam Rm 1 G178	
Model	size 6		size 6		size 8		size 8		size 6	
Air Flow - L/s (cfm) - maximum	47	100	165	350	201	425	170	360	61	130
T.S.P. - Pa (in w.g.)	188	0.75	188	0.75	188	0.75	188	0.75	188	0.75
Entering Air Temperature °C (°F)	12.8	55	12.8	55	12.8	55	12.8	55	12.8	55
Leaving Air Temperature °C (°F)	55.0	131	30.4	87	29.5	85	29.2	85	45.2	113
Heating Cap. - kW (MBH)	2.4	8.2	3.5	12.0	4.0	13.8	3.4	11.5	2.4	8.2
Water Flow - L/s (gpm)	0.03	0.5	0.05	0.8	0.06	0.9	0.05	0.8	0.03	0.5
Notes	1		1		1		1		1	

Units to be pressure independent and completed with air flow sensor.

Radiated / discharge NC = 20 / 25.

Coil Capacities are selected for entering water temperature of 60.0°C (140.0°F). Water flow rate is based upon 17.0°C (30.0°F) temperature drop with a minimum flow of 0.03 L/s (0.5 gpm). Maximum water pressure drop 6 kPa (2 ft), unless noted otherwise. Coil section c/w access door.

Note:

1. Air terminal unit shall be constant air volume.

CONTROL VALVES												
Mark	V-AHU1		V-UH1		V-UH2		V-CUH1		V-CV1		V-CV2	
Service	AHU-1		UH-1		UH-2		CUH-1		CV-1		CV-2	
Type	3-W Mod		2-W 2-P		2-W 2-P		2-W 2-P		3-W Mod		3-W Mod	
Flow - L/s (gpm)	0.28	4.4	0.12	1.9	0.08	1.3	0.06	1.0	0.05	0.9	0.04	0.6
P.D. - kPa (psi)	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0
Notes												

Mark	V-CV3		V-CV4		V-CV5		V-CV6		V-CV7		V-CV8	
Service	CV-3		CV-4		CV-5		CV-6		CV-7		CV-8	
Type	3-W Mod		3-W Mod		3-W Mod		3-W Mod		3-W Mod		3-W Mod	
Flow - L/s (gpm)	0.03	0.5	0.05	0.8	0.03	0.5	0.03	0.5	0.03	0.5	0.04	0.6
P.D. - kPa (psi)	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0
Notes												

Mark	V-CV9		V-CV10		V-CV11		V-CV12		V-CV13		V-CV14	
Service	CV-9		CV-10		CV-11		CV-12		CV-13		CV-14	
Type	3-W Mod		3-W Mod		3-W Mod		3-W Mod		3-W Mod		3-W Mod	
Flow - L/s (gpm)	0.03	0.5	0.05	0.8	0.03	0.5	0.05	0.8	0.06	0.9	0.05	0.8
P.D. - kPa (psi)	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0
Notes												

Mark	V-CV15											
Service	CV-15											
Type	3-W Mod											
Flow - L/s (gpm)	0.03	0.5										
P.D. - kPa (psi)	6.9	1.0										
Notes												

Refer to control contractor's shop drawings for piping configuration for multi-port valves.
 Heating control valves are to be spring powered to fail to full heat upon loss of power where specified.

Valve Types:

- 2-W Mod PICCV : 2-way modulating pressure independent characterized control valve
- 2-W 2-P PICCV : 2-way 2-position pressure independent characterized control valve
- 2-W Mod : 2-way modulating control valve
- 2-W 2-P : 2-way 2-position control valve
- 3-W Mod : 3-way modulating control valve
- 3-W 2-P : 3-way 2-position control valve

LOUVRES								
Mark	L-1		L-2		L-3		L-4	
Service	Mech. Rm. G175 AHU-1 O/A		Elec. Rm. G176 Intake		Boiler. Rm. G174 Intake		Oxygen Stor. G184 Intake	
Air Flow - L/s (cfm)	1,803	3,820	71	150	71	150	24	50
Width - mm (in.)	1,524	60	406	16	406	16	406	16
Height - mm (in.)	610	24	305	12	305	12	305	12
Free Area - Square Metres (Sq. Ft.)	0.5	5.750	0.0	0.410	0.0	0.410	0.0	0.410
Air P.D. - Pa (in w.g.)	15	0.06	5	0.02	5	0.02	2.5	0.01
Free Area Velocity - m/s (FPM)	3.4	664	1.9	366	1.9	366	0.6	122
Notes	1, 2		1, 2		1, 2		1, 2	

Select louvre fastening type to suit building construction.

1. Custom baked enamel finish. Colour to be selected by Architect at shop drawing review.
2. Air P.D. = 50 Pa (0.20 in. w.g.) at beginning point of water penetration, 378 m/min (1,240 FPM)

MOTORIZED DAMPERS								
Mark	MD-1		MD-2		MD-3		MD-4	
Service	L-4 louvre intake		L-2 louvre intake		L-3 louvre intake		HRP-1 O/A Bypass	
Air Flow - L/s (cfm)	24	50	71	150	71	150	1,803	3,820
Width - mm (in.)	406	16	406	16	406	16	711	28
Height - mm (in.)	305	12	305	12	305	12	457	18
Free Area - Square Metres (Sq. Ft.)	0.1	1.3	0.1	1.3	0.1	1.3	0.3	3.5
Face Velocity - m/s (FPM)	0.2	38	0.6	113	0.6	113	5.5	1091
Notes	1, 2,3, 4		1, 2,3, 4		1, 2,3, 4		1, 4, 5	

Mark	MD-5		MD-6			
Service	HRP-1 E/A Bypass		HRP-1 E/A			
Air Flow - L/s (cfm)	455	965	455	965		
Width - mm (in.)	356	14	406	16		
Height - mm (in.)	356	14	457	18		
Free Area - Square Metres (Sq. Ft.)	0.1	1.4	0.2	2.0		
Face Velocity - m/s (FPM)	3.6	709	2.5	483		
Notes	1, 4, 5		1, 4, 6			

1. Air P.D. shall be less than 7 Pa (0.03 in. w.g.) at 5.08 m/s (1,000 FPM).
2. Insulated airfoil blades.
3. To be interlocked with exhaust fan by controls contractor.
4. 2-position ON - OFF control damper
5. To be interlocked for open position when AHU-1 O/A is in economizer mode (not minimum O/A position)
6. To be interlocked for closed position when AHU-1 O/A is in economizer mode (not minimum O/A position).

HEATING COILS		
Mark	HC-AHU1	
Service	AHU-1	
Circuiting		
Tubing Diameter - mm (in.)	13	0.5
Fin Type		
Rows	1	
Fins per Inch	8	
Fin Height - mm (in.)	572	22.5
Fin Length - mm (in.)	1118	44
Air Flow - L/s (cfm)	1803	3,820
Air P.D. - Pa (in w.g.)	15	0.06
Ent. Air Temp °C (°F)	12.8	55.0
Lvg. Air Temp °C (°F)	21.6	70.9
Heating Cap. - kW (MBH)	19.2	65.6
Water Flow - L/s (gpm)	0.28	4.4
Water P.D. - kPa (ft.)	18.6	6.2
Notes	1	

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.

CABINET UNIT HEATERS - HOT WATER									
Mark	CUH-1								
Service	Corridor G171								
Horsepower	1/4								
Depth - mm (in.)	241	9.50							
Length - mm (in.)	711	28.00							
Width - mm (in.)	660	26.00							
Air Flow - L/s (cfm)	87	185							
Heating Cap. - kW (MBH)	2.5	8.4							
Water Flow - L/s (usgpm)	0.06	1.0							
Water P.D. - kPa (ft.)	2.45	0.8							
Notes	1								

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.
 Provide master key locked access doors for motor controls and valves. Scheduled performance is based upon
 60.0°C (140°F) entering water temperature, 43.3°C (110°F) leaving water temperature,
 and 15.6°C (60°F) entering air temperature.
 Heating capacity is at specified design water and air conditions.
 Specified water pressure drop is at the specified design flow rate.

- Notes:
- Unit is recessed in ceiling with integral supply and return grilles in the bottom of the cabinet that's exposed and installed flush with the ceiling, allowing service access from the bottom of the cabinet.

UNIT HEATERS - HOT WATER				
Mark	UH-1		UH-2	
Service	Boiler Room		Mech. Room	
	G174		G175	
Motor Horsepower	1/12		1/12	
RPM	1500		1500	
Air Flow - L/s (cfm)	224	475	224	475
Heating Cap. - kW (MBH)	4.69	16.00	3.16	10.79
Water Flow - L/s (usgpm)	0.12	1.9	0.08	1.3
Water P.D. - kPa (ft.)	5.11	1.70	2.32	0.77
Notes				

Refer to Specification for accessories not scheduled. Refer to drawings for installation details.

Scheduled performance is based upon 60.0°C (140°F) entering water temperature, 43.3°C (110°F) leaving water temperature, 15.6°C (60°F) entering air temperature.

Heating capacity is at specified design water and air conditions.

Specified water pressure drop is at the specified design flow rate.

PUMPS										
Mark	P-B1		P-B2		P-1		P-2		P-3	
Location	Boiler G174		Boiler G174		Boiler G174		Boiler G174		Boiler G174	
Service	Primary for boiler B-1		Primary for boiler B-2		Secondary Loop		Secondary Loop		DHW Recirculation	
Flow - L/sec (usgpm)	0.88	14	0.88	14	1.07	17	1.07	17	0.32	5
Head - kPa (ft.)	36	12	36	12	63	21	63	21	24	8
Pump Conn. Size - mm (in.)	25	1	25	1	32	1.25	32	1.25	19	0.75
Horsepower	1/6		1/6		1/3		1/3		1/12	
Notes	3		3		3		3		1, 3	

1. Pumps to be bronze construction for all domestic water applications.
2. Motor to be suitable for 600/3/60 power and 1800 rpm unless noted otherwise.
3. Motors to be suitable for 120/1/60 power and 1800 rpm unless noted otherwise.

ROOF HOODS		
Mark	RH-1	
Service	AHU-1 relief	
Type	Hooded	
Overall Size - mm	1220x1145	
Air Flow - L/s (cfm)	2,600	3,000
Air P.D. - Pa (in w.g.)	25	0.05
Throat Width - mm (in.)	762	30
Throat Length - mm (in.)	610	24
Throat Area - m ² (ft ²)	0.56	5.0
Notes	1,2,3	

Contractor to install matching manufacturer's roof curb.

1. Complete with birdscreen, foam curb seal, pre-fabricated 305mm (12") high roof curb with 25mm thick insulation, in compliance with RCABC curb minimum height requirement.
2. Unit and curb shall have polyester urethane powder coating, resistant to the sun (UV rays).
3. Unit c/w 25mm hood insulation.

END of SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 91 00 Commissioning
- .3 Section 23 08 00 Commissioning of Mechanical Systems

1.2 General

- .1 Provide, install, program and commission a BACnet-based DDC control system to achieve the performance specified in the following clauses.
- .2 Work covered by sections referred to above consist of fully operational EMCS, including, but not limited to, following:
 - .1 Building Controllers.
 - .2 Control devices as listed in I/O Summaries.
 - .3 Data communications equipment necessary to effect an EMCS data transmission system including gateway and LAN hardware and software for connection to incumbent BACnet network.
 - .4 Field control devices.
 - .5 Software and graphics package complete with full documentation for software and equipment for system including 1 site computers.
 - .6 1 site desktop PC.
 - .7 Complete operating and maintenance manuals and field training of operators, programmers and maintenance personnel.
 - .8 Acceptance tests, technical support during commissioning, full documentation.
 - .9 Wiring interface co-ordination of equipment supplied by others.
 - .10 Miscellaneous work as specified in these sections and as indicated.

1.3 Metric Reference

- .1 Conform to CAN/CSA-Z234.1.
- .2 Provide required adapters between Metric and Imperial components.

1.4 Standard Compliance

- .1 All equipment and material to be from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
- .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

- .3 Submit proof of compliance to specified standards with shop drawings and product data. Label or listing of specified organization is acceptable evidence.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards, codes and specifications is not regulated by an organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

1.5 Submittals

- .1 Submit in accordance with Section 01 01 50 - General Instructions.
- .2 Provide six copies of schematic control diagrams for review. Each valve, actuator and instrument shall be given an identification label which will refer directly to control diagram.
- .3 Provide damper shop drawings which include data such as arrangement, velocities, and static pressure drops for each system on shop drawings.
- .4 Provide shop drawings including complete operating data, system drawings, wiring diagrams, and type written detailed operational description of sequences, and description and engineering data on each control system component.
- .5 At completion of work, make detailed check of automatic control system and submit written report to the Departmental Representative.
- .6 Provide sufficient copies of complete parts and repair manuals for binding in O&M Manuals.
- .7 Provide "record" control drawings and schedules; incorporate into O&M Manuals.
- .8 The submittals shall be prepared using the dynamic graphics software normally provided with system and be incorporated into the dynamic graphics system for on-line reference. Provide original, registered software disks of Windows, the Graphics Software package, the Operating System software, and the project graphic schematics, floor plan layouts, and control drawings.

1.6 Extra Materials

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

1.7 Preliminary Design Review Meeting

- .1 Convene a Preliminary Design Review meeting within 45 working days of award of contract to:
 - .1 Undertake functional review of preliminary design documents, resolve inconsistencies.
 - .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).

- .3 Review interface requirements of materials supplied by others.
- .4 Review "Sequence of Operations".
- .2 Contractor's programmer to attend meeting.
- .3 Departmental Representative retains right to revise sequence or subsequent Control Description Logic prior to software finalization without cost to Departmental Representative.

1.8 Monitoring and Control Features

- .1 Operator defined digital and analogue alarms and automatic alarm condition reporting.
- .2 Direct keyboard override of all inputs and outputs, with an indication on the display for any point that is operating under keyboard override.
- .3 Addition, deletion, definition and modification of all points from operator keyboard.
- .4 Trend log graphing and reporting of user selected points at user defined intervals.
- .5 Run time logging of digital points.
- .6 Ability to accept a variety of standard analogue and digital input signals.
- .7 Ability to generate a variety of standard analogue and digital output signals.

1.9 Offline Storage

- .1 The DDC system shall have the capability to be taken off-line in the event of failure or for maintenance and returned to operation without the need for entering any portion of the software program manually.
- .2 An off-line disk storage device shall be utilized to provide software backup and reload. Backup and verification of the entire system, with full applications software, shall be less than TWO (2) seconds per real point. Use site desktop PC for off-line storage.

1.10 Power Surge Protection

- .1 The DDC system shall be protected from power line surges and voltage transients by installation of a power line filter.

1.11 Power Failure Protection

- .1 The DDC system shall have automatic protection from any power failure of at least TWENTY-FOUR (24) hours duration.
- .2 This protection shall at a minimum include continuous real-time clock operation and automatic system restart upon power return.
- .3 Outputs shall have the option of being set to "staggered start" upon power reset.

1.12 Electrical Components, and Conduit

- .1 Provide all control system components, except those supplied as part of packaged equipment controls, but including all auto sequencing devices, electric relays, safety devices and electrical interlocks required to accomplish specified

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- sequences. Refer to the electrical motor schedule in the electrical drawings and/or specification, which delineate the limits of electrical work in Division 26 (Electrical) serving mechanical systems.
- .2 Provide all control circuit transformers required for control systems and not supplied by Division 26 including line voltage power connection from indicated outlets shall be included by Division 25.
 - .3 All line voltage wiring shall be copper with RW90 X-Link P.E. insulation #12 minimum size. AWG wire shall be sized to meet code.
 - .4 Wiring is to be in conduit 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. Wiring in suspended ceiling spaces does not require conduit but shall be neatly installed parallel to building lines using bridle rings. All wiring installed under this contract shall be plenum rated FT-6 or FT-4, if approved by all authorities having jurisdiction. Locate wiring away from top or bottom of ceiling joists or trusses to minimize possibility of accidental damage. Number 18 gauge wire may be used in Class 2 circuits unless voltage drops are excessive. THHN wire will not be acceptable. Twisted shielded wiring, minimum of 22 gauge wire shall be used for all DDC or co-axial communication wiring. Line voltage alternating current wiring shall not be run in the same conduit, or cabling as DDC wiring.
 - .5 Use 1m of flexible conduit for all connections to vibrating equipment. Use liquid tight flex cable and connections where required.
 - .6 The Control Contractor shall locate magnetic starters from the electrical drawings. All electrical work provided by this Contractor shall comply with all requirements of the Division 26 electrical specification, the Canadian Electrical Code and Local Codes and Ordinances.
 - .7 Wire all line voltage thermostats, pressure switches or aquastats for single phase equipment.
 - .8 Division 26 has been requested to provide specific devices, including magnetic starters supplied with 120 volt holding coils, HOA switching and space for the addition of auxiliary contacts. The Control Contractor shall provide all necessary normally open and normally closed contacts, wired to a terminal strip within the starter enclosure, required to achieve the specified control interlocking and sequencing. Manual starters for 120 volt equipment are to contain On-Off selector, external H.O.A., integral overload protection and pilot lights. The Controls Contractor shall provide control wiring interlocks from the control contacts provided on the automatic branch lines of the assembly, which will be contained within the associated Motor Control or Starter Assembly.
 - .9 Refer to Division 26 Specifications and Motor Schedule for the scope of work to be provided by the Electrical Contractor. Division 25 shall supply and install all components, in addition to those outlined within the Division 26 documents, as may be deemed necessary to provide all interlocks or sequences as called for elsewhere within the specifications. Include for the supply and installation of 2 Cat 5 Ethernet, plenum rated cables from the hub location to the communications backboard. Coordinate with Division 26 and the Departmental Representative for interconnection of the hub or switch to the site network.

- .10 All power supplies for controls are this Contractor's responsibility unless otherwise specified in the Electrical Specifications. All control transformers to be located in fan rooms or mechanical rooms only and are to be mounted in serviceable locations.
- .11 Line voltage will not be run with signal or trunk wiring or be present in the same junction box.
- .12 All shielded wiring will be grounded at the BMS panels and prevented from grounding at the terminal end.
- .13 Run all wiring parallel to building lines. All wiring to be installed in a neat, workmanlike manner.
- .14 Support wiring independent of piping, ductwork, and equipment. Keep wiring clear of hot piping, ductwork/equipment.
- .15 Identify all junction boxes with control company label.
- .16 There are to be no splices in any of the control wiring except at devices or control panels.

1.13 Identification, Calibration and Programming

- .1 Provide a written sequence of operation for each piece of equipment or system being controlled that does not require knowledge of DDC programming. Provide a print out of the complete data base, including program listings, inputs, outputs, controllers, virtual points, trend logs, alarm points, etc. Provide in an organized manner, separated for each panel.
 - .1 Procedures for daily operation of the system.
 - .2 Theory of operation of the equipment.
 - .3 Theory of operation of the control program.
- .2 Mount an input/output layout sheet within each controller. This sheet shall include the name of the points connected to each controller channel.
- .3 Identify all controllers and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:
 - .1 Point descriptor.
 - .2 Point type and channel number.
 - .3 Corresponding controller number.
- .4 Program each controller immediately following installation. Setup and tune all control loops during the initial start-up of the systems. Submit a well documented print out of the controller program for review.
- .5 At the time of the Departmental Representative's Demonstration and Instruction Period:
 - .1 Demonstrate and confirm that all systems are programmed and operating correctly. Submit trend logs, 1 week in duration, that confirm systems are operating as designed and follow the internal building loads in an energy efficient manner.

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- .2 Submit CD's (including back-up diskettes) containing up to date copies of the programs in each controller.
 - .3 Submit (4) CD's with printed PDF copies of the final programs that include all point definitions, weekly and annual schedule settings, controller setpoints and tuning parameters, and documented general control language programs. (As Built control shop drawings)
 - .4 Provide the original software CD's and the users manuals for all software programs provided as part of this contract. Provide one set of original disks for each notebook, laptop, and desktop computer the software has been installed on. The controls contractor shall be responsible for registering all software with the manufacturer in the Departmental Representative's name. Provide copies of the registration of all software to the Departmental Representative as part of the final inspection.
 - .6 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.
 - .2 Printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each controller.
 - .3 Update printed and diskette copies of any changes made to programs for any controller.
 - .7 Provide two days of on-site instruction to the Departmental Representative during the first year of operation, scheduled as requested by the Departmental Representative, during one or more of the 2 visits.

1.14 Controller Software

- .1 Each stand alone control panel shall contain a complete software development system in each panel. The software development system shall consist of a menu driven, prompted programming language containing complete libraries of control algorithms for DDC, Energy Management, and Facilities Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application specific programming of each individual stand alone control panel.
- .2 Four user access levels shall be provided with a user access code available at each level. Each level shall permit identifiable multiple user access.
- .3 Point names shall be defined using a minimum of 128 alphanumeric characters to provide an English language description of the point function.
- .4 The stand alone control panel shall be capable of generating sorted alarm, trend log, energy management, maintenance time remainder, and exception log reports on a prioritized basis. Segregated report generation shall be invoked by manual request, time of day, calendar, accumulated run time, or event occurrence.
- .5 DDC Control:
 - .1 The network of stand alone control panels shall individually perform setpoint reset, ramping functions, 2-position ON/OFF control, PID loop control, linear sequencing, rotating sequencing, binary sequencing,

HI/LO/AVE selection, energy dead band, and thermostat controls as required to control their connected systems of equipment.

- .6 Energy Management Control:
 - .1 The network of stand alone control panels shall individually perform time of day scheduling, optimum start/stop, enthalpy optimization, trend logging, demand limiting and all control optimization strategies, such as supply air reset, and soft ramp-up, for their connected systems of equipment.
 - .2 Coordination of strategies involving multiple systems of equipment shall be performed by sharing of necessary data between the stand-alone control panels on the communicating network.
- .7 Facilities Management Control:
 - .1 The Departmental Representative shall be provided the ability to read out temperatures and other values and to adjust specific items from localized, as well as remote centralized location. Every controller shall provide the following reports:
 - .2 Facility Diagnostics
 - .1 The facilities management system shall provide diagnostic reports for selected systems of equipment as specified.
 - .3 Alarm Occurrence Status
 - .1 When specified alarm conditions occur, provide a report available to printout, listing the status of specific items associated with the equipment generating the alarm. Report shall be routed through auto dial out feature to a specific printer or combination of printers. Report shall record the time the status information was taken, and shall allow operational personnel to use this information to diagnose the alarm situation.
- .8 SAC and Micro Controller Trend Logs:
 - .1 Controllers shall be capable of storing up to twenty-five (25) full trend logs with a minimum of 200 data samples each. They shall be able to collect and store samples of the value of any system variable (i.e. temperature). The operator shall be able to create a trend log, with each trend log containing up to 4 points. The sample frequency shall be selectable for each trend log between 1 second and 24 hours. The ability to graphically display to 4 points on the screen simultaneously, print a log, or store a log on disk in an ASCII format that can be imported into a standard spreadsheet program shall be provided. This capability shall be provided for all forms of access.
- .9 Network communication/controllers Trend Logs:
 - .1 Trend logs shall be provided to collect and store samples of the value of a point i.e., temperature. The network communication/controllers shall have sufficient memory to create and store 200 full trendlogs. Each BacNet trendlog shall be capable of monitoring 1 I/O or virtual point from any controller or combination of controllers across the network, and storing a minimum of 2000 data samples for each trended point. The sample

frequency shall be selectable for each trend log between 1 second and 24 hours. The network communication/controllers shall be capable of archiving the trended data to the Host computer or dialing out to a remote trend computer and downloading the data automatically. The ability to indefinitely retain the contents of a trend log in the controller or automatically transfer the contents of a trend log to disk storage, printer or remote site and restart the log shall be provided.

.10 Host Level Trending:

.1 Shall be provided to collect and store samples of the value of any system variable (i.e. temperature Trend Logs: Shall be provided to collect and store samples of the value of any system variable. The operator shall be able to create a BACnet trend log, with each trend log containing 1 point. The sample frequency shall be selectable for each trend log between 1 second and 99 hours. The ability to link multiple single point BACnet trend logs to be displayed on an 8 point Multi-trend log for comparative analysis shall be provided. Ability to print a log, or store a log on disk in an ASCII format that can be imported into a standard spreadsheet program shall be provided. This capability shall be provided for all forms of access.

11. The Ethernet interface with the remote operator's terminal shall provide all features listed above.

1.15 Computer Graphics Software

.1 Incorporate the following standards for the required host capabilities and installed features:

.1 The host computer operator interface, network interface and graphical interface software shall be Microsoft Windows based.

.2 Provide one licensed copy of the complete HOST software package complete with operating manuals, installation manuals, setup manuals, programming manuals, and original diskettes.

.3 Host operator interface.

.2 The following functionality shall be available to the operator from either the onsite host, remote host, or colour laptop connected to anywhere on the network inside the building. These workstations shall operate as graphic interface devices. Attention must be paid to developing an interface to the system using a minimum of user keystrokes. The primary user interface must be the mouse.

Provide functionality such that any of the following may be performed simultaneously, at either workstation and in any combination, via user-sized windows.

.1 Dynamic color graphics and graphic control

.2 Alarm management and control

.3 Time of day scheduling

.4 Trend data definition and presentation

.5 Graphic definition

- .6 Graphic construction
- .7 Database functions
- .3 Graphic generation and design:
 - .1 Provide a default graphic consisting of a visual overview of the entire control system. The display shall be in a tree format. Indicate the various branches of graphic access available from the tree for each mechanical system and building zone. The site plan of the facility should be used as a reference tree to show the relationship of each system to a particular building zone. Graphic links for each zone must be available to allow the user to link directly to the desired graphic or step systematically forward or backward through the tree to each graphic associated with the mechanical system. The operator must be able to return directly to the default from any level of graphic menu penetration.
 - .2 As a minimum, provide the following graphic screens and dynamic linking:
 - .1 A default graphic to be used as a central starting point for penetrating the menu of available graphic screens.
 - .2 Zone summary graphic. Dynamically indicate zone high select (Hsel) and low select (Lsel) temperatures, AHU supply air temperatures and setpoints, and status of the air handling units serving the zone.
 - .3 Dynamic graphic floor plans for each building zone, scaled appropriately to be readable from a laptop. Indicate room temperatures, architectural room number, control valve position, supply fan system serving the area, and any associated equipment such as exhaust fans, fume hoods, etc. From this screen the operator shall be able to command the control valve, adjust the room setpoint, access the graphic screen for the supply fan system, view a trend log of the room temperature, or access a graphic for associated mechanical equipment.
 - .4 A schematic of each mechanical system. As a minimum, each graphic will indicate all DDC I/O points and software variables associated with each system. Indicate the DDC point names, current status value, and operator priority.

All graphic screens shall be created using the same software supplied to the Departmental Representative. Provide the graphic data files in a format suitable for inclusion into the graphical operator interface and for direct loading into the graphic editor. The graphic data files shall be the sole property of the Departmental Representative.

DEFAULT GRAPHIC COLOURS			
Normal On	GREEN	Text Arial 12 pt	BLACK
Heating Equipment	RED	Normal Off	BLACK
Background	WHITE	Cooling Equipment	BLUE
Ducts	BLACK	ALARM	RED
Sensors	BLUE		

- .4 Graphical links:
 - .1 All system graphical links will be located in the upper left corner of the screen. These links will be displayed in sequential order representative of the menu tree.

1.16 Related Work

- .1 The following incidental work shall be furnished by the mechanical sub-contractor under the supervision of the controls subcontractor:
 - .1 Installation of control dampers including duct transitions, assembly and interconnection of multiple section dampers.
 - .2 Supply and installation of sheet metal baffles as required to eliminate air stratification.
 - .3 Supply and installation of access panels for service and installation of control equipment.
 - .4 Installation of automatic valves, wells, flow switches, and other pipe related control devices.

PART 2 PRODUCTS

2.1 Site Desktop PC

- .1 The existing computer on site available for the proposed EMCS software installation has the following features and capacities:
 - o Stand alone desktop computer with monitor
 - o Dell Optiplex 9010 X86 base PC
 - o MS Windows 7 Professional version 6.1.7601 Service Pak 1 Build 7601
 - o Intel® Core™, i5-3570 CPU at 3.40 GHz, 3401 MHz, 4Core(s) 4 logical pro
 - o 4 GB RAM
 - o 464 GB hard drive with 418 GB available
- .2 Contractor shall confirm existing computer on site can be used for the new EMCS software, including but limited to network connections, fire walls, system hardening, etc.
- .3 If the existing computer cannot be utilized for the proposed EMCS system installation, then the contractor shall provide a new desktop computer with monitor installed on site adjacent to the existing computer for the new EMCS software.

PART 3 EXECUTION

3.1 General

- .1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats and temperature sensors 1.5m above floor.
- .2 Install damper motors on outside of ducts. Do not locate in outside air stream.
- .3 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.
- .4 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.

- .5 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- .6 Equipment shall be installed in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation.
- .7 Permanently identify each wire, cable, conduit and tube at each terminal.
- .8 Wiring and tubing shall be identified at each DDC panel by termination number. Wiring and tubing shall be identified at terminal device by termination and DDC panel numbers.
- .9 All transmitters, interfaces, terminations and control relays, etc. shall be mounted in field cabinets that may be locked.
- .10 Freeze protection devices shall be hard wired and also wired to alarm through DDC system.
- .11 All wall mounted devices in new finished space shall be mounted on a wall box. The wall box shall be connected to the ceiling space by a conduit stub. On renovations, when sensors are mounted in existing finished walls, wiring or tubing may be fished into the walls without conduit.

3.2 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 penetrating the enclosure that are not required to be in conduit must be neatly bundled and strapped in place.

- .3 All Building Controllers will be installed in CSA rated enclosures that are complete with hinged and key-locked doors. The door will be painted and labeled suitably bearing the manufacturer's system name/logos, the controller address, and the installing contractor's contact information. This enclosure will be mounted at a height that provides easy access without the need of a ladder.
- .4 A hard points list shall be affixed on the inside of the door/cover of the enclosure.
- .5 The inside bottom of the enclosure shall be clean of dirt, metal shavings, and debris.
- .6 Provide EMT conduit with set screw metal fittings where wiring is exposed and in all mechanical rooms. All conduit will be piped smoothly and neatly following building lines. Wiring above accessible ceilings and in wall cavities may be run free-air.
- .7 Liquid-tight flexible conduit to be used for rooftop unit wiring c/w liquid-tight fittings. Provide spun aluminum roof jack where control wiring penetrates roof unless penetration is within waterproof rooftop unit curb.
- .8 All junction boxes will have covers properly and firmly affixed after installation completion.

3.3 I/O Wiring

- .1 All input/output device wiring will use #18-2 solid core cable with individually jacketed conductors and jacketed sheath over the pair.
- .2 Use plenum 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 I/O wiring that requires a transition to a different conductor to meet electrical code requirement shall be executed using a terminal strip.
- .7 Low voltage I/O wiring may be mixed together within a conduit. Low and line voltages may not be mixed together within a conduit.

3.4 Power Wiring

- .1 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 I/O device will be powered from this supply.
- .3 Power wiring shall not be mixed with I/O wiring in a conduit.

3.5 LAN Wiring

- .1 Provide LAN wiring as per manufacturer's specification.

- .2 For EIA-485 LAN wiring, use low capacitance shielded #18-2 or #22-2 cable. Ensure that each contiguous section of shield is terminated at a single point.

3.6 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.
- .2 The contractor is to supply digital point and non digital checkout data sheets for all controlled components installed in this contract, including components supplied by others. The data sheets shall indicate each components physical installation is complete, End to End, identification, tagged, the result of the functional test, calibration deviation recorded, setpoints and set-up of each device, digital and non digital.
- .3 Each digital input or control device shall be checked by physical operation of the monitored device in the field with the result noted. Each digital output or controlled device shall be commanded or tested On/Off, Open/Close as required and the corresponding field device checked for correct operation with the result and comments noted.
- .4 Each analog input or control device shall have its field values measured with a calibrated test instrument, with the deviation recorded and adjusted, if necessary, at the AI set up. The field measurement and analog point deviation must be reported. A hard copy of the set up for each digital and non digital controller with adjustments is required. Field set up and setpoints of other devices shall be reported.
- .5 Each analog output, control or controlled device shall be field tested. The physical test data sheet is to indicate each controlled device function through its range 0, 25, 50, 75, 100% and 1 to 100% as required with no leakage or bypass of the controlled medium.
- .6 Submit copies of all test data sheets intended to be used to the Departmental Representative and Commissioning Authority prior to the contractor's verification at least three months before the scheduled substantial completion of the project.
- .7 The controls contractor shall provide sequence of operation check sheets, to the Departmental Representative, Commissioning Agent and Commissioning Authority, in standard letter size for each DDC and non DDC system sequence. Each sequence to be verified with each item/page signed off with comments noted.
- .8 The commissioning contractor is not to commence controls checks until the above documentation is received. The Temperature Control Supplier and Installer shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Control Supplier in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Temperature Control Supplier for the purchase price of the material.

- .9 All documentation, tagging, identification, as-builts, software, instruction manuals, special control connection to access all devices and panels must be in place before the granting of substantial performance.
- .10 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Controls Contractor for the purchase price of the material. The Temperature Control Supplier shall cooperate fully with the Commissioning Agent to work together to obtain a fully operating system, providing additional technicians and trades people to assist the designated commissioning person as required. Refer to Section 01 91 31 – Commissioning (CX) Plan.
- .11 The controls contractor is to provide the technicians for field checks, calibration, checkouts, and commissioning necessary for a complete and fully operational system. Provide two 2-way portable radios for the commissioning period.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 25 05 01 EMCS: General Instructions

1.2 References

- .1 Canadian Standards Association (CSA)
 - .1 C22.2 No.205-M1983 (R1992), Signal Equipment.
- .2 Institute of Electrical and Electronics Engineers
 - .1 IEEE C37.90.1-1984, Surge Withstand Capabilities Test for Protective Relays and Relays Systems.

1.3 Maintenance Procedures

- .1 Provide manufacturers recommended maintenance procedures for insertion in Section 01 01 50 – General Instructions and 25 05 01 – EMCS: General Instructions.

1.4 Submittals

- .1 In accordance with Section 01 01 50 – General Instructions and 25 05 01 – EMCS: General Instructions. Submit product data sheets for each product item proposed for this project.

PART 2 PRODUCTS

2.1 System Descriptions

- .1 Provide a fully networked system of controllers which use LAN communications to support the distributed control features as specified herein. Each controller shall be connected directly to the LAN. Each controller shall have equal LAN access priority and shall NOT REQUIRE A SEPARATE GATEWAY or interface controller to accomplish normal, network communications.
- .2 Provide a means to ensure communication integrity. At a minimum indicate for each controller in system: on-line/off-line status, residence of program or no program, the scan rate (frequency at which the controller updates all I/O and runs all programs), the number of network points imported and exported.
- .3 The system will display an error message, in the event of a communication error.
- .4 To prevent damage to the system, each connection to the LAN shall be provided with a means of isolation, either optically or fast-blow fuse or by some other means.
- .5 Upon failure of the LAN to communicate information, each controller will retain the last legitimate value of its imported network points, and continue to control the systems based on those values. Failure of any controller, or any part of a

controller on the LAN, shall not affect the ability of the LAN to communicate among the remaining controllers.

- .6 Each hard point and soft point shall have a user-definable, unique, system-wide logical point mnemonic. The format of the point mnemonic shall conform to the naming convention of the incumbent system.

2.2 Memory

- .1 Each controller shall have enough random access memory for all of the following:
 - .1 Variables - ONE (1) for each hard point connected to the controller.
 - .2 PID Controllers - TWO (2) for each analogue output point connected to the controller.
 - .3 Weekly Schedules - ONE (1) for every major system connected to the controller.
 - .4 Annual Schedule - ONE (1) for the entire LAN.
 - .5 Trend Logs - ONE (1) for each pair of hard points connected to the controller with 100 samples each.
 - .6 Runtime Logs - ONE (1) for each digital hard and soft point.
 - .7 Programs - ONE (1) for each output point connected to the controller. Each program must contain enough memory for TWENTY (20) syntactically correct lines of OCL with at least four operators.

2.3 Processing Speed

- .1 Scan Rate - The maximum permissible scan rate is ONE (1) second. The scan rate is defined as the time it takes to controller CPU to sample all inputs, calculate all variables, update all timers and PID controllers, check all schedules, update all trend logs and runtime logs execute all OCL programs and assign values to all outputs.
- .2 Provide a peer to peer high speed local area network (LAN) capable of supporting as many controllers as required to meet the minimum point capacity of the system as specified elsewhere. The network shall permit synchronization of all real time clocks, and the automatic transferring of the value of points from one controller. All BACnet MSTP system LANs shall operate at a communication speed in excess of 76K baud. Provide Bacnet Ethernet communication backbone operating at 10 mega baud. Provide a minimum of 1 [one] BACnet Building Controller [B-BC] for each main mechanical room Network communication/controllers shall be provided in sufficient numbers and memory configurations to meet the specified operational trending and system network access and performance requirements without utilizing the Host Computer.

2.4 Building Controllers

- .1 Building Controllers shall reside on the main LAN or highest level of communication.
- .2 The controller shall communicate on the main LAN using either Ethernet (IEEE.802.3) with TCP/IP and/or EIA-485.

- .3 In addition to main LAN communications, the controller shall support EIA-485 subLANs, PC, modem and intelligent thermostat communications.
- .4 The controller shall have at least one port (other than the PC port) which can be configured to BACnet conformance class 3 using EIA-232 point-to-point communications for interface to other BACnet products.
- .5 The controller must be modular in design with removable I/O device terminations on separate I/O cards for ease of expansion and replacement.
- .6 Controllers will accommodate a maximum of 160 universal I/O points on board using a single address.
- .7 All I/O points must be universal (i.e. user definable as digital or analogue). Dedicated analogue/digital points will not be accepted.
- .8 All outputs must have optional HOA on board for easy override by non DDC users.

2.5 Local Terminal Capability

- .1 The Local Operator's P.C. shall have full access to the entire system including programming and shall interface at any primary or micro controller point in the system. Provide remote floor location connections so that all points are within 50m maximum of a terminal access point. The system shall be capable of supporting multiple local operator terminals. The operator's terminal shall be capable of performing the following functions:
 - continuous display of labelled, system variables
 - network wide, password controlled access
 - setpoint and parameter adjustment
 - setting and clearing of timed and permanent overrides
 - acknowledging system alarms
 - stand alone controller program uploads, and downloads.
 - viewing alarm and exception logs
 - graphical and textual display of all physical points
 - graphical and textual display of trended data
 - dynamic system schematics
 - full system programming revisions/changes including database modifications

2.6 Remote Operator Terminal Communication

- .1 Provide a TCP/IP 100 MB Ethernet interface between the EMCS and the Site's Ethernet Network. Supply and install all necessary hardware and software necessary to provide operator interface from any remote building on the site. Final connection to Ethernet network will be by the Departmental Representative.

2.7 VAV Controller

- .1 VAV Controller (BACnet overview): A VAV Controller is VAV terminal unit controller with integral damper actuator and on-board differential pressure based flow measurement.
 - .1 Data Sharing - Ability to provide the values of any of its BACnet objects and Ability to allow modification of some or all of its BACnet objects by another device.
 - .2 Device and Network Management - Ability to respond to information about its status.
- .2 VAV Controllers shall be used for dual duct mixing boxes and single duct air terminal units.
- .3 VAV Controllers shall communicate on the main LAN or subLAN using EIA-485 (MSTP). In addition to main or subLAN communications, the controller shall support PC and/or modem communications and intelligent thermostat communications.
- .4 Programming the controller shall be accomplished over the LAN or directly via PC and will not require the mandatory use of any other special interface hardware or a Building Controller. Firmware based programming will be accepted.
- .5 Provide 120v-24vac transformers for controls.

PART 3 EXECUTION

3.1 General

- .1 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.
- .2 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.
- .3 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- .4 Equipment shall be installed in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 25 05 01 EMCS: General Instructions

1.2 References

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C12.7-1993, Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13-1978(R1987), Requirements for Instrument Transformers.
- .2 National Electrical Manufacturer's Association (NEMA)

1.3 Submittals

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 01 50 – General Instructions and 25 05 01 – EMCS: General Instructions.
- .2 Include:
 - .1 Information as specified for each device.
 - .2 Manufacturer's detailed installation instructions.
- .3 Pre-Installation Tests
 - .1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.
- .4 Manufacturer's Instructions
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 Closeout Submittals

- .1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 01 01 50 – General Instructions and 25 05 01 – EMCS: General Instructions.

PART 2 PRODUCTS

2.1 General

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

- .3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in NEMA 3R enclosures.
- .8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 Averaging Duct Sensors

- .1 Shall be installed in all mixed air ducts and/or plenums, discharge air ducts and/or plenums, or any duct and/or plenum where stratification occurs.
- .2 Shall have a minimum length of 1.5 meters with a duct and/or plenum cross sectional area of .75 square meters or less, and a minimum length of 6 meters for duct and/or plenum cross sectional areas in excess of .75 square meters.
- .3 The sensor shall have thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.
- .4 Accuracy: plus or minus 0.05°C at 21°C.
- .5 Minimum sensing range: -40°C to 40°C.

2.3 Duct Sensors

- .1 Shall be installed in all ducts and/or plenums where stratification of the air flow does not occur.
- .2 Shall have thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.
- .3 Minimum length: 203mm.
- .4 Accuracy: plus or minus 0.2% over its operating range.
- .5 Minimum sensing range: 4.5° C to 60°C.

2.4 Immersion Sensors

- .1 Shall be complete with a brass immersion well.
- .2 Shall have thermistor sensing elements with a scale range lookup table in the DDC producing a linear output over its sensing range.
- .3 Accuracy: plus or minus 0.05°C at 21°C.
- .4 Minimum sensing range: -40°C to 40°C.

2.5 Room Temperature Sensors

- .1 Shall have a blind cover for all applications. Provide a secured temperature sensor for public areas.
- .2 Shall have a thermister sensing element producing a linear output over its sensing range.
- .3 Accuracy: plus or minus 0.2% over its operating range.
- .4 Minimum sensing range: 4.5°C to 35°C.

2.6 Differential Pressure Sensors (DPS)

- .1 Shall vary the output voltage with changes in differential pressure.
- .2 End to end accuracy: not less than +1% of span including non-linearity, repeatability and hysteresis.
- .3 Application: building pressurization control shall have auto-zeroing feature.

2.7 Current Sensors (CT)

- .1 Shall vary the output voltage with a change in current.
- .2 Provide actual analog current indication for status of all motors 1 horsepower and larger.
- .3 In software provide multiple switch points to determine both motor status and belt breakage. Size for inrush and F.L.A.
- .4 Provide alarm indication for high and low current.
- .5 Provide digital current indication for all motors 3/4 HP and smaller by using current switches (CS) which shall open or close a contact from motor induced current to indicate motor status.

2.8 Motion Detector (MD):

- .1 Shall be utilizing microwave and PIR technology plus a micro controller, using adaptive threshold technology to provide false alarm immunity.
- .2 Sensor shall have electronic temperature compensation and microwave pattern shaping to match the PIR pattern.
- .3 Mounting location, model and number of detectors to be in accordance with manufacturer's recommendations.

2.9 Airflow Measuring Station:

- .1 Thermal dispersion airflow measuring station. Bead-in-Glass thermistors, waterproof epoxy sensor, 304 stainless steel mounting, FEP plenum rated cable, microprocessor-based with high performance A/D converter, 2% sensor airflow accuracy, 0 to 5,000 FPM airflow operating range, -20°F to 160°F temperature operating range, 24VAC power supply; analog, RS-485 and Ethernet (BACnet Ethernet, TCP/IP) output.

2.10 Control Valves and Actuators

- .1 Provide automatic temperature control valves as scheduled and indicated on drawings. Sufficient clearance above control valves shall be provided to allow removal of superstructure without removing body from line. All valve stems shall be vertical. All electric valves, including zone valves, scheduled for modulating service shall be fully proportional (no floating control) suitable for 0-10 volt, or 4-20 mA input signal.
- .2 Control valves, both 2 and 3 way configuration, shall have the following minimum characteristics:
 - .1 Body shall be brass meeting ANSI Standard B16.15 Class 250 for all valves 50 mm and smaller. Larger valves shall be cast iron, Class 125, meeting ANSI Standard B16.15.
 - .2 Valve stem shall be 316 stainless steel.
 - .3 Valves shall have brass plug, composition seat with maximum seat leakage of 0.01% of flow rating per ANSI B16.104, and equal percentage flow characteristic.
 - .4 Valves for terminal zone coils, fan coils and radiation shall have EPT or TFE packing material and NPT, union or flare connections.
 - .5 Valves for primary equipment sized 50 mm and smaller shall have screwed connections. Valves sized 65 mm and larger shall have flanged connections.
 - .6 Ball Valves are not acceptable for control applications.
- .3 When more than one control valve is used for temperature or pressure control on a system, or equipment item they shall be sequenced. e.g. two valves on a heating coil or pressure reducing station; heating and cooling coil valves on an air handling system.
- .4 Valves on hazardous services shall fail to a safe position. e.g. Valves controlling heating to domestic hot water shall fail closed to heating when not powered.
- .5 Actuators shall be of the rotary or piston type for either modulating or two position control. Actuators shall be powered by an overload-proof synchronous motor. Control voltage shall be either 120 VAC, 24 VAC, 10 VDC, or 4-20 mA with spring return on power failure, where required. (ie outdoor air dampers and HVAC primary heating valves). Actuators (motors) shall have repair kits available, and be re-buildable in the field. Provide proportional actuator position feedback on all primary equipment (air handling units) to prove actuator position.
- .6 All control valves shall have replaceable bonnets, and packing. The packing shall be replaceable in the field without having to remove the valve from the piping network.
- .7 All control valves shall be sized to deliver the specified flow rate in the 100% open position. Control valves using a "limited stroke" to achieve the proper flow coefficient shall not be used.

2.11 Dampers and Actuators

- .1 All control dampers not furnished with packaged equipment shall be supplied by the controls subcontractor and installed by the sheet metal subcontractor. Provide damper actuators for all dampers shown or specified.
- .2 All dampers in a mixing application shall be parallel blade with direction of closing producing opposed air streams for optimal mixing. Return air dampers shall be a tight closing, low leakage type with replaceable blade and edge seals, T.A. Morrison Series 1000 or approved equal.
- .3 Actuators shall be electronic, direct coupled, as manufactured by Belimo, Siemens, or Approved Equal. Control voltage shall be 0-10 VDC, or 4-20 mA with an internal spring return on power failure. Provide a 2-10 VDC proportional actuator position feedback signal on all primary equipment (air handling units, relief air and emergency generators) to prove actuator position. Actuators shall permit manual positioning of damper when actuator is not powered.

PART 3 EXECUTION

3.1 General

- .1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats and temperature sensors 1.5m above floor.
- .2 Install damper motors on outside of ducts. Do not locate in outside air stream.
- .3 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.
- .4 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- .5 All transmitters, interfaces, terminations and control relays, etc. shall be mounted in field cabinets that may be locked.
- .6 Freeze protection devices shall be hard wired and also wired to alarm through DDC system.
- .7 All wall mounted devices in new finished space shall be mounted on a wall box. The wall box shall be connected to the ceiling space by a conduit stub. On renovations, when sensors are mounted in existing finished walls, wiring or tubing may be fished into the walls without conduit.

3.2 Sensors

- .1 Sensors provided shall be installed in accordance with the Manufacturer's prescribed procedures.
- .2 Sensors shall be rigidly mounted and mountings shall be adequate for the environment within which the sensor operates.

- .3 Averaging type temperature sensors shall be used wherever mixed air or stratified temperature is to be monitored. They shall be installed in a serpentine configuration with adequate provision for the mechanical protection of the sensor and such that it is supported as required along its entire length.
- .4 Duct type Thermistors shall be used for the monitoring of all uniform air temperature. Length shall be such that the sensing element is installed to not less than one third of the duct width or duct diameter from the duct wall.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 25 05 01 EMCS: General Instructions

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 Sequence of Operation

.1 Boiler and Circulating Pump Control

- .1 Provide an outdoor temperature sensor to be mounted on the north side of the building away from the exhaust air outlets from the building. When the outdoor air temperature is above 17°C and when there is no demand for domestic hot water heating, the boiler plant shall be disabled.
- .2 When the outdoor air temperature is below 17°C, sequence the boilers (B-1 and B-2) and the associated primary pumps (BP-1 and BP-2) to maintain water supply temperature set point. Enable the space heating distribution pumps (P-1 and P-2) when there is demand for space heating.
- .3 The supply water temperature to the space heating loop shall reset based on the following schedule (adjustable):

<u>Outdoor Air Temp.</u>	<u>Supply Water Temp.</u>
17°C	37.7°C
-11°C	60.0°C

- .4 Controls shall be wired through a Hand-Off-Auto DDC interface panel to permit manual override operation of each boiler. In the Hand position the boilers shall bypass any DDC control. In "Auto" setting, DDC control shall enable each boiler in sequence.
- .5 Provide a minimum 10 minute (adjustable) delay between staging the boilers. Provide a time delay on pump shutdown to remove residual heat from boiler before stopping.
- .6 Boiler shall operate on active / standby basis. Alternate run time of boilers and associated primary pumps on a weekly basis. Provide override at the DDC.
- .7 Provide current transformers to monitor status of circulating pumps.
- .8 Monitor and alarm low water level, flame failure, low water temperature and high water temperature for each boiler. Water temperature sensor shall be installed at each boiler and at the header. Refer to piping schematic and Points List for additional information.

-
- .2 Domestic Hot Water Recirculation Pump Control
 - .1 Domestic hot water recirculation pump (P-3) shall be switched by the building DDC control system to control pump operation in accordance with time of day schedule.
 - .2 Provide current transformer to monitor status of circulating pump.
 - .3 Air Handling Unit, AHU-1:
 - .1 The DDC control system shall switch the system from "occupied" to "unoccupied" mode of operation and shall allow override capability from the room sensor to restore "occupied" mode of operation. The room sensor shall maintain reduced temperature during "unoccupied" periods and shall be integrated with the system optimal start feature.
 - .2 During "occupied" mode of operation the outdoor air damper and return air dampers shall be positioned as determined by the balancing contractor to provide the scheduled minimum outdoor air volume, except during economizer control.
 - .3 During the heating season, the heating control valve shall modulate to maintain room temperature set point. Upon demand for cooling the heating control valve shall modulate close.
 - .4 The DDC shall enable the remote condensing unit and provide outputs to the remote condensing unit controller, which provide discharge air control with reset from the DDC. The mixed air temperature shall be maintained at the highest temperature allowable without causing overheating or allowing the outdoor air volume to fall below the minimum setting. The mixed air temperature of the air handling system shall be limited to a minimum of 12.8°C during a demand for cooling. Coordinate with condensing unit manufacturer on controls.
 - .5 When the outdoor air temperature is above the return air temperature, the modulating outdoor air damper shall revert to the minimum outdoor air damper position and the condensing unit shall be stage to maintain the required supply air temperature to prevent overheating.
 - .6 The outdoor air dampers are to remain closed during the morning warm-up period until the return air temperature is 20° C.
 - .7 Air handling unit is to run continuously during "occupied" mode of operation and are to cycle to maintain a reduced temperature with the outdoor air damper remaining closed during "unoccupied" periods. An optimal start program shall control the morning start-up of all air handling unit to reach the "occupied" temperature set point at the required time. The calculation shall compensate for outdoor air temperature, actual indoor air setback temperature, and warm up period required, based upon past performance. Under "heating" mode of control the start up shall be delayed as long as possible. Under "cooling" mode of control, the unit shall start and run on 100% outdoor air when appropriate to pre-cool the building to set point temperature using free cooling.
 - .8 Provide ASHRAE Cycle II low limit control for the economizer dampers. If the mixed air temperature exceeds a high limit or falls below a low limit,

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- the outdoor air damper shall maintain the normal minimum ventilation set point (ASHRAE II) until the mixed air return to normal.
- .9 Provide analog pressure differential sensor across each filter bank and monitor status of fan operation and filter pressure drop for each air handling unit.
 - .10 Provide all field wiring including power wiring from disconnect switch to motor terminal block.
 - .11 For each zone provide room temperature sensor to sequence reheat control upon a demand for heating. Monitor supply air temperature downstream of reheat coil.
 - .12 Whenever the air handles outdoor air dampers is at minimum position, the heat pipe bypass dampers shall be closed and the heat pipe damper shall be open. Whenever the air handles economizes is operating, then the heat pipe bypass dampers shall be open and the heat pipe dampers closed.
- .4 Constant Air Volume Air Terminal Controllers:
- .1 Furnish and install a DDC electronic control system for the control and monitoring of constant air volume air terminal units.
 - .2 The control system enclosures shall be made of material that is suitable for use in ceiling plenum applications.
 - .3 The DDC electronic control system shall consist of a local control panel, enclosures, damper actuator, differential pressure transducer, space temperature controller.
 - .4 The DDC system shall be capable of controlling pressure independent, single duct, constant air volume air terminal unit complete with independently sequenced reheat.
 - .5 A proportional damper actuator shall be directly mounted on the air terminal unit damper shaft. The actuator drive speed shall be variable and the actuator travel shall be continuously adjustable to prevent damage to terminal boxes due to over torquing. The damper actuator shall be configurable for clockwise or counter-clockwise primary air damper operation. The damper operator shall have adequate torque to properly operate damper from full open to full closed position.
 - .6 Air flow shall be measured and controlled by a multi-point averaging differential pressure transmitter, in accordance with the variable air volume box manufacturer's specifications. The flow transmitter shall contain an automatic on-line recalibration circuit that eliminates transducer errors due to temperature and long term sensor drift.
 - .7 The zone temperature shall be controlled by a controller with automatic self-tuning proportional and integral (P+I) action. The temperature controller shall be complete with setpoint adjustment capability by the room occupant and occupancy override to restore the day temperature setpoint.
 - .8 The zone temperature controller shall be capable of automatically changing over from heating mode to cooling mode to satisfy the space demand based on the supply air temperature conditions. The controller shall have separate, independent PID loop algorithms complete with its own tuning parameters for both the heating and cooling modes of operation.

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- .9 The zone temperature controller shall control the primary air damper, terminal reheat and perimeter radiation in sequence to maintain zone temperature.
- .10 The temperature control system shall have night set back capability for each zone.
- .11 The central control panel shall monitor and control the electronic control system on each variable air volume terminal unit.
- .12 The terminal box controller shall automatically revert to stand alone control mode in the event of a central control panel communication failure. Upon re-establishment of network communications, the terminal box controller shall automatically revert back to central control.
- .13 The terminal box controller shall be capable of reporting the following parameter values to the central control system:
- Room space temperature.
 - Supply duct temperature of each air terminal unit.
 - Instantaneous terminal flow velocity.
 - Room temperature setpoint.
 - Occupied/unoccupied status.
 - Damper position.
 - Self-diagnostics information.
 - Heating water valve position for hydronic re-heat boxes.
 - Space temperature cooling setpoint.
 - Space temperature heating setpoint.
 - Airflow setting (CFM).
 - Night setback.
 - Night setup.
 - Overrides.
- .14 The central management system shall be capable of changing the following operating parameter values for each terminal box controller.
- Space temperature cooling setpoint.
 - Space temperature heating setpoint.
 - Airflow setting (CFM).
 - Night setback.
 - Night setup.
 - Overrides.
- .15 Provide air terminal unit controllers, temperature sensors, control valves, and duct static pressure sensor to achieve the following sequence of operation. The controller shall be supplied to the air terminal unit manufacturer for factory installation.

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- .16 The duct static pressure sensor shall be located at the remote end of the main supply air duct (exact location to be determined by the Controls Contractor).
 - .17 Monitor air volume and supply air temperature at the DDC system. Provide an alarm at the DDC when the temperature exceeds or drops below set point.
 - .18 When the AHU is disabled, the damper shall remain closed.
 - .19 When the AHU is enabled, the damper shall open. The DDC system shall send a signal to the air terminal unit controller to maintain constant air volume at all time. The damper will modulate to maintain the duct static pressure and air volume as the filters at the AHU unit become loaded.
 - .20 The control valve at reheat coil shall modulate to maintain space temperature. Where perimeter radiation is provided, the room temperature sensor shall sequence the reheat coil control valve and perimeter radiation control valve in sequence to maintain space temperature.
- . 5 Exhaust Fans, Make-Up Air Unit, Motorized Dampers and Electric Baseboard Heaters:
- .1 EF-1 and EF-2 shall be started, stopped and monitored at the DDC. Fans shall be interlocked with the operation of AHU-1.
 - .2 EF-3 shall be started, stopped and monitored at the DDC. Fan shall operate continuously during normal operation.
 - .3 EF-4 shall be started, stopped and monitored at the DDC. Interlock motorized damper to open when exhaust fan operating. Cycle exhaust fan when space temperature exceeds 25°C (adjustable) set point. Alarm to DDC if room temperature exceeds alarm high temperature set point of 30 °C (adjustable). Operate electric baseboard heater when space temperature is below 20°C (adjustable) set point. Alarm to DDC if room temperature is below alarm low temperature set point of 15°C (adjustable).
 - .4 EF-5 shall be started, stopped and monitored after DDC. Interlock motorized damper to open when exhaust fan operating. Cycle exhaust fan when space temperature exceeds 25°C (adjustable) set point. Alarm to DDC if room temperature exceeds alarm high temperature set point of 30 °C (adjustable). Operate unit heater when space temperature is below 20°C (adjustable) set point. Alarm to DDC if room temperature is below alarm low temperature set point of 15°C (adjustable).
 - .5 EF-6 shall be started, stopped and monitored at the DDC. Interlock motorized damper to open when exhaust fan operating. Exhaust fan shall operate continuously for ongoing ventilation of the space. Alarm to DDC if room temperature exceeds alarm high temperature set point of 30 °C (adjustable). Operate electric baseboard heater when space temperature is below 20°C (adjustable) set point. Alarm to DDC if room temperature is below alarm low temperature set point of 15°C (adjustable).

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- .6 EF-7 shall be started, stopped and monitored at the DDC. Interlock make-up air unit MUA-1 to operate when exhaust fan operating. Exhaust fan shall operate continuously for ongoing ventilation of the space. Alarm to DDC if room temperature is below alarm low temperature set point of 10 °C (adjustable). Alarm to DDC if make-up air unit supply air temperature is below alarm low temperature set point of 5 °C (adjustable) or above alarm high temperature set point of 30 °C (adjustable). Provide analog pressure differential sensor across each filter bank and monitor status of fan operation and filter pressure drop for make-up air unit. Adjust supply air temperature of make-up air unit to 10 °C (adjustable).

 - .6 Optimal Start Program
 - .1 An optimal start program shall control the morning start-up of all air handling units to reach the "occupied" temperature set point at the required time. The calculation shall compensate for outdoor air temperature, actual indoor air setback temperature, and warm up period required, based upon past performance. Under "heating" mode of control the start up shall be delayed as long as possible. Under "cooling" mode of control, the unit shall start and run on 100% outdoor air when appropriate to pre-cool the building to setpoint temperature using free cooling. The outdoor air dampers are to remain closed during the morning warm up period until the return air temperature is 20°C.

 - .7 Low Temperature Protection
 - .1 All air supply systems shall be fitted with a hard wired manual reset, adjustable setting, low limit thermostat which shall stop system fans when temperatures below set point, normally 4°C, are sensed. Monitor status of all low temperature thermostats.

3.2 Point List

- .1 The following point lists are typical of the Analog and Digital output and input points required to achieve the intended sequence of operation and provide the required level of monitoring and control. They are intended to set a minimum level of acceptability. All additional points required to achieve the specified features and sequence of operation shall be provided by the control contractor.

.2

BOILER PLANT CONTROLS							
POINT DESCRIPTION	POINTS				ALARM/INDICATION		
	AI	AO	DI	DO	HI	LO	FAIL
BOILERS							
OUTDOOR AIR TEMPERATURE	OTS						
PRIMARY HOT WATER PUMPS (P-B1, P-B2) START/STOP/STAT	CT			CR			X
BOILER HWS TEMP. (TYP. 2)	WTS				X	X	
BOILER HWR TEMP (TYP. 2)	WTS				X	X	
BOILER LWCO (TYP. 2)			DCI			X	
BOILER FLAME FAILURE (TYP. 2)			DCI / R-ST				X
BOILER ENABLE/DISABLE (TYP. 2)				CR			
BOILER SUPPLY WATER TEMPERATURE SETPOINT (TYP. 2)		X					
SPACE HEATING LOOP							
BUILDING DISTRIBUTION PUMPS (P-1, P-2) START/STOP/STAT	CT			CR			X
SUPPLY WATER TEMPERATURE	WTS				X	X	
SUPPLY TEMPERATURE SETPOINT		X					
RETURN WATER TEMPERATURE	WTS				X	X	
DOM. WATER HEATING LOOP							
DOMESTIC WATER RECIRCULATION PUMP (P-3) START/STOP/STAT	CT			CR			X
SUPPLY WATER TEMP. (TYP. 2)	WTS				X	X	
RETURN WATER TEMP. (TYP. 2)	WTS				X	X	
GAS METER (TYPE 2)	X				X		
BOILER MAKE-UP WATER METER	X				X		
BUILDING DOMESTIC WATER METER	X				X		

.3

AIR HANDLING UNIT, AHU-1							
POINT DESCRIPTION	POINTS				ALARM/INDICATION		
	A	AO	DI	DO	HI	LO	FAIL
SUPPLY FAN START/STOP/STATUS	CT			CR			X
RETURN FAN START/STOP/STATUS	CT			CR			X
SUPPLY AIR TEMPERATURE	DTS				X	X	
OUTDOOR AIR HEAT PIPE TEMPERATURE							
EXHAUST AIR HEAT PIPE INLET TEMPERATURE							
EXHAUST AIR HEAT PIPE OUTLET TEMPERATURE							
MIXED AIR TEMPERATURE	ATS					X	
MIX AIR DAMPER		DMA					
HEAT PIPE OUTDOOR AIR BYPASS DAMPER							
HEAT PIPE EXHAUST AIR BYPASS DAMPER							
HEAT PIPE EXHAUST AIR DAMPER							
HEATING COIL VALVE		VMA					
CONDENSING UNIT START/STOP/STATUS	CT			CR			X
CONDENSING UNIT ALARM			X				X
CONDENSING UNIT DISCHARGE AIR TEMP. CONTROL AND RESET		X					
FILTER STATUS	DPS				X		
LOW LIMIT TEMPERATURE			LTS			X	
RETURN AIRFLOW	FSA	POT					
RELIEF AIR		DMA					
ZONE COILS (TYP.)		VMA					
ZONE COIL DISCHARGE TEMP (TYP.)	DTS					X	

.4

AIR TERMINAL UNITS, TYPICAL							
POINT DESCRIPTION	POINTS				ALARM/INDICATION		
	AI	AO	DI	DO	HI	LO	FAIL
SUPPLY AIR TEMPERATURE	DTS				X	X	
AIRFLOW	FAS	DMA					
DAMPER		DMA					
REHEAT CONTROL VALVE		VMA					

.5

EXHAUST FANS, MAKE-UP AIR UNIT, MOTORIZED DAMPERS, ELECTRICAL BASEBOARD HEATERS, TYPICAL							
POINT DESCRIPTION	POINTS				ALARM/INDICATION		
	AI	AO	DI	DO	HI	LO	FAIL
FANS (START/STOP/STAT)	CT			CR			X
SPACE TEMPERATURE (WHERE APPLICABLE)	RTS				X	X	
LOUVER INTAKE DAMPER (WHERE APPLICABLE)		DMA					
ELECTRIC BASEBOARD HEATER (WHERE APPLICABLE)				CR			
FILTER STATUS	DPS				X		
SUPPLY AIR TEMPERATURE	DTS				X	X	

.6

CABINET UNIT HEATERS, UNIT HEATERS							
POINT DESCRIPTION	POINTS				ALARM/INDICATION		
	AI	AO	DI	DO	HI	LO	FAIL
SPACE TEMPERATURE	RTS				X	X	
HEATING CONTROL VALVE				VMD			
SUPPLY FAN				CR			

NOTE: POINT COUNT IS APPROXIMATE. CONTROLS CONTRACTOR SHALL VERIFY EXACT QUANTITY AND PROVIDE ADDITIONAL POINTS AS REQUIRED TO ACHIEVE THE SEQUENCE OF OPERATION DESCRIBED IN THE CONTRACT DOCUMENT.

ATS Averaging Temperature Sensor	DPS Diff. Press. Switch (Analog)	OTS Outdoor Air Temp. Sensor
ASD Adjustable Speed Drive	DTS Duct Temperature Sensor	POT Potentiometer
CDS Carbon Dioxide Sensor	DHS Duct Humidity Sensor	R-ST Relay Status
CS Current Switch	ES End Switch	RHS Room Humidity Sensor
CR Digital Relay	FSA Flow sensor - Air	RTS Room Temperature Sensor
CT Analog Current Transformer	FSW Flow sensor - Water	VMA Valve Motor (Analog)
DCI Dry Contact Input	LTS Low Temperature Switch	VMD Valve Motor (Digital)
DHS Duct Humidity Sensor	MOP Proportional A.O. (4-20 ma)	VPM Variable pump motor
DMA Damper Motor (Analog)	MD Motion Detector	WTS Water Temperature Sensor
DMD Damper Motor Digital	O-SW Override Switch	

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 The general conditions and general requirements together with all amendments and supplements contained in the General Specifications shall form an integral part of the electrical specification and will be made part of this contract.
- .2 Reference to "Electrical Divisions" shall mean all Divisions 26, 27, 28, 33, 34 and 48 in the Master Format or the Canadian Master Specifications.
- .3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
- .4 Confirm with the architectural plans and specifications the extent and nature of the work and how it will affect the electrical work. Include in the tender sum for any complications or additional work described therein.
- .5 Review mechanical plans and specifications for the extent of electrical work required to make mechanical systems complete and include this work in the tender sum.
- .6 Review structural plans for limitations of penetrations or inclusions of electrical equipment. In the tender sum, allow for avoiding critical areas with electrical equipment.
- .7 Review existing record plans and site conditions for limitations of penetrations or inclusions of electrical equipment. In tender sum, allow for avoiding critical areas with electrical equipment.
- .8 Comply with the requirements of the General Contract, and coordinate the installation with all other trades on site.
- .9 Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied by other trades.

1.2 DRAWINGS AND SPECIFICATIONS

- .1 The drawings and specifications compliment each other and what is called for by one is binding as if called for by both. If there is any doubt as to meaning or true intent due to a discrepancy between the electrical drawings and specifications, and all other contract documents. **The most expensive alternative is to be allowed for.**
- .2 The plans show the approximate location of outlets and apparatus but the right is reserved to make such changes in location as may be necessary to meet the emergencies of construction in any way. No extra will be allowed for such changes to any piece of electrical equipment unless the distance exceeds 3 metres, or if the relocation is required after initial installation is complete.
- .3 It is imperative that the contractor visit the site and completely familiarize himself as to the work to be undertaken.

1.3 CODES AND STANDARDS

- .1 All electrical work shall be carried out in accordance with the latest edition of the CEC C22.1 (Canadian Electrical Code) as amended and adopted by the

Province of British Columbia and to the satisfaction of the Electrical Inspection Authority having jurisdiction, except where specified or specifically stated otherwise.

- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 latest edition, except where specified or specifically stated otherwise.
- .3 All work shall be carried out in accordance with the National Building Code current edition (including all local amendments) to the satisfaction of local building inspector authority having jurisdiction.
- .4 Any electrical material and/or equipment supplied by any contractor or sub-contractor for installation on this project must bear evidence of CSA approval or special CSA certification acceptable to the Chief Electrical Inspector for the Province of British Columbia.

1.4 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and Operating Personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235 latest edition.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay all associated fees.
- .3 Fees will cover all routine inspections by the District Electrical Inspector. Any fees for follow-up inspections found to be necessary by the District Electrical Inspectors as a result of incorrect work shall be borne by this contractor without any cost to the Departmental Representative.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
- .5 Furnish Certificates of Acceptance from Electrical Inspection Department [authorities having jurisdiction] on completion of work to Departmental Representative.

- .6 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain electrical permit and pay associated fees.
- .7 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost to the Contractor.
- .8 Furnish to Departmental Representative on completion of work Certificates of Acceptance from Electrical Inspection Department.

1.7 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with these specifications and as indicated on the Architectural and Electrical drawings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

1.8 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 on the Architectural and Electrical drawings.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1200 mm.
 - .3 Panelboards: as required by Code or as indicated.

1.9 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads (lighting and mechanical) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

1.10 CONDUIT AND CABLE INSTALLATION

- .1 Install flashing and gooseneck assembly for all roof penetrations for running cables to serve roof mounted equipment.
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.11 EXTRA WORK

- .1 Any extra work ordered to be done shall be governed by this specification unless specific instructions or clauses are contained in the Change Order. In such cases, these instructions or clauses shall supersede those of the specification for this particular application only.

1.12 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or supervised apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks. The activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical Contractor License as issued by the Province that the work is being conducted.
- .3 Conduct and pay for following tests:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350V - 600 V circuits, feeders and equipment with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for Departmental Representative's review.

1.13 CO-ORDINATION OF TRADES

- .1 Consult with Construction Manager and all subtrades involved to confirm the location of the various outlets and equipment, and cooperate fully to ensure that no conflict arises during the installation.
- .2 Special care shall be taken that equipment, outlets, junction boxes or pullboxes will not be obstructed by other structure, equipment, pipes or ducts installed under this general contract by other trades.
- .3 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a

- satisfactory installation. Make no deviations to the design intent involving extra cost to the Departmental Representative.
- .4 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.
 - .5 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Departmental Representative.
 - .6 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.14 SUBSTITUTIONS

- .1 Unless otherwise noted on the plans or specifications, substitutions may be approved by the Departmental Representative if requested by the contractor or by equipment suppliers, for items specified by the manufacturer's catalogue number.
- .2 Requests for approval of such substitutions shall be submitted at least five (5) working days prior to the tender closing date.
- .3 Complete description and data sheets of proposed substitution shall accompany the application and supplier must be prepared to submit samples for approval on short notice.
- .4 Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the specified item shall apply for comparison if no other clause of this specification applies. The decision of the Departmental Representative to accept or reject shall be final.
- .5 Off-the-shelf items such as standard boxes, EMT, which are specified by description only or indicated on the drawings, without any manufacturer, model, type or catalogue number, do not require approval prior to the tender closing date.
- .6 Submit list of alternates used, within one week after acceptance of tender.

1.15 PROTECTION OF EQUIPMENT

- .1 See section 1.23.7 for lighting.

- .2 This contractor shall provide and ensure maximum protection of electrical equipment on the site. Electrical equipment, including existing electrical equipment, shall be kept clean and dry at all times and caution shall be taken to ensure no mechanical damage is done to the equipment. Equipment shall not be delivered to the site until it can be stored safely or placed in final position and the space is clean.

1.16 DAMAGES

- .1 If the finish of electrical equipment is damaged either when received or during installation, have such equipment completely refinished and restored to its original condition at no cost to the Departmental Representative.
- .2 Irreparably damaged equipment shall be replaced at no cost to the Departmental Representative.

1.17 SHOP DRAWINGS

- .1 Submit shop drawings, product data and samples in accordance with the contract specifications.
- .2 Shop drawings and product data shall indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other sections.
- .5 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the Construction Manager.
- .6 Shop drawings must be received by the Departmental Representative at a date early enough to permit reasonable study prior to approval and manufacture, or to permit alterations where necessary. Late submissions of shop drawings will be sufficient reason for a stoppage of construction pending approval, or removal and replacement of any unsatisfactory item at the contractor's expense.
- .7 Shop drawings/product data content:
 - .1 Shop drawings submitted title sheet.
 - .2 Data shall be specific and technical.
 - .3 Identify each piece of equipment.
 - .4 Information shall include all schedule data.
 - .5 Advertising literature will be rejected.
 - .6 The project and equipment designations shall be identified on each document.
 - .7 The shop drawings/product data shall include:
 - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
 - .2 Mounting arrangements.
 - .3 Control explanation and internal wiring diagrams for packaged equipment.

- .4 A written description of control sequences relating to the schematic diagrams.

1.18 CUTTING AND PATCHING

- .1 This contractor is responsible for all cutting or blocking out required to install electrical equipment.
- .2 If this contractor makes excessive cuts or does not coordinate work so that finished work requires cutting or patching, then this contractor shall pay for all patching to original condition.
- .3 Any dispute resulting from this shall be referred to the Departmental Representative for decision.
- .4 Prior to any major cutting of walls or floor, review the proposed location, size and method with the Departmental Representative. This includes notification when cutting or coring into any fire rated construction.

1.19 FIRESTOPPING

- .1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Section 1300.
- .2 Submit material safety data sheets provided with product delivered to job-site.
- .3 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- .4 The work is to be installed by a contractor with at least one of the following qualifications:
 - .1 FM 4991 Approved Contractor
 - .2 UL Approved Contractor
 - .3 Hilti Accredited Fire Stop Specialty Contractor
- .5 Installer shall have minimum 3 years of experience with fire stop installation.
- .6 Seal all openings for conduit or sleeve penetrations in fire rated and smoke rated separations using approved materials.
- .7 All block outs and access slots to be sealed using approved fire stopping assembly. Provide full details for all fire stopping applications as they relate to each application.
- .8 Provide shop drawings for all fire stopping products, including assembly details as it relates to each application. Products shall be ULC approved as an assembly.
- .9 Allow for the destructive testing of 10% of fire stopping applications. Should installations not conform to manufacturer's details, an additional 25% of installation will be destructively tested and should there be more failures, the contractor will be responsible to remove all fire stopping products and reinstall products correctly, at no additional cost to the Departmental Representative.

1.20 PROTECTION OF EXPOSED LIVE EQUIPMENT

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.21 SPRINKLER PROTECTION

- .1 Provide drip covers or CSA Type 2 enclosure for all new surface mounted panelboards and cabinets in sprinklered rooms.
- .2 Provide drip covers for all communications backboards in sprinklered rooms.
- .3 Provide sprinkler covers for all communications racks in sprinklered rooms.

1.22 INSPECTIONS AND TESTS

- .1 Notify the Departmental Representative and authorities having jurisdiction at least five (5) working days in advance when the installations will be ready for inspection or testing.
- .2 Test reports, signed by all attending authorities, shall be submitted to the Departmental Representative through the General Contractor after successful completion of an inspection or test.
- .3 Conduct all tests in a thorough and complete manner to the satisfaction of the Departmental Representative and pay for any fees incurred to complete tests.
- .4 Furnish the Departmental Representative with a copy of Certificate of Inspection from B.C. Electrical Safety Branch indicating that all work has been satisfactorily completed and issued prior to final connection.

1.23 CLEAN UP

- .1 Vacuum clean all new raceways and any electrical equipment. Ensure that no debris or spare parts are left in any electrical equipment.
- .2 Any scrap material shall be removed from the site and disposed of by the Contractor.
- .3 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

1.24 SURPLUS MATERIALS

- .1 All material removed from existing site and not being reused in this contract shall be the property of the Departmental Representative. Material as it becomes surplus shall be reviewed by the Departmental Representative and that part considered of value to the Departmental Representative shall be classed as surplus material, all other becomes scrap material, and shall be disposed of by the contractor.

1.25 SPARE PARTS

- .1 This contract calls for spare parts or material. These are to be provided new in unopened cartons to the Departmental Representative at the time of substantial completion of the contract.

- .2 Obtain a signed receipt from the Departmental Representative for all these parts or materials and include a copy in the front of the maintenance manual. Without this receipt these items will be treated as a deficiency and the cost withheld at twice the estimated value by the Departmental Representative.

1.26 SUBSTANTIAL PERFORMANCE

- .1 Provide request to Architect/Departmental Representative in writing that a Substantial Performance Inspection shall be carried out.
- .2 Do not issue this written request until the following have been completed and/or submitted to Departmental Representative:
 - .1 As-installed drawings (CAD files or Revit model) have been provided.
 - .2 All deficiencies noted during job inspections have been completed.
 - .3 Warranty Certificates have been provided.
 - .4 All systems have been tested and are ready for operation.
 - .5 All Inspection Certificates have been furnished including Final Electrical Inspection Certificate.
 - .6 The Departmental Representative personnel have been instructed in the operation and maintenance of all systems.
 - .7 All equipment identification has been completed.
 - .8 The cleaning up is finished in all respects.
 - .9 All spare parts and replacement parts specified have been provided and receipt of same acknowledged.
 - .10 Copies of Seismic Departmental Representative's Schedules B1, B2 and CB have been submitted.
 - .11 Fire Alarm System is verified and operational. Copy of Verification Report submitted to Departmental Representative.

1.27 AS-BUILT DRAWINGS

- .1 Obtain two (2) sets of white prints for the sole purpose of recording changes in installation as they occur. One (1) set is to be used in the field for day-to-day recording, and one (1) set for submittal after completion.
- .2 These plans shall be kept up-to-date as changes occur and shall be available to be inspected by the Departmental Representative.
- .3 Arrange and pay for the incorporation of any "as-built" changes to reproducible plans and AutoCAD disks. These changes shall be of similar quality of presentation as the original plans. NOTE: All plans whether requiring as-built changes or not, shall be included in this set.
- .4 These amended drawings shall be given to the Departmental Representative at time of final inspections.
- .5 "As-built" drawings shall include the location and circuit numbers of junction boxes in ceiling spaces, and all conduit placed in or under poured concrete. Note normal depth of conduits below top of concrete slab.

1.28 OPERATING AND MAINTENANCE MANUALS

- .1 Submit **four sets** of operating and maintenance manuals for equipment or as requested by the general section of the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, electrical inspection authority certificate and contract guarantee.
- .2 Submit documentation in **green colored** heavy duty three ring binders, with lettering on spine identifying: "OPERATING AND MAINTENANCE MANUAL", project title and system names.
- .3 Submit one copy for approval by Departmental Representative prior to assembly of final sets.

1.29 DEMONSTRATION OF SYSTEMS

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service Departmental Representative to supervise start-up of installation, check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.30 WARRANTY

- .1 Within a period of one year from the date of final acceptance of work, replace or repair at own expense any defect in workmanship or material. Reused material shall be operating satisfactorily at the time of final acceptance but subsequent failures are not the responsibility of this contractor.
- .2 Warranties for equipment having more than one year guarantee shall be made out to Departmental Representative, and copies shall be provided in the maintenance manuals.
- .3 Maintenance from manufacturer and contractor of all equipment shall be included for first year, including all lamps except incandescent.

1.31 PAINTING

- .1 Arrange and pay for the painting of the devices noted in these specifications, in particular:
 - .1 exposed conduits and conduit fittings where required.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Refer to Section 01 35 18 of the General Requirements.

2.2 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

2.3 MATERIALS AND EQUIPMENT

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .2 Factory assemble control panels and component assemblies.

2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on the electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule.
- .2 Control wiring and conduit is specified in [Division 16] [Divisions 26, 27, 28, 33, 34 and 48] except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Specifications and shown on mechanical drawings.

2.5 WARNING SIGNS

- .1 As specified and to meet the requirements of the BC Electrical Inspection Authority and the Departmental Representative.
- .2 Decal signs, minimum size 175mm x 250mm.

2.6 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.7 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with [nameplates] [and] [labels] as follows:
- .2 Nameplates:
 - .1 Lamicoid 3mm thick plastic engraving sheet, mechanically attached with self tapping screws.
 - .2 Nameplate colors shall be as follows:
 - .1 Normal power: Black face with white letters;
 - .2 Life safety emergency power: Red face with white letters;
 - .3 Standby power: Blue face with white letters.
 - .3 Nameplate sizes shall be as follows

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .3 Labels:
 - .1 Embossed plastic labels with 6mm high letters unless specified otherwise.
- .4 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate and label.
- .6 Identification to be English.
- .7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .8 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .9 Terminal cabinets and pull boxes: indicate system and voltage.
- .10 Label all receptacles with branch circuit label indicating panel name and branch circuit number. Use brother P-Touch device or similar. Labels are to be white with black lettering.

2.8 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1 [latest edition].
- .4 Use colour coded wires in communication cables, matched throughout system.

2.9 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at [15] m intervals.
- .3 Colours: [25] mm wide prime colour and [20] mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

Part 3 Execution

3.1 PROJECT CLOSEOUT REQUIREMENTS

- .1 The following items are required for the Contractor to provide to the Electrical Departmental Representative prior to releasing a Schedule C-B.
 - .1 Final record drawings (as-built)

- .2 Maintenance manual
- .3 Warranty letter
- .4 System briefing to Departmental Representative
- .5 Electrical final from AHJ
- .6 Fire stopping letter

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18 latest edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65 latest edition, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, latest edition, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

1.2 GENERAL REQUIREMENTS

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.
- .2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.
- .3 Flexible AC90 armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.
- .4 Cabling indicated to be 2-Hour Fire-Rated shall be compliant to CAN/ULC-S139 and CSA 38-95 (Draka Lifeline, Raychem RHW, or Shawflex). Cabling shall be low smoke halogen free. Conduit to be sized and installed as per manufacturers' requirements for these specialized cables and assemblies regardless of the size indicated on drawings.
- .5 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .6 Non-metallic sheathed wiring is not to be used on this project.

Part 2 Products

2.1 WIRE AND CABLE GENERAL

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.
- .3 Use RWU90XLPE for underground installations.
- .4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.
- .5 TBS90 #14 AWG stranded shall be used in all switchgear assemblies.
- .6 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131 [latest edition].
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel or aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1000 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 CONTROL CABLES

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.
- .2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with TWH over each conductor and overall covering of PVC jacket.
- .3 600 V type: stranded copper conductors, sizes as indicated with R90 (x-link) ethylene-propylene rubber insulation type over each conductor and overall covering of PVC jacket.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In underground ducts in accordance with Section 26 05 34.
 - .3 In trenches in accordance with Section 26 05 34.
 - .4 All wires are to be pulled in together in a common raceway, using liberal amounts of Compound 77 lubricant.
 - .5 All power circuits connected to isolated ground type receptacles are to have individual separate neutral c/w insulated bonding conductor.
 - .6 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.

- .7 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Install cable in trenches in accordance with Section 26 05 34.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Install cable in trenches in accordance with Section 26 05 34.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.4 INSTALLATION OF CONTROL CABLES

- .1 Control cable and conduit will be supplied and installed by Mechanical Contractor. Controls wiring must be installed in conformance with Electrical Specifications. Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No.41- Grounding and Bonding Equipment.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors as required sized for conductors.
- .2 Joint boxes in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- .3 Junction boxes with respective pothead for cables for enclosing stress - cone within.

Part 3 Execution

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

Part 1 General

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 3 m long for each concrete encased electrode, bare, stranded, soft annealed.
- .3 Grounding conductors: bare stranded copper, soft annealed.
- .4 Insulated grounding conductors: green.
- .5 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where conduit is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground.
- .11 Make grounding connections in radial configuration only. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.
- .13 Ground secondary service pedestals.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary system.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.4 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0 AWG.

3.5 PATIENT CARE

- .1 Grounding in operating rooms: to CAN/CSA Z32.
- .2 Connect equipment and leakage current devices to building ground system.
- .3 Install ground bus for conductive floor tile. Make connections from tile system to bus in accordance with tile manufacturer's instructions. Ground resistance to CAN/CSA Z32.
- .4 Locate ground bus inside each patient care area, within the care area as defined in CAN/CSA Z32.

3.6 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, intercommunication systems as indicated.

3.7 PERMAFROST

- .1 Bond non-current carrying metal parts together with size #30 AWG copper equipotential conductor. Run conductor from separate lug or service neutral bar to, but not necessarily limited to, following indoor systems and equipment:
 - .1 Hot water heating system.
 - .2 Main water pipe.
 - .3 Main building drain.
 - .4 Telephone, radio/TV, emergency and fire alarm lead-in or service conduits, near panels.
 - .5 Make connections to pipes on building side of main valves and tanks. Connect jumpers across boilers to supply and return hot water heating pipes.

3.8 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests before energizing electrical system.

-
- .3 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.
- .3 Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 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.

2.3 CABINETS

- .1 Sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (if required) for surface or flush mounting as required.
- .2 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal blocks as required.

- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 20 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

END OF SECTION

Part 1 General

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES – GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347V outlet boxes for 347V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang device boxes for flush installation, minimum size 76 x 51 x 38 mm or as indicated. For 347 V switches, use 347 V type device boxes.
- .2 Larger 102 mm square x 54mm deep outlet boxes to be used for single gang when more than one conduit enters one side, for telecommunication outlets (for slack storage), or for flush mounting devices in finished plaster and/or tile walls. Provide raised device covers as required.
- .3 For larger boxes (those requiring more wiring space, MUTOAs, etc.) use pre-ganged 102 mm high x 51 mm deep solid type as required. Allow extra gang for telecommunication outlets.
- .4 Boxes for surface mounted switches, receptacles, or telecommunications outlets to be 102 mm square, or 102 mm high utility, boxes, with rounded corners and raised surface covers. Minimum 38 mm (54 for telecom.) deep
- .5 Lighting fixture outlets: 102 mm square outlet boxes or octagonal outlet boxes.
- .6 Provide extension and plaster rings as required.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang type shallow or deep boxes for devices flush mounted in exposed block walls, minimum 95 mm high x 63 mm deep.

2.4 SURFACE CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.5 FITTINGS – GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.

- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.
- .2 Support boxes independently of connecting conduits.
- .3 Ceiling outlet boxes to be provided for each surface mounted fixture.
- .4 Fill open boxes with paper, sponges, foam or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.
- .6 No sectional or handy boxes to be installed.
- .7 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .8 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.
- .9 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .10 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .11 Where outlet boxes penetrate an assembly with a fire-resistance rating (fire separation), ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire. Such boxes may not exceed 0.016 mm² per NBCC 3.1.9.2.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

Part 2 Products

2.1 SPLICE BOXES

- .1 Splice boxes cast iron enclosures 6 mm thick painted with chromate primer and gray enamel to provide mechanical protection and moisture seal for direct buried cable splices rated 7.5 kV and consisting of:
 - .1 Two halves, split along cable axis, finely ground matching surfaces, fastened with galvanized steel bolts, top half with large filling holes with gasketed plugs for medium hard asphalt base compound, bottom half with screws on inside for bonding armour, and box end openings sealed by:
 - .1 Wrapping cables with anhydrous tape and clamping to make snug fit, for 2, 3 and 4 way splices.

2.2 JUNCTION BOXES DISTRIBUTION LEVEL

- .1 Welded steel rectangular boxes 6 mm thick painted with chromate primer and gray enamel with removable plate on front side, designed for through run of main cable and porcelain enclosed disconnecting branches of single conductor cables, using pothead plug and socket disconnectors enclosed in porcelain tubes and caps, standard designed for no voltage disconnecting, and for wall mounting in manholes, branch cables rated 250 A, 5 kV, filled with medium hard asphalt base compound.

2.3 JUNCTION BOXES POWER LEVEL

- .1 Cast iron octagonal box painted with chromate primer and gray enamel with joints ground smooth and fitted with gasket, contacts mounted on porcelain supports to which conductors are fastened by soldered-on lugs, medium hard asphalt compound filled, suitable for 3 phase, 15 kV cable, 250 MCM maximum cable size.

Part 3 Execution

3.1 INSTALLATION

- .1 Install splice boxes at cable joint, on floor of trench. Tighten armour clamps and fill with compound.
- .2 Connect cable terminals to box contacts. Fasten lid securely and check for air leaks before trench is backfilled.

- .3 Install distribution level steel boxes on walls of manholes. Splice main cable in box and connect branch feeder. Fasten cover and fill with compound.
- .4 Install power level boxes as follows:
 - .1 Cast iron type: on trench floor, connect cable terminals to box contacts, fasten lid and fill with compound before trench is backfilled.
 - .2 Steel type: mount on wall of manhole; connect cables to box terminals; install disconnect links, fasten lid securely.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.
- .2 Rigid metal conduit (RMC): to CSA C22.2 No. 45.
- .3 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .4 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.
- .5 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .6 PVC (DB2) conduit: to CSA #C22.1 211-1.
- .7 Flexible metal conduit (FMC): to CSA C22.2 No. 56.
- .8 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

1.2 BASIC WIRING METHODS

- .1 Underground or in concrete exterior to building:
 - .1 All wiring shall be in Schedule 40 RPVC conduit.
- .2 Concrete walls and slabs interior to building:
 - .1 All wiring shall be in Schedule 40 RPVC conduit.
- .3 Surface raceways - interior:
 - .1 All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.
- .4 Surface raceways - exterior:
 - .1 All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Consultant's satisfaction.

1.3 LOCATION

- .1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc. for a complete operating job to meet in all respects the intent of the drawings and specifications.
- .2 Outlet positions shown on architectural drawings (plans and elevations) to take precedence over locations and mounting heights indicated on electrical plans or in specifications.
- .3 Locate electrical devices on walls with regard given for convenience of operation and conservation of wall space. Switches, receptacles, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.
- .4 Review the exact location criteria of each electrical outlet and device with the Departmental Representative prior to rough-in. Relocate any item installed without architectural confirmation as required by the Departmental Representative at no cost to the Departmental Representative as long as the relocation is within 3m of the location originally shown on the electrical drawings.

- .5 Do not install outlets back-to-back in party walls; allow a minimum of one stud space horizontal clearance between boxes. Install behind all outlets in party walls a Lowry Acoustic backing pad.
- .6 Locate light switches on latch side of doors.
- .7 All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.
- .8 All raceways and wiring shall be installed concealed in building fabric as much as possible.
- .9 All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted unless indicated otherwise.

Part 2 Products

2.1 CONDUIT GENERAL

- .1 All conduit fittings shall be malleable steel, set screw type. No cast fittings.
- .2 All connectors shall have insulated throat type bushing, connectors etc.
- .3 Bonding conductor to be provided in all conduit runs.

2.2 EMT RACEWAY

- .1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.
- .2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

2.3 FLEXIBLE ELECTRIC NON-METALLIC (ENT) TUBING

- .1 Flexible electrical non-metallic tubing (ENT) **shall not** be used on this project.

2.4 OUTLET BOXES AND JUNCTION BOXES

- .1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.
- .2 Outlet boxes to be galvanized steel.
- .3 Junction boxes to be galvanized steel or aluminum.

2.5 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500mm oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.6 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT in all exterior applications. Set-screws are not acceptable.

2.7 EXPANSION FITTING FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.8 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Use rigid galvanized steel threaded conduit except where specified otherwise.
- .3 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.
- .4 Use rigid pvc conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.
- .5 Minimum conduit size for lighting and power circuits: 19mm.
- .6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .8 Install fish cord in empty conduits.
- .9 Dry conduits out before installing wire.
- .10 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.
- .11 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.
- .12 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.
- .13 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 FIRESTOPPING

- .1 Apply ULC approved fire stopping assembly to all conduit penetrations passing through fire rated walls and floors.
- .2 Provide shop drawings showing details for each type of application on the project. Shop drawings shall include catalogue data and installation details.
- .3 For all communication sleeves accessible via ceilings or in stacked closets/rooms passing through floors, provide 2 hour rated STI EZ-PATH assembly. Where quantity is not indicated on plans, provide minimum two sleeves between each floor and each communication closet/room.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.
 - .2 CAN/CSA C22.1 No.126.2, Non Metallic Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA FG 1, Fibreglass and Cable Tray Systems.
 - .2 NEMA VE 1, Metal Cable Tray Systems.
 - .3 NEMA VE 2, Cable Tray Installation Guidelines.

1.2 PRODUCT DATA

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.
- .3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.
- .4 Identify types of cable trays used.

Part 2 Products

2.1 CABLE TRAY (COMMUNICATION ROOM)

- .1 A flex or basket type cable tray shall be provided above equipment cabinets and around the perimeter of the room and shall be attached to the Communications cable tray infrastructure.
- .2 The tray shall be mounted @ 2.7M AFF unless otherwise noted.
- .3 Wall mounted tray brackets shall be bolted through any plywood backboards to the wall.
- .4 Cable tray to have rounded edges where in possible contact with cables.

2.2 CABLE TRAY (INTERIOR PATHWAYS)

- .1 All ventilated tray to be steel or aluminum, complete with angles, offsets, corners, saddles, tees, etc. as indicated and required to suit the installation. Radii on fittings shall be 300mm minimum.
- .2 All steel non-painted tray shall be hot dip galvanized after fabrication to CSA G164-1965 ASTM designation A386.
- .3 All tray shall have 45 degree corners at all vertical and horizontal corners, tees and width change locations.
- .4 Cable tray to have a minimum cable loading depth of 114mm. Cable tray width to be a minimum of 305mm wide for communications, or as indicated on drawings

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- .5 Suspended tray supports to be trapeze style hangers of minimum 40mm square "Unistrut" supported from 9.5mm threaded rod hangers from preset or afterset concrete inserts or direct steel support.
 - .6 Barriers required where different systems are in same cable tray. Barriers to be continuous metal dividers for entire length of the tray.
 - .7 Fire Barrier Pillows to be self contained firestop product for use in through-penetration firestops. Product to achieve up to three (3) hours fire rating in accordance with ASTM E 814 tests.

2.3 CABLE TROUGH

- .1 Cabletroughs and fittings: to NEMA FG 1/VE 1 and CAN/CSA C22.1 No. 126.1/2.
- .2 Ladder Ventilated & Non Ventilated wire mesh type, Class A C1 to CAN/CSA C22.2 No.126.1/2.
- .3 Solid covers for complete cabletrough system including fittings.
- .4 Barriers required where different voltage systems are in same cabletrough.
- .5 Ground cable trays with bare copper conductor attached to each tray section in accordance with CEC requirements.
- .6 Provide fire stop material at firewall penetrations.

2.4 SUPPORTS

- .1 Provide splices and supports for a continuously grounded system as required.

Part 3 Execution

3.1 GENERAL INSTALLATION – POWER & COMMUNICATIONS

- .1 Cable trays are usually installed in the false ceiling space of hallways and located to keep conduit lengths to a minimum.
- .2 Provide cable tray in approximate location and general routing as shown on drawings.
- .3 Provide dropouts when cables exiting all horizontal cable trays.
- .4 Support suspended cable tray from trapeze style hangers with hangers spaced as recommended by the manufacturer based on a maximum load capacity for the tray. Support trays at all corners, offsets and tee fittings
- .5 Where shown and appropriate, support cable tray from wall using a cantilever support arrangement. Cable trays may be supported using wall mounted support on masonry walls or from the building steel only.
- .6 Generally Cable Trays shall be separated at a minimum 450mm from the adjacent wall unless otherwise indicated.
- .7 Cable tray location and mounting heights to be coordinated on site with other trades to provide minimum headroom and serviceability. Verify drawing details to allow for all services run in ceiling spaces. Provide vertical and horizontal offsets as required to suit job site conditions.

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- .8 Cable tray sections shall be joined by approved connector plates and rust-resistant (plated) hardware. Torque all hardware as per manufacturer's recommendations.
 - .9 Unless otherwise indicated, bond all cable tray with a minimum #6 AWG copper bonding conductor installed continuously within the full length of all cable trays. Securely connect the bond wire to the tray at each end and at a minimum of 15m intervals. Connect bonding conductor to the building ground system at one or both ends.
 - .10 Provide pulleys and rollers to install cables.
 - .11 Install ventilated type tray in corridors and as vertical risers. Where cable trays pass through solid walls and floors, trays shall be solid type with cover and shall extend a minimum of 450 mm on each side of the wall or floor.
 - .12 Where cable tray passes through fire separations install fire pillows as required to maintain proper fire rating.
 - .13 Cable tray may require installation of risers, bend, etc. to adjust tray up or down as well as sideways for the tray routing to fit within limits of space available, and to clear other services, ducts, pipes etc. along the route. Routing may be adjusted somewhat as necessary to enable installation of services under other trades. These field adjustments are to be done at no extra cost to the Departmental Representative.
 - .14 Where tray runs change elevation, trays shall overlay each other when manufactured waterfall assemblies can not be used. To prevent cables stress install drop-outs on the top tray when overlap method is to be used. Further, tray sections shall be coupled together to provide some rigidity. This coupling maybe made by using a short length of tray and adjustable elbows or may be coupled by means of common support rods at the tray overlap.
 - .15 Sharp metal edges in cable trays which could cut the cable shall be smoothed and the cable dressed away from these edges. Manufacturer surface imperfections shall be touched up with a cold galvanizing coating before installing cable.
 - .16 There shall be no wiring joints or splices within the cable tray.

3.2 INSTALLATION – COMMUNICATIONS

- .1 Use ventilated cable tray for Voice/Data service cable down drops in the Communication Rooms.
- .2 Cables shall be secured in place in tray with tie wraps where in horizontal runs and with cable clamps in vertical runs. Low tension cabling shall be secured to tray by use of Velcro style straps. Support cables routed vertically through a service riser with a basket type wire grip equal to Hubbell Kellems grip for power cables and data cables including fiber optic cables.
- .3 The “communications” cable tray system is for extra-low voltage cabling only. There shall be no cables within the tray that has a voltage exceeding 36V.
- .4 Power distribution conduits shall not be located within 200mm of the cable tray.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00 Common Work Results - Electrical.

Part 2 Products

2.1 WIREWAYS

- .1 Wireways and fittings: to CSA C22No.26.
- .2 Sheet steel with [hinged] [bolted] cover to give uninterrupted access.
- .3 Finish: baked grey enamel.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

- .1 Install wireways and auxiliary gutters.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter to full length of equipment.

END OF SECTION

Part 1 General

1.1 SYSTEM DESCRIPTION

- .1 The interior and exterior lighting shall be tied to and controlled by the existing lighting control system which currently controls lighting in existing Building G.
- .2 Low voltage control system designed to provide remote switching of lighting loads by use of:
 - .1 Low voltage momentary contact switches
 - .2 Control transformers
 - .3 Low voltage rectifiers
 - .4 Dimming switches
 - .5 Occupancy sensor lighting control
 - .6 Photosensitive daylighting control
 - .7 Interior lighting time clock control (tied into the existing lighting control panel and operate as per the interior lighting in the existing 'Building G').
 - .8 Exterior lighting combination time clock and photoelectric control (tied into the existing lighting control panel and operate as per the exterior lighting in the existing 'Building G').
 - .9 Manual switch control.

1.2 PRODUCT DATA

- .1 Submittal package: Submit shop drawings and product data as specified below in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide a composite wiring and/or schematic diagram of the complete lighting control system complete with all components, indicating relay panels, master switches, local switches, occupancy sensors and daylight sensors. Indicate the building location reference for all components.
- .3 Provide manufacturers catalogue sheets, specifications and installation instructions for all system components.

1.3 MANUFACTURERS

- .1 Shall have a minimum of 10 years experience in the manufacture of networked low voltage lighting control systems.

Part 2 Products

2.1 COMPONENTS

- .1 All system components shall be of the same manufacturer.
- .2 Designed for lighting control up to and including 600V 20 amp.
- .3 Certified to make or break under full rated load.
- .4 Cable sets consisting of starter cables, joiner cables, and control cables.

2.2 ENCLOSURES

- .1 Relay panel interiors shall be pre-assembled complete with the necessary relays, transformers and devices. Relay panels are wall mounted and shall have interiors separate from enclosure so as to permit easy mounting, conduit installation and wire pull to enclosures.
- .2 Quick change frames with pre-assembled relays, transformer rectification, multi-recessed control ports, and one power-in plug and five power-out receptacles.

2.3 FRAMES

- .1 Quick change frames are pre-installed into enclosure and complete with up to ten control ports, one power-in plug and five power-out receptacles.
 - .1 One power out receptacles is for circuit feeding unswitched.
 - .2 Each of 4 power-out receptacles is controlled using one low voltage switch kit and/or one occupancy sensor kit.
 - .3 The remaining two control ports are for connection to central computer.
 - .4 Additional ports for 24/15 volts are available for feeding the VAV's and or additional equipment.

2.4 REMOTE CONTROL SWITCHES

- .1 Single pole, double throw, momentary contact, standard duty, rated, 25 V, double push-button action with pilot lights.

2.5 CONTROL TRANSFORMER

- .1 Low voltage power Class 2, input 120 or 347VAC, 60 Hz, output 40 VA at 24 V steady draw.
- .2 Provide 120V circuit to power transformer from local emergency power panel.

2.6 SEQUENCES/SCANNERS

- .1 Provide programmable sequencers/scanners.
- .2 Provide scanners to suit quantity of relays (including spares) noted in Lighting Relay Schedules.

2.7 NETWORK MANAGER

- .1 Provide LAN/web-based interface for remote monitoring. Provide data outlet at lighting controls location in Electrical Room and connect to network manager.

2.8 DELAY TIMER

- .1 Provide 120V relay connected to local lighting circuit. Connect this relay to a Delay Timer and connect the delay timer output to the programmable scanner input to indicate power failure. In the event of a power failure, all lighting relays for circuits from Emergency Power Panel to be enabled.

2.9 DIMMING SWITCHES

- .1 Incandescent dimmers
 - .1 Full range dimmer designed to produce 0 to 100% brightness control by means of single slider.
 - .2 Advanced solid-state circuitry with silicon symmetrical switch.

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- .3 LED push button switch separate from slide to turn dimmer on/off.
 - .4 Rated: 1000 watts at 120V.
 - .5 Multi-location capability.
 - .6 Radio/TV interference filter.
 - .2 Electronic low voltage dimmers
 - .1 Full range dimmer designed to produce 0 to 100% brightness control by means of single slider.
 - .2 Advanced solid-state circuitry with silicon symmetrical switch.
 - .3 LED push button switch separate from slide to turn dimmer on/off.
 - .4 Rated: 425 watts.
 - .5 Multi-location capability.
 - .6 Radio/TV interference filter.

2.10 OCCUPANCY SENSOR LIGHTING CONTROLS

- .1 Wall mounted wall switch
 - .1 Dual technology, PIR and ultrasonic occupancy sensor.
 - .2 Adjustable delayed-off time setting 30 seconds to 30 minutes.
 - .3 180° field of view.
 - .4 120V or 347V supply as required.
- .2 Ceiling mounted controls 120V supply
 - .1 Dual technology, PIR and ultrasonic occupancy sensor.
 - .2 Adjustable delayed-off time setting 20 seconds to 15 minutes.
 - .3 360° field of view.
 - .4 120V supply.
 - .5 Built-in isolated relay.
- .3 Ceiling mounted controls 24V supply
 - .1 Dual technology, PIR and ultrasonic occupancy sensor.
 - .2 Adjustable delayed-off time setting 15 seconds to 30 minutes.
 - .3 360° field of view.
 - .4 24VDC supply.
 - .5 Built-in isolated relay.
 - .6 With range suitable for coverage area.

2.11 PHOTOSENSITIVE DAYLIGHTING CONTROL

- .1 Dimming Light Level Sensor
 - .1 Indoor ceiling mounted photosensor.
 - .2 Low voltage (0-10VDC) control signal, interfaces to Advance Mark VII or Motorola Helios T5 and T8 dimming ballasts to reduce light output in proportion to the amount of daylight sensed.
 - .3 0-10V automatic dimming.
 - .4 Adjustable set point settings.
 - .5 Closed loop operation.

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- .2 Light Level Switch
 - .1 Indoor ceiling or wall mounted photo conductive cell.
 - .2 Switches lights off when sufficient daylight is sensed.
 - .3 With range suitable for sensing area.

**2.12 EXTERIOR LIGHTING ELECTRONIC TIMECLOCK/PHOTOCELL CONTROL
L.V. RELAYS**

- .1 Microprocessor controlled low voltage lighting control panel with adjustments and indications built into face of controller.
- .2 Two output groups, each with three outputs (max two 20A relays per output) and two on/off momentary outputs.
- .3 Master override buttons built into the control panel.
- .4 Memory backup (7 days).
- .5 Astronomical Clock.
- .6 Complete with NEMA 1 enclosure with lockable door and transformer.
- .7 Remote photo sensor complete with weatherproof mounting package.

2.13 EXTERIOR LIGHTING COMBINATION TIMECLOCK AND PHOTOCELL CONTROL

- .1 Recessed mounted adjustable photocell capable of switching 1500 watt load.
- .2 365 day electronic timing control centre complete with photo control feature.
- .3 Time clock controls 3 circuits independently, complete with manual bypass switch for each circuit.
- .4 Complete with 24 hour reserve power timing mechanism.

2.14 INTERIOR LIGHTING TIMECLOCK CONTROL

- .1 Time clock controls 3 circuits independently, complete with manual bypass switch for each circuit.
- .2 Complete with 24 hour reserve power timing mechanism.

2.15 MANUAL CONTROL

- .1 Individual remote control switches as indicated.
- .2 Eight circuit manual master selector switch mounted in 100 mm square box with:
 - .1 Master lock-out switch
 - .2 Individual red jewelled pilot lights.
- .3 Nine circuit manual dial-type master selector.
- .4 Twelve circuit manual dial-type master selector.

Part 3 Execution

3.1 INSTALLATION

- .1 Install system panels and components at locations shown on the drawings and in strict accordance with manufacturer's instructions.

3.2 RELAY PANELS AND CONDUIT

- .1 Ensure that conduit for line voltage wires enters panel in line voltage areas and conduit for low voltage control wires enters panel on low voltage areas. Check manufacturer's drawings for location of line and low voltage areas.

3.3 DAYLIGHT SENSORS

- .1 Locate daylight sensors at locations indicated on the drawings and per manufacturer's recommendations for closed loop and open loop applications. Ensure there is no artificial light shining directly into the sensor head.
- .2 Adhere to manufacturer's recommendations for wiring and programming.

3.4 OCCUPANCY SENSORS

- .1 Locate sensors in rooms indicated on the drawings . Locate sensors so there are no objects blocking the infra red sensor from viewing all of the coverage area. Keep away from HVAC vents and direct light from light fixtures.
- .2 Dual technology, PIR and ultrasonic occupancy sensors shall be utilized.
- .3 Adhere to manufacturer's recommendations for location, wiring and programming.

3.5 LOW VOLTAGE WIRING

- .1 For low voltage wiring, provide wire type as recommended by the manufacturer.
- .2 Adhere to manufacturer's recommendations as to maximum wire length and maximum quantity of relays per switch.
- .3 Data line shall be #16 twisted pair Belden #8471 or equal. Data line switches require 2 pair #16 Belden #8472 or equal.

3.6 LINE VOLTAGE WIRING

- .1 Use wire gauges from #10AWG to #12AWG as appropriately sized for the circuit.
- .2 If a LonWorks system is being installed and being integrated with another LonWorks system the system integrator shall be responsible for setting up and programming the system.

3.7 FIELD QUALITY CONTROL

- .1 On completion of installation, manufacturer representative shall be notified to carry out site inspection and report any inconsistencies in the installation or system operation to the Departmental Representative. Corrections are to be implemented to comply with required installation and operational parameters defined in the drawings and specifications.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This Section specifies the materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

- .1 Use transformers of one manufacturer throughout the project.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No.47, Air Cooled Transformers (Dry Type).
 - .2 CSA C9, Dry Type Transformers.

1.3 PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal procedures.

Part 2 Products

2.1 STANDARD TRANSFORMERS

- .1 Type: ANN, 600 volts, 3 phase delta primary.
- .2 Primary taps: 2 x 2 1/2% full capacity taps above and 2 x 2 1/2% taps below the nominal voltage.
- .3 Secondary: 3 phase, 60 Hz 120V/208V 4 wire Y (see drawings for kVA rating). Electrostatic shielded grounded star secondary.
- .4 Class H, 220°C insulation with temperature rise not exceeding 115°C maximum in 40°C ambient.
- .5 K rating: minimum K-13.
- .6 Efficiency: Energy Star rating & NEMA Premium
- .7 Basic Impulse Level (BIL): standard.
- .8 Hipot: standard.
- .9 Windings: High grade aluminum or copper windings, VPE or VPI type.
- .10 Impedance: per ANSI recommendations but must not be less than 4%.
- .11 Average Sound Level: Noise emission shall not exceed requirements per ST20 standard.
- .12 Impedance at 170 degrees C: standard.
- .13 Enclosure: air ventilated EEMAC 1, removable metal front panel "sprinkler-proof" design. Provide angled louvres for ventilation slots to prevent entrance of water from the sprinkler fire protection system. Air cooled type, natural circulation in ventilated enclosure.
- .14 Mounting: provide external vibration isolator kit. Provide "Super W Pads" Neoprene.

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- .15 Finish: in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .16 Scott-T connected transformers not acceptable.

Part 3 Execution

3.1 MOUNTING

- .1 Mount dry type transformers on floor unless otherwise noted on drawings.
- .2 Provide 100 mm concrete house-keeping base pad unless otherwise detailed.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Provide wonderboard or approved alternate if installed closer than 300mm from any combustible surface.

3.2 CONNECTIONS

- .1 Make primary and secondary connections in accordance with the manufactures diagrams.
- .2 Check all factory connections for correct tightness before energization.
- .3 Torque the building system wiring transformer connections using a torque wrench set to the manufacturers recommended settings. Note the torque setting on the equipment identification label for future maintenance reference.
- .4 All external wiring connections to transformer casing shall be enclosed in flexible conduit. Typically minimum 900mm flex to minimize vibration transmission to building structure.
- .5 Conduit to only enter transformers within the bottom third of the transformer casing, to minimize heat transfer to conduit.
- .6 Energize transformers immediately after installation is completed, where practicable.

3.3 EQUIPMENT IDENTIFICATION

- .1 Size 7 label in accordance with Section 26 05 00.
- .2 Include the transformer identification (as indicted on the project drawings), primary power source equipment designation, equipment served and torque setting of connections. E.g. Transformer T1, served from CDPH-1, serving CDPL-1, Cable Connection Torque x Nm.

3.4 GROUNDING

- .1 Provide a ground conductor with all feeder runs to dry type transformer installations. The ground shall be either green insulated or identified and connected as a ground to the ground pad in the transformer enclosure and then to the secondary neutral of the transformer. From the transformer ground pad

make cable connection to non-current carrying ground of the distribution centre or panel supplied from transformer.

END OF SECTION

Part 1 General

1.1 PRODUCT INFORMATION

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- .3 Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

1.2 PLANT ASSEMBLY

- .1 Install circuit breakers in panelboards before shipment from plant.
- .2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .3 All panelboards to be of a common manufacturer.

1.3 FINISH

- .1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Panel finish to be standard ASA Grey baked enamel. Confirm with Departmental Representative prior to shop finishing panels.

Part 2 Products

2.1 PANELBOARDS, DOORS AND TRIMS

- .1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.
- .2 Bus and breakers unless otherwise indicated on the drawings and in the specifications, shall be rated for:
 - .1 Minimum 10 kA at 208Y/120V.
 - .2 Minimum 22 kA at 600Y/347V.
- .3 Tin plated aluminum bus with full size neutral.
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.
- .5 Mains capacity, number of circuits and number and size of branch circuit breakers as indicated.
- .6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.
- .7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.
- .8 Panelboards to have flush doors.

- .9 Provide two keys for each panelboard and key similar voltage and system panelboards alike.
- .10 Panel tubs to be typically 600mm wide.
- .11 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.
- .12 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.

2.2 BREAKERS

- .1 For Power Distribution Panelboards: Bolt on type molded case, adjustable and interchangeable trip, single, two and three pole, 120/208V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard.
- .3 Main breaker (where required) to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.
- .5 Provide minimum 10% spare breakers.
- .6 Provide breaker type Ground Fault Interrupter(s) (GFI) as indicated.

2.3 PANELBOARD IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.
- .3 Complete updated circuit directory with typewritten cards located in slide-in plastic pocket fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.
- .4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.
- .2 Mount panelboards to height given in Section 26 05 00 or as indicated.
- .3 Connect loads to circuits as indicated.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 330 00 – Submittal Procedures.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush Mounted Wiring Devices.
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General Use Snap Switches.

Part 2 Products

2.1 SWITCHES

- .1 Heavy duty commercial grade.
- .2 20 A, 120 V or 347 V, single pole, double pole, three-way, four-way switches as indicated.
- .3 Manually-operated general purpose ac switches as indicated and with following features:
 - .1 Terminal holes approved for No.10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle (red toggle for emergency power circuits).
- .4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rating capacity of motor loads.
- .5 Switches of one manufacturer throughout project.
- .6 Standards of acceptance: Specification grade.

2.2 RECEPTACLES – GENERAL

- .1 Heavy duty commercial grade.
- .2 Duplex receptacles, CSA type L5-15 R, 125 V, 15 A, U ground, with following features:
 - .1 White nylon 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 non riveted grounding contacts.

- .3 Receptacles of one manufacturer throughout project.
- .4 Standards of acceptance: Specification grade.

2.3 RECEPTACLES – PARTICULAR APPLICATION

- .1 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button. Equal to Specification grade.
- .2 All other single outlet and special purpose receptacles to be equal to Specification grade. Confirm ampacity, voltage and pin configuration prior to installation.

2.4 COVER PLATES

- .1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. Outlets in labs or as indicated in the drawings or specifications.
- .2 Steel: sheet steel hot dip galvanized with rolled edges for surface mounted utility boxes.
- .3 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.
- .4 All plates to be beveled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.
- .5 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Cover plates to fasten to box by four screws.
- .7 Gaskets: resilient rubber or close cell foam urethane.
- .8 Cover plates for all wiring devices to be from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.
- .2 All plates to be installed parallel or perpendicular to building lines.

3.2 INSTALLATION PARTICULAR

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Receptacles:

- .1 Install all receptacles in the vertical plane unless otherwise noted.
- .2 Generally install the L5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.
- .3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.
- .4 Where split receptacles has one portion switched, mount vertically and switch the upper portion.
- .5 Ground fault interrupter duplex receptacles to be used, where shown on the drawings.
- .3 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure to CAN/CSA C22.2 No.4.
- .2 Provision for padlocking in off switch position by locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuseholders: to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CAN/CSA C22.1-09, Canadian Electrical Code, Part I.
- .2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

1.2 ADDITION OF ACCEPTABLE MANUFACTURERS

- .1 See Section 26 05 00 subsection 1.23.7.

1.3 PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.

1.4 INTENT

- .1 Provide lighting fixtures and accessories for all outlets as listed in the Luminaire Schedule and as shown on drawings.
- .2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.
- .3 Ground all lighting equipment to grounding system.
- .4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.
- .5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

Part 2 Products

2.1 LED DRIVERS

- .1 Electronic type
- .2 Thermally protected
- .3 Dimmable to 20% minimum output

2.2 LUMINAIRES

- .1 Accessories and components shall comply with relevant CSA Standards.
 - .2 All fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools for cleaning.
 - .3 Fixtures shall incorporate adequate gasketting, stops and barriers to form light traps and prevent light leaks.
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- .4 Fixtures shall be designed for adequate dissipation of ballast and lamp heat to avoid short ballast life, nuisance thermal tripping and decreased lamp output.
 - .5 Construction of all fixtures shall be such as to provide a rigid well aligned fixture. Formed or ribbed backplates, end plates, reinforcing channel, heavy gauge sockets, straps, etc., shall be used where required to accomplish this.
 - .6 The construction and performance of all LED fixtures shall be subject to the acceptance of the Departmental Representative. Full photometric data from independent testing laboratory shall be provided when requested by the Departmental Representative.

Part 3 Execution

3.1 INSTALLATION AND SUPPORTS

- .1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.
- .2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
- .3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.
- .4 Self aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.
- .5 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Luminaire Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.
- .6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.
- .7 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.

END OF SECTION

Part 1 **General**

1.1 SECTION INCLUDES

- .1 This section specifies materials and installation for exit signs complete with directional arrows.

1.2 TYPE OF EXIT SIGN

- .1 Install specification grade LED type exit signs in general public areas where indicated on drawings.
- .2 Install specification grade weatherproof LED type exit signs where designated 'WP' where indicated on drawings.

1.3 PRODUCT DATA

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

Part 2 **Products**

2.1 EXIT SIGN TYPES

- .1 General Public Areas:
 - .1 Thin line, LED type with white finish thermoplastic housing.
- .2 All exit signs shall comply with CAN/CSA C860.
- .3 Exit signs shall be complete with 10 year warranty.

2.2 MOUNTING TYPE

- .1 Exit signs to be suitable for universal mounting. Allow for exit signs to be mounted as to best suit ceiling/wall type and architectural features:
 - .1 surface wall mounted
 - .2 end wall mounted double face
 - .3 recessed wall mounted
 - .4 ceiling mounted single face
 - .5 ceiling mounted double face
- .2 Exit signs to have direction arrows where indicated.
- .3 Provide steel rod pendant supports for exit signs to mount to +3.5m A.F.F. in high ceiling areas as required.

Part 3 **Execution**

3.1 INSTALLATION

- .1 Install exit signs as shown on plans complete with double face units where indicated.

- .2 Connect to life safety emergency power circuit as indicated on the plans.
- .3 Exit signs must be clear of all visual obstruction.

3.2 LOCATION

- .1 Review locations of exit signs with Departmental Representative to ensure effectiveness and compatibility with decor before rough in. Failure to do so may result in relocation at no extra charge to the project.

3.3 MOUNTING HEIGHT

- .1 Wall mounted signs shall be clear above doors and, if space allows, 2.4 metres to centre, but with 25mm clearance of ceiling.
- .2 Ceiling mounted signs shall be mounted directly on ceiling, unless it is obstructed from view. Stem mount using two fixture rods (9.5mm white smooth type).

3.4 SPARE

- .1 Provide quantity of two (2) spare exit signs and allow for installation to within 5 meter radius of nearest exit sign shown on plans to suit final fit-up requirements.

END OF SECTION

1 General

1.1 OVERVIEW

- 1.1.1 The telecommunications wiring infrastructure (Cable Plant) shall serve as an information transport system for analog voice, voice over IP (VoIP), data (LAN) and video signals distributed throughout a building from designated demarcation points to telecommunication outlets placed at various locations specific to each project.
- 1.1.2 Fibre and copper backbone shall provide connectivity between the ER and each TR.
- 1.1.3 All cables and terminations of the Cable Plant shall be identified and labeled at all locations. All cables shall be labeled in an alpha-numeric scheme at all termination locations. All terminations shall comply with requirements of EIA /TIA-568A standard (and all associated addenda), and shall be tested for Category 6 performance.

1.2 SCOPE OF WORK

- 1.2.1 Include detailed design, manufacturer, supply, installation, inspection and testing of communications wiring infrastructure and items contained within as described in these performance specifications and summarized in the following elements of the work:
 - 1.2.1.1 Section 27 05 26 – Grounding and Bonding
 - 1.2.1.2 Section 27 05 28 – Interior Pathways
 - 1.2.1.3 Section 27 05 53 – Identification
 - 1.2.1.4 Section 27 11 00 – Communications Equipment Rooms and Fittings
 - 1.2.1.5 Section 27 13 10 – Backbone Cabling
 - 1.2.1.6 Section 27 15 00 – Communication Cable Inside Buildings

1.3 DEFINITION OF TERMS

- 1.3.1 The following abbreviations may be used within this specification document and in the drawings.
 - 1.3.1.1 ANSI: American National Standards Institute
 - 1.3.1.2 ASTM: American Society for Testing and Materials
 - 1.3.1.3 BICSI: Building Industry Consulting Service International
 - 1.3.1.4 ATV: Cable TV
 - 1.3.1.5 CP: Consolidation Point
 - 1.3.1.6 CSA: Canadian Standards Association - equipment safety approvals and testing for Canada
 - 1.3.1.7 EF: Entrance Facility
 - 1.3.1.8 EGB: Electrical Ground Breaker
 - 1.3.1.9 EIA: Electronic Industries Association
 - 1.3.1.10 ER: Equipment Room
 - 1.3.1.11 ETL: ETL Testing Laboratories – product testing laboratory for U.S. and Canada
 - 1.3.1.12 FDC: Fibre Distribution Centre (fibre splice tray or termination tray)
 - 1.3.1.13 IDF: Intermediate Distribution Frame
 - 1.3.1.14 IEEE: Institute of Electrical and Electronic Engineers

- 1.3.1.15 ISO: International Standards Organization
- 1.3.1.16 MEGB: Main Electrical Ground Busbar
- 1.3.1.17 NEMA: National Electrical Manufacturer's Association
- 1.3.1.18 TGB: Telecommunications Ground Busbar
- 1.3.1.19 TR: Telecommunications Room
- 1.3.1.20 TMGB: Telecommunications Main Ground Busbar.
- 1.3.1.21 TO: Telecommunications Outlet
- 1.3.1.22 ULC: Underwriters Laboratories of Canada - testing laboratory for Canada (see C-UL and UL)
- 1.3.1.23 UTP: Unshielded Twisted Pair
- 1.3.1.24 WA: Work Area

1.4 REFERENCES STANDARDS

- 1.4.1 Design, manufacturer, supply, installation, inspection and testing of communications wiring infrastructure and related items shall comply with the following codes and standards in their latest draft including all addendum, unless otherwise stated:

- 1.4.1.1 Canadian Electric Code
- 1.4.1.2 BC Building Code
- 1.4.1.3 ANSI/TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard Part 1 – General Requirements
- 1.4.1.4 ANSI/TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard Part 2 – Balanced Twisted Pair Cabling Components Cabling
- 1.4.1.5 ANSI/TIA/EIA-568-B.3 - Commercial Building Telecommunications Standard Part 3 – Optical Fibre Cable Components Standard
- 1.4.1.6 ANSI/TIA/EIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces
- 1.4.1.7 ANSI/TIA/EIA-606-A - Administration Standard for the Commercial Telecommunications Infrastructure
- 1.4.1.8 TIA J-STD-607-A – Commercial Building Grounding and Bonding Requirements for Telecommunications
- 1.4.1.9 IEEE 802.11 series of Wireless Standards
- 1.4.1.10 IEEE 802.3 series of Ethernet Standards
- 1.4.1.11 ISO 8802-3 series of Standards
- 1.4.1.12 BICSI – Information Technology Systems Installation Methods Manual (IT'S IMM).
- 1.4.1.13 Canadian Electrical Code (CEC) Part 1 C22.1 including B.C. Amendment and Regulation
- 1.4.1.14 WorkSafe BC
- 1.4.1.15 British Columbia Building Code
- 1.4.1.16 UL Cable Certification Program
- 1.4.1.17 NEMA
- 1.4.1.18 ASTM
- 1.4.1.19 UL Testing Bulletin
- 1.4.1.20 TIA/EIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
- 1.4.1.21 TIA/EIA-568-C.1 Commercial Building Telecommunication Standard
- 1.4.1.22 TIA/EIA-568-C-2 Balanced Twisted-Pair Telecommunications Cabling and Component Standards
- 1.4.1.23 TIA/EIA-568-C-3 Optical Fibre Cabling Components
- 1.4.1.24 TIA/EIA-569-B Commercial Building Standard for Telecommunication Pathways and Spaces

- 1.4.1.25 TIA/EIA-606-A Administration Standard for Commercial Telecommunication Infrastructure of Commercial Buildings
- 1.4.1.26 TIA/EIA-758-A Customer-Departmental Representative Outside Plant Telecommunications Infrastructure Standard
- 1.4.1.27 TIA/EIA-942 Telecommunications Infrastructure Standard for Data Centres
- 1.4.1.28 CSA-T527 Grounding and Bonding for Telecommunications in Commercial Buildings
- 1.4.1.29 TIA/EIA-492CAA Detail Specification for Class Iva Dispersion-Unshifted Singlemode Optical Fibre
- 1.4.1.30 TIA/EIA-492AAAC-A Detail Specification for 850-nm Laser Optimized, 50-um Core Diameter/ 125-um Cladding Diameter Class Ia Grade-Index Optical Fibre
- 1.4.1.31 TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fibre Cable Plant
- 1.4.1.32 TIA-526-14A Measurement of Optical Power Loss of Installed Multimode Fibre Cable Plant
- 1.4.1.33 IEEE 802.3af, Power over Ethernet (PoE) Standard
- 1.4.1.34 IEEE 802.3at, Power over Ethernet + (Plus) Standard
- 1.4.1.35 IEEE 802.3an, Physical Layer and Management Parameters for 10 Gbps Operation, Type 10GBASE-T
- 1.4.1.36 IEEE 802.11, Wireless Standard
- 1.4.1.37 BICSI – Telecommunication Distribution Methods Manual
- 1.4.1.38 BICSI – Information Transport Systems Installation Manual
- 1.4.1.39 BICSI – Customer-Departmental Representative Outside Plant Design Manual

1.5 APPLICATION STANDARDS

- 1.5.1 Applications standards supported should include, but not be limited to, IEEE 802.3, IEEE 802.11, 10/100/1000 BASE-T up to 100m (328 feet), IEEE 802.5, 250MHZ. The 100-meter distance limit includes a maximum 90 meter of horizontal copper cable length between the patch panel and user outlet jack + 10 meters for the patch cords.

1.6 APPROVED MANUFACTURER

- 1.6.1 All signal carrying components (connectors, cabling, panels etc.) of the structured cabling systems for telecommunication system provisions shall be from a single manufacturer.
- 1.6.2 Approved cabling manufacturers are Belden, Panduit, and Commscope.
- 1.6.3 Match existing cable and connectivity manufacturer for renovations.

1.7 CONTRACTOR QUALIFICATIONS

- 1.7.1 Contractor shall hold current manufacturer's certification and shall employ manufacturer- certified and trained staff to perform installation of the cabling system.

2 Definition of Terms

- 2.1.1.1 The following abbreviations may have been used within these documents and standard drawings.

- 2.1.1.1.1 AFF Above Finished Floor
- 2.1.1.1.2 AHJ Authority Having Jurisdiction
- 2.1.1.1.3 AWG: American Wire Gauge
- 2.1.1.1.4 BICSI: Information Transportation Systems Association
- 2.1.1.1.5 BACnet: Building Automation Data Communications Protocol
- 2.1.1.1.6 CATV: Cable Television/Satellite Television
- 2.1.1.1.7 CCTV: Closed Circuit Television
- 2.1.1.1.8 COMM: Communications
- 2.1.1.1.9 CP: Consolidation Point
- 2.1.1.1.10CSA: Canadian Standards Association
- 2.1.1.1.11EIA: Electronic Industries Association
- 2.1.1.1.12ESBC: Electrical Service Bonding Conductor
- 2.1.1.1.13IEEE: Institute of Electrical and Electronic Engineers
- 2.1.1.1.14IP: Internet Protocol
- 2.1.1.1.15OTDR: Optical Time Domain Reflectometer
- 2.1.1.1.16POE: Power Over Ethernet
- 2.1.1.1.17SRG: Signal Reference Grid
- 2.1.1.1.18TIA: Telecommunications Industry Alliance
- 2.1.1.1.19TBB: Telecommunications bonding Backbone
- 2.1.1.1.20TEBC: Telecommunications Equipment Bonding Conductor
- 2.1.1.1.21TGB: Telecommunications Grounding Busbar
- 2.1.1.1.22TMGB: Telecommunications Main Grounding Busbar
- 2.1.1.1.23TYP: Typical
- 2.1.1.1.24ULC: Underwriters Laboratories of Canada
- 2.1.1.1.25UTP: Unshielded Twisted Pair
- 2.1.1.1.26U/FTP: Shielded Twisted Pair
- 2.1.1.1.27VOIP: Voice over Internet Protocol

3 Quality Assurance

3.1 QUALITY ASSURANCE

- 3.1.1 The Installer shall be an employee of the Contractor and/or authorized sub-contractor. Submit a copy of the manufacturers training certificate to the on-site telecommunications project manager with the tender package.
- 3.1.2 Manufacturer refers to the company that manufactures the components and is responsible for the design and installation guidelines used by the Contractor to complete this cabling system installation. The manufacturer along with the Contractor is responsible for the final warranty and certification of the installation and application assurance.
- 3.1.3 All cabling, termination hardware, and connecting cords shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.
- 3.1.4 The contractor shall accept complete responsibility for the installation, certification, and support of the cabling system. Contractor shall show proof that it has the certifying manufacturer's support on all of these issues.
- 3.1.5 All work shall be performed and supervised by Telecommunications Technicians who are qualified to install voice, data & multimedia cabling systems and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.

3.1.6 The Telecommunications Technicians employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the vendor is a current certified installer of the manufacturer must be provided in writing prior to work commencing on the structured cabling of the building.

3.1.7 The contractor (including subcontractors if any) shall have a proven 7-year track record in projects of similar nature.

3.2 PERMITS

3.2.1 Contractor shall obtain and pay for all permits and inspections by Authority Having Jurisdiction as required by local authorities to commence, execute and substantially complete work.

3.3 DAMAGE

3.3.1 Where existing structure, grade or paving has to be removed, altered or otherwise defaced to facilitate communication installation, Contractor shall arrange for breaking of openings or grooves in any building structure or breaking of pavement and/or digging of trenches

3.3.2 Any equipment, structure, pavement or grade damaged by the execution of this Contract will be repaired to its original condition. Any cost incurred for such work shall be allowed for in tender sum.

3.3.3 Irreparably damaged equipment, structures, walls, surfaces etc. shall be replaced at no cost to the Departmental Representative.

3.3.4 If the finish of new equipment, structures, walls, surfaces etc. damaged by this contractor, the contractor, at the discretion of the Departmental Representative, shall either replace or restore the equipment, structures, walls, surfaces etc. to its original condition by re-spraying, refinishing, etc. at no cost to the Departmental Representative.

3.3.5 Openings and conduits shall not be burned into panels. Oversized openings shall not be patched up with loose plates or oversized washers. Oversized openings will be considered damaged to the equipment and are to be treated as specified above.

3.3.6 The Contractor shall use extreme care when working near existing services and any services disturbed will be replaced at his cost to the satisfaction of the Consultant.

3.3.7 Contractor shall determine the location of the existing underground services from the Authorities Having Jurisdiction and/or Departmental before excavation of existing grade and sub-grade, or new construction begins.

3.4 NOT IN CONTRACT

3.4.1 Supply and installation of computers, servers, switches, routers and wireless access points are not in this contract and shall be provided by others.

3.5 WARRANTY AND CERTIFICATION

- 3.5.1 Contractor shall provide a one year Labour Warranty for the entire installation to guarantee against substandard installation practices based on the installation guidelines outlined in codes and standards listed. The warranty shall commence from the date final acceptance.
- 3.5.2 Contractor shall provide a one year Product Warranty for the entire installation. The warranty shall commence from the date of final acceptance.
- 3.5.3 Contractor shall provide a twenty-five-year performance guarantee and certification on all non-consumable products installed.

3.6 MANUFACTURER'S CABLING SYSTEM PERFORMANCE WARRANTY

- 3.6.1 A system performance warranty shall be issued to guarantee that the telecommunications wiring infrastructure shall support up to, but not be limited to, 10/100/1000G Base-T applications.
- 3.6.2 All cabling products and workmanship must include coverage as follows:
 - 3.6.2.1 System Performance Warranty to Category 6 Standards from manufacturer;
- 3.6.3 System Performance Warranty certificate must be provided by the subject warranty manufacturer;
- 3.6.4 The System Performance Warranty term will be as provided by the warranty underwriting manufacturer, from the date of final acceptance of the project;
- 3.6.5 The name and address of the building/facility and location of the site must appear on the warranty document;
- 3.6.6 The Contractor must be fully approved and certified by the proposed warranty underwriting manufacturer prior to responding to the bid;
- 3.6.7 Testing shall be performed by telecommunications technicians who are qualified and certified by the manufacturer to perform related tests as required by the manufacturer in accordance with the manufacturer's methods

3.7 CLEANING

- 3.7.1 Contractor shall leave the site every day in a clean and safe manor.
- 3.7.2 Contractor shall remove all debris, surplus material and all tools.

3.8 CONSTRUCTION SUBMITTALS

- 3.8.1 The contractor shall submit directly to the IT Department a PDF copy of all shop drawings relating to communications infrastructure, including but not limited to:
 - 3.8.1.1 Copper Cable
 - 3.8.1.2 Fibre Optic Cable
 - 3.8.1.3 Patch Panels
 - 3.8.1.4 Jacks
 - 3.8.1.5 Patch Cords
 - 3.8.1.6 Racks and all related accessories

- 3.8.1.7 Rack mount UPS and all related accessories
- 3.8.1.8 Consolidation Points
- 3.8.1.9 Cable Tray
- 3.8.1.10 J-Hook
- 3.8.1.11 Faceplates

- 3.8.2 The contractor shall receive written approval from consultant of these shop drawings before purchasing or installation.

- 3.9 SUBSTANTIAL SUBMITTALS
 - 3.9.1 The contractor shall submit directly to the consultant an electronic copy of the maintenance manuals which shall contain the following documents:
 - 3.9.1.1 Contractors name, address and telephone numbers.
 - 3.9.1.2 Neatly type written table of contents arranged in a systematic order
 - 3.9.1.3 All communication infrastructure shop drawings
 - 3.9.1.4 Warranty and Certification Certificates
 - 3.9.1.5 Test results of all cable installations
 - 3.9.1.6 As built drawings in PDF and AutoCAD format – showing accurate riser diagrams, room layouts, rack layouts and floor plans indicating all outlets with associated outlet labels.

END OF SECTION

1 General

1.1 SECTION INCLUDES

1.1.1 This section specifies the materials and installation for interior pathways for communications systems.

1.2 SCOPE

1.2.1 Provide a Certified Cable Tray System for the system described in these specifications.

2 Design and Performance Requirements

2.1.1 All pathways shall be sized with 50% spare capacity, based on a 40% fill ratio.

2.1.2 All pathways shall avoid potential sources of electromagnetic interference by maintaining clearances of at least:

2.1.2.1 305 mm from fluorescent ballasts

2.1.2.2 305 mm from electrical power distribution conduit and cable, less than 1kV

2.1.2.3 1000 mm from electrical power distribution conduit and cable, more than 1kV.

2.1.2.4 1220 mm from motors and transformers.

2.1.2.5 305 mm from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and power distribution and conduits.

2.1.2.6 305 mm from HVAC equipment, ducts and pipes

2.1.3 Communication pathways shall never be occupied by any system, other than IT related communications.

2.1.4 Communication pathways shall never be routed through rooms containing large amounts of heat above average room temperature or sources of EMI such as mechanical rooms.

2.1.5 Cable Trays for communications systems:

2.1.5.1 Cable trays shall be provided to serve as the major pathway for all communications cabling.

2.1.5.2 Cable trays shall meet current national and local standards for manufacture and installation.

2.1.5.3 Cable trays shall be galvanized steel ventilated ladder type – CSA C22.2 No. 126 Class C1 (latest version) c/w fittings and be manufactured to NEMA classification standards. Minimum dimensions: 150mm (6") max rung spacing, 100mm (4") high and 400mm (17 5/8") width c/w barrier and side rails unless otherwise noted.

2.1.5.4 Where cable tray requires pass through walls, solid tray section c/w minimum 400mm (17 5/8") on each side of the wall shall be provided.

2.1.5.5 Cable tray shall be sized to 400mm wide when installed within the ceiling and 530mm when installed within a raised floor. Run cable tray in a continuous run to each consolidation point location.

2.1.5.6 Cable shall pass through into the communication rooms from the cable tray with the use of an appropriately rated re-enterable firestop sized to match cable tray capacity.

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- 2.1.5.7 All ceiling mounted cable tray inner corners shall consist of a 45 degree angle not a 90 degree angle. In corridors a sweep bend shall be used consisting of a 500 mm radius.
 - 2.1.5.8 All raised floor mounted cable tray inner corners shall come with a Bend Radius Control Corner. All cable tray corner sections and sections adjacent to consolidations points shall be a flat Universal Intersection with no side rails.
 - 2.1.5.9 Cable trays installed within a ceiling space shall be installed a minimum of 75 mm above T-bar ceilings and have a minimum of 150 mm of clear space above the cable tray and a minimum of 300 mm of clear space on one side of the cable tray.
 - 2.1.5.10 Cable trays installed within a ceiling space shall be supported at both ends of each 3m section, 600 mm from the ends with Unistrut and threaded rods. Should it be possible for cable to come into contact with the threaded rod, the rod shall be sleeved to protect the cable from damage.
 - 2.1.5.11 Cable trays installed within a raised floor shall be installed 50 mm below the floor panel and shall always be installed over obstacles such as mechanical duct and never under.
 - 2.1.5.12 Whenever cable transitions from one elevation to another, a cable drop-out (water fall) accessory shall be provided or a piece of cable tray shall be field modified to achieve the same result.
- 2.1.6 Conduit and boxes shall be installed as follows:
- 2.1.6.1 The minimum size of communications back box shall be a 103mm x 103mm (4"x4"), 90mm (3 5/8") deep flush- mounted box c/w single gang mud-ring.
 - 2.1.6.2 Mounting heights shall be 300mm (12") AFF and 150mm (6") above counter tops.
 - 2.1.6.3 The minimum size conduits extending from each communications back box shall be 27mm (1") EMT conduit c/w pull string to nearest major cable pathway accessible ceiling or floor space.
 - 2.1.6.4 Surface raceway such as Wiremold containing outlets shall have a depth of 90mm.
 - 2.1.6.5 A minimum of one 27 mm diameter conduit shall run from the outlet box to the cable tray. A conduit run shall serve no more than one outlet box and shall not be daisy chained.
 - 2.1.6.6 If conduit has an internal diameter of 50 mm or less then the bend radius shall be at least six times the internal diameter. If conduit has an internal diameter of more than 50 mm then the bend radius shall be at least ten times the internal diameter.
 - 2.1.6.7 The maximum number of bends between cable pull boxes in a conduit run shall be two 90° bends.
 - 2.1.6.8 Conduit runs shall have no continuous sections longer than 30m between pull boxes.
 - 2.1.6.9 If a conduit run requires a reverse bend between 100° and 180° then a pull box shall be inserted into the bend but shall not be used as the bend.
 - 2.1.6.10 Pull boxes shall be adequately sized for the radius of the connecting conduits and the manufacturer's specified cable bend radius.
 - 2.1.6.11 Pull boxes shall be installed in fully accessible spaces.
 - 2.1.6.12 Support and secure all boxes independent of the conduit connected thereto.
 - 2.1.6.13 All conduit ends shall be protected by insulating bushings.

- 2.1.6.14 Use only manufacturer approved cable lubricants. Any excess lubricant shall be cleaned so as to leave conduit exteriors suitable for painting.
- 2.1.6.15 All conduits shall be left with a nylon pull string installed.

2.1.7 Hangers and Supports for Communications Systems

- 2.1.7.1 J-hooks shall be provided for all miscellaneous cable support where cable tray is not provided or accessible for both in-ceiling or under raised floor applications.
- 2.1.7.2 J-hook size shall be based on the number of cables it will hold plus expansion.
- 2.1.7.3 J-hooks shall be spaced at intervals of 1200mm (47 1/4") O.C. with maximum cable sag of 305mm (12").
- 2.1.7.4 Mounting the support brackets or hangers to suspended ceiling drop wires shall be unacceptable. Each J-hook shall have an independent support or bracket.
- 2.1.7.5 Within telecommunications rooms, cables shall be supported by J-hooks at maximum 600mm (23 5/8") intervals.

2.1.8 Surface Raceways for Communications

- 2.1.8.1 Shall have the capability for containing both, power and communications cabling and have a metallic barrier between them.
- 2.1.8.2 Shall be CSA approved.

2.1.9 Entrance and Riser Conduits

- 2.1.9.1 Entrance ducts shall be minimum (3) 100mm (4") ducts with no more than (2) 90-degree bends.
- 2.1.9.2 Riser and riser sleeve conduits shall be minimum (3) 100mm (4") conduits c/w bushings between each vertically aligned TR.

3 Products

3.1 CEILING SPACE CABLE TRAY

- 3.1.1 Obtain cable tray components through one source from a single manufacturer.
- 3.1.2 Cable tray shall have the following characteristics:
 - 3.1.2.1 Continuous, rigid, welded steel wire
 - 3.1.2.2 Continuous T-weld on top rail of tray
 - 3.1.2.3 All cable trays shall be purchased in 3m straight sections
 - 3.1.2.4 Finish: electroplated zinc coating
 - 3.1.2.5 Accessories shall include: drop-outs (water falls), splice kits and mounting kits.

END OF SECTION

1 General

1.1 SECTION INCLUDES

1.1.1 This section specifies the materials and installation of Identification labeling for communications systems.

1.2 SCOPE

1.2.1 The scope of work included within the section includes identification and administration of an end-to-end structured cabling system and its pathways and spaces.

1.2.2 Identification of voice and data cables and outlets shall be as per the scheme used in the existing part of the building, and in coordination with CSC IT.

2 Design and Performance Requirements

2.1.1 Labeling shall be in accordance with the following:

2.1.1.1 Labeling and administration shall adhere to EIA/TIA 606A labeling Standard.

2.1.1.2 All identification labels shall be uniform and made using a mechanically imprinted label (e.g. Brother P-Touch Type label). All cable labels shall have black lettering (approx. 3mm high) on white background. Hand written labels shall not be accepted.

2.1.1.3 All telecommunications cabling (horizontal and backbone), faceplate/connectors, patch panels, cross-connects, racks, cabinets, grounding and bonding, etc. shall be labeled.

2.1.1.4 All Identification markings shall be uniform for each type of system.

2.1.1.5 Horizontal cables and Faceplate Port Identification

2.1.1.6 Patch Panel Identification: Shall match existing facility labeling scheme.

2.1.1.6.1 All patch panels shall be numbered sequentially from top to bottom (i.e., P1, P2, P3, etc.).

2.1.1.6.2 Ports within patch panel shall follow a similar labeling convention to that of the horizontal cabling excluding the telecommunications room identifier.

2.1.1.7 Rack Identification

2.1.1.7.1 All racks shall be numbered sequentially (i.e. R1, R2, R3, etc.)

2.1.1.8 Backbone cable Identification

2.1.1.8.1 Inter-building Convention: Shall match existing facility labeling scheme.

2.1.1.9 Grounding and Bonding Identification

2.1.1.9.1 The Telecommunications Main Ground Bus bar shall be labeled with TMGB.

2.1.1.9.2 The Telecommunications Ground Bus bar in each telecommunications space shall have the following convention: TR-TGB (where TR = Telecommunications Room ID)

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- 2.1.1.10 A wiring record (spreadsheet or table) shall be provided containing the following information:
 - 2.1.1.10.1 Identification label/numbers for patch panel port jacks
 - 2.1.1.10.2 Cable pair-to-pin assignment for each port
 - 2.1.1.10.3 Cable length for each cable
 - 2.1.1.10.4 The cable pairs to pin assignment for each telecommunication outlet.
 - 2.1.1.10.5 A complete legend on how to read the cable identification system
 - 2.1.1.11 Cable labels shall be vinyl construction with a white printing area and a clear tail that self-laminates the printed area when wrapped around the cable. The clear area should be of sufficient length to wrap around the cable at least 1.5 times.
 - 2.1.1.12 Vinyl identification labels shall appear on the following locations with the designations indicated on the cable schedule and drawings:
 - 2.1.1.12.1 Outlet identification on both ends of every cable
 - 2.1.1.12.2 Outlet identification on the front of all faceplates
 - 2.1.1.12.3 Port identification on the front of all patch panels
 - 2.1.1.12.4 Panel identification on the front middle of all patch panels
 - 2.1.1.12.5 Pair identification on the front of termination fields
 - 2.1.1.12.6 Wireless identification on the front of all wireless access points
 - 2.1.1.12.7 Pull Box identification stating "Communications"
 - 2.1.1.12.8 Consolidation Points on the cover stating grid location
 - 2.1.1.13 Lamacoid identification labels shall appear on the following locations with the designations indicated on the drawings:
 - 2.1.1.13.1 Rack identification on the top centre of the cabinet
 - 2.1.1.13.2 Grounding identification
 - 2.1.1.14 All firestops shall be labelled stating "WARNING FIRESTOP SEAL DO NOT DISTURB" and also the contractor's name, address and phone number, date installed, fire rating.

END OF SECTION

1 General

1.1 SECTION INCLUDES

1.1.1 This section specifies the materials and installation for communication cables inside buildings.

1.2 SCOPE

1.2.1 Supply and installation of a communication cabling system, complete with provision of cables, connectors, patch panels and termination fields as specified in this and associated specification sections and the drawings.

1.2.2 All Voice/Data cabling shall be supplied and installed by a communications cabling contractor.

1.2.3 All Voice/Data cabling shall be CAT6 type.

1.2.4 Data cable colour shall be blue.

1.2.5 Voice cable colour shall be white.

1.2.6 Each Voice/Data wall outlet shall contain 2-telephone jacks and 4-data jacks.

1.2.7 Each wall outlet shall be a 2-gang backbox with a 2-gang, 6-port faceplate.

1.2.8 Cables from wall outlets shall be routed from the new Healthcare expansion areas to the existing T&E room G202.

1.2.9 The contractor shall supply and install new CAT6, 24-port patch panels to terminate all new CAT6 cables.

1.2.10 The contractor shall label each cable at both ends and label all wall outlet ports and patch panel ports. Contractor shall coordinate with CSC IT departmental representative regarding labeling standards.

1.2.11 The contractor shall install the new CAT6, 24-port patch panels into an existing communications system equipment cabinet located in T&E room G202.

1.2.12 The contractor shall install telephone 24-port CAT6 patch panels in the bottom portion of the existing communications cabinet below the existing telephone 24-port patch panels.

1.2.13 The contractor shall install data 24-port CAT6 patch panels in the upper portion of the existing communications cabinet above the existing data 24-port patch panels. The contractor shall coordinate 24-port patch panels installation locations with CSC IT departmental representative prior to installation.

1.2.14 Shared Services Canada shall supply and install all required network switches for the new Healthcare expansion project.

1.2.15 The supplied communications cabling system shall be in full and complete working order.

1.3 REFERENCES

1.3.1 ANSI/TIA-568 C.0 Generic Telecommunications Cabling for Customer Premise

- 1.3.2 ANSI/TIA-568 C.1 Commercial Building Telecommunications Cabling
- 1.3.3 ANSI/TIA-568 C.2 Balanced Twisted Pair Telecommunications Cabling and Components Standard
- 1.3.4 ANSI/TIA-568 C.3 Optical Fiber Cabling Components Standard
- 1.3.5 ANSI/TIA/EIA-942 - Telecommunications Infrastructure Standards for Data Centers
- 1.3.6 CSA-C22.2 No. 03-01 (R2005) – Test Methods for Electrical Wires and Cables
- 1.3.7 Bicsi (latest edition) Telecommunications Distribution Methods Manual

2 Design and Performance Requirements

- 2.1.1 Horizontal Cabling:
 - 2.1.1.1 All copper horizontal UTP cabling (shall meet or exceed all applicable EIA/TIA 568 standards (including all addendums and technical service bulletins) for Category 6 performance.
 - 2.1.1.2 Cabling shall be Category 6 UTP 4-pair, 23AWG solid; CMR or CMP-rated cable
 - 2.1.1.3 Each horizontal cable shall extend from the ER/TR to the telecommunications outlet in the WA without a splice.
 - 2.1.1.4 The maximum length of each cable run must not exceed 90 m.
 - 2.1.1.5 Horizontal UTP cabling shall terminate on rack mounted patch panels.
- 2.1.2 Faceplates and Connectors
 - 2.1.2.1 Work Area Faceplates
 - 2.1.2.1.1 Work area faceplates shall house all category 6 and coaxial cable connectors.
 - 2.1.2.1.2 Faceplates shall be a 2- gang, 6-port configuration mounted on dual-gang electrical box with 2-gang mud ring. The colour to be coordinated.
 - 2.1.2.1.3 Blank inserts shall be provided for all unused ports.
 - 2.1.2.2 Insert and Connectors
 - 2.1.2.2.1 Category 6 inserts shall be 8-pin RJ45 type. The cable terminations are to be configured for T568A wire map. Colours shall be consistent for all telecommunications outlets.
 - 2.1.2.2.2 Category 6 inserts must accept RJ11 plugs.
 - 2.1.2.2.3 All inserts and connectors must be securely fastened to the faceplate.
- 2.1.3 Workstation copper connecting Cords
 - 2.1.3.1 Work area connecting cords shall be factory-terminated, T568A pin assignment, category 6, with 8-pin RJ45 plug at each end.
 - 2.1.3.2 Provide patch cables for both ends of cables installed. Provide patch cables for 50% of installed cables.
 - 2.1.3.3 Required quantity, length and colours shall be coordinated.

2.1.4 Fiber ER/TR Patch Cords

2.1.4.1 Provide only manufacturer's factory-made fibre patch cords.

2.1.4.2 Fibre patch cords shall match the performance of the fibre backbone cable.

2.1.4.3 Required lengths, connector type and quantities shall be coordinated.

2.1.5 Cross-Connect Wire

2.1.5.1 Where IDC blocks are used for voice-grade service, 24 AWG solid tinned copper, 1-pair is to be used. Individual wires shall be insulated with semi-rigid PVC. Pair-untwist shall not exceed 75mm from the point of termination. The wires shall be neatly routed via D-rings.

2.1.5.2 Where IDC blocks are used for cross-connects for data-grade services, the wire or cable shall conform to category 6, recommended by the manufacturer.

2.1.5.3 The quantity of cross-connection wires shall be adequate to cross connect all horizontal copper cable runs.

3 Products

3.1 CABLE PERFORMANCE

3.1.1 Cable performance shall at minimum meet ANSI/TIA 568 (latest edition). Standards for the noted cable and cable category. All cables to meet best practice industry performance and construction requirements.

3.1.2 Data Horizontal cabling shall have the following characteristics:

3.1.2.1 Cable shall meet or exceed Category 6 requirements as per standards.

3.1.2.2 Conductors are twisted in pairs, each individual twisted pair includes a metallic foil shield and is protected by a flame-retardant PVC jacket.

3.1.2.3 ULC and CSA rated as CMR/FT6.

3.1.2.4 Insulation: colour coding as per standards

3.1.2.5 Jacket: printed at intervals stating cable code, AWG, manufacturer and length markings, blue in colour.

3.1.3 Data Termination shall have the following characteristics:

3.1.3.1 All jack shall meet or exceed the requirements of ANS/TIA-568-C.2 Category 6, IEEE 802.3an-2006, and ISO 110801 Class E_A channel standards

3.1.3.2 All data jacks and data patch panels shall meet CAT6 requirements.

3.1.3.3 8-wire, RJ45

3.1.3.4 Patch panels shall be modular 1U 24-port patch panels.

4 Execution

4.1 INSTALLATION

4.1.1 Communication backbone cable must be run in conduit EMT if passing through space which is not a communication room. Within the communication room, backbone cable may be run in cabletray or as noted in the drawings.

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- 4.1.2 Horizontal distribution communication cable may be run in EMT, PVC, or cabletray. No free air unsupported cabling will be accepted unless specifically requested in writing.
 - 4.1.3 When routing communication cabling, avoid: sources of EMF, mechanical/electrical rooms, areas of high or low ambient temperatures, exterior or structural load bearing walls.
 - 4.1.4 Optimum cabling routing is to be coordinated on site prior to rough-in of conduit or installation of cable supports. No extras will be allowed for re-roughing of installed infrastructure that have not been coordinated with other trades on site.
 - 4.1.5 Communication cabling is to be run through conduit in slab where noted. Contractor must coordinate these runs prior to rough-in and pouring with the latest architectural/interior drawings.
 - 4.1.6 Contractor is to avoid running communication cabling under-slab. Any planned runs not specifically called for in the drawings are to be brought to Departmental Representative's attention prior to rough-in.
 - 4.1.7 Communications cabling shall not be run in areas until the area is enclosed from the elements. Pathways installed prior to area enclosure must be allowed to air dry after enclosure before cable is run.
 - 4.1.8 400 mm of slack cable is to be left coiled in each communication outlet box for termination.
 - 4.1.9 Max cable fill in conduit shall not exceed 40%.
 - 4.1.10 Bend radius of cable in conduit less than 53mm in diameter shall not be less than 6 times cable diameters or as per cable manufacturer recommendation.
 - 4.1.11 Bend radius of cable in conduit less than 53mm in diameter or greater shall not be less than 10 times cable diameter or as per cable manufacturer recommendation.
 - 4.1.12 Pulling tension must not exceed cable manufacturers recommended pulling tension guidelines.
 - 4.1.13 Contractor shall fill one conduit unless noted otherwise before running cable in other conduits which have the same destination/routing.
 - 4.1.14 All penetrations in fire rated partitions are to be firestopped per specifications. Any re-pulling of cable through penetrations after firestopping has been applied shall result in re-firestopping the penetration affected to meet the requirements of the firestopping specification.
- 4.2 WARRANTY
- 4.2.1 Telecommunication cabling and termination hardware shall be complete with a 25-year warranty from the manufacturer.

5 Testing

5.1 GENERAL REQUIREMENTS

- 5.1.1 Provide all labor, materials, tools, and field test instruments as required to completely test the communications system.
- 5.1.2 Test procedures and test equipment shall comply with the standards referenced in Section 27 00 10 Communication General Requirements.
- 5.1.3 Testing shall be carried out as outlined in this document and the project drawings.
- 5.1.4 Testing of the system must be coordinated with the overall project schedule to avoid conflict with the other trades or construction schedule. The Departmental Representative shall be informed of the time of testing and invited to attend the tests at their discretion at least 5 business days in advance.
- 5.1.5 Any link which is tested then is subsequently disturbed (re-terminated, etc.) must be re-tested to confirm performance requirements. No extras will be allowed for re-testing of links when links are disturbed as a result of uncoordinated testing/construction scheduling.
- 5.1.6 Any testing recommended by the cable manufacturer in addition to the tests outlined in the following sections shall be carried out and recorded. No extra will be allowed for this work.
- 5.1.7 Only trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to:
 - 5.1.7.1 Installation certification programs provided by BiCSi,
 - 5.1.7.2 The ACP (Association of Cabling Professionals),
 - 5.1.7.3 The manufacturer of the cabling, or
 - 5.1.7.4 The manufacturer of the testing equipment.
- 5.1.8 Prior to start of testing, provide a sample format of the proposed test results to the Departmental Representative for review at least 5 business days in advance.
- 5.1.9 Prior to start of testing, the links shall be fully completed with all labeling, outlets, cables, patch panels and associated components fully assembled. Any testing performed on incomplete links shall be redone after completion of the link at no extra cost.
- 5.1.10 Field test equipment shall have the latest software and firmware installed.
- 5.1.11 The copper test equipment testing Category 6 cable shall comply with the accuracy requirements for Level IV field testers and Category 6 cabling as defined in the above standards. All software shall be the latest versions, and licensed.
- 5.1.12 All installed cable runs shall be tested and must pass the requirements of the standards defined above. Any failing link shall be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The passing result of the tests for all links shall be provided in the test results documentation.

5.1.13 Testing will be considered completed once records show that all installations meet the 100% pass rate.

5.2 FIRE STOPPING

5.2.1 Fire-stopping systems shall meet the requirements of applicable codes and the approval of the authorities having jurisdiction.

5.2.2 All communications pathways and/or cable penetrations of fire rated barriers must be firestopped with an approved system after cable installation.

6 Testing Execution

6.1 TEST PARAMETERS

6.1.1 Channel tests for Category 6 shall be performed for the following items:

- 6.1.1.1 Insertion Loss
- 6.1.1.2 Near End Cross Talk (NEXT) Loss
- 6.1.1.3 Power Sum Near End Cross Talk (PS NEXT) Loss, for category 6 and higher
- 6.1.1.4 Attenuation to Cross Talk Ratio Far-End (ACR-F)/ELFEXT Loss, for category 6 and higher.
- 6.1.1.5 Power Sum Attenuation to Cross Talk Ratio Far-End (PS ACR-F)/PS ELFEXT Loss, for category 6 and higher.
- 6.1.1.6 Return Loss
- 6.1.1.7 Propagation Delay
- 6.1.1.8 Power Sum Alien Crosstalk (PS ANEXT), for category 6
- 6.1.1.9 Power Sum Alien Attenuation to Cross Talk Ratio Far-End (PS AACR-F), for category 6.

6.1.2 Permanent Link tests shall be performed for the following items:

- 6.1.2.1 Wiremap
- 6.1.2.2 Length
- 6.1.2.3 Insertion Loss
- 6.1.2.4 Near End Cross Talk (NEXT) Loss
- 6.1.2.5 Power Sum Near End Cross Talk (PS NEXT) Loss, for category 6 and higher
- 6.1.2.6 Attenuation to Cross Talk Ratio Far-End (ACR-F)/ELFEXT Loss, for category 6 and higher
- 6.1.2.7 Power Sum Attenuation to Cross Talk Ratio Far-End (PS ACR-F)/PS ELFEXT Loss, for category 6 and higher
- 6.1.2.8 Return Loss
- 6.1.2.9 Propagation Delay
- 6.1.2.10 Delay Skew
- 6.1.2.11 Power Sum Alien Crosstalk (PS ANEXT), for category 6
- 6.1.2.12 Power Sum Alien Attenuation to Cross Talk Ratio Far-End (PS AACR-F), for category 6

6.1.3 Horizontal cable tests shall be performed for the following items:

- 6.1.3.1 Insertion Loss
- 6.1.3.2 Near End Cross Talk (NEXT) Loss
- 6.1.3.3 Power Sum Near End Cross Talk (PS NEXT) Loss, for category 6 and higher

- 6.1.3.4 Attenuation to Cross Talk Ratio Far-End (ACR-F)/ELFEXT Loss, for category 6 and higher
- 6.1.3.5 Power Sum Attenuation to Cross Talk Ratio Fare End (PS ACR-F)/PS ELFEXT Loss, for category 6 and higher
- 6.1.3.6 Return Loss
- 6.1.3.7 Propagation Delay
- 6.1.3.8 Power Sum Alien Crosstalk (PS ANEXT), for category 6
- 6.1.3.9 Power Sum Alien Attenuation to Cross Talk Ratio Fare-End (PS AACR-F), for category 6

6.1.4 All testing shall be in accordance with ANSI/TIA-568-C.2 and ANSI/TIA-1152.

7 Documentation

7.1 DOCUMENTATION AND DELIVERY OF TEST RESULTS

- 7.1.1 The test results/measurements shall be transferred into a database utility that allows for the maintenance, inspection and archiving of these test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument".
- 7.1.2 The database for the completed job shall be stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports. This database to include the results for the testing parameters listed in point #3 of this specification.
- 7.1.3 The detailed test results data to be provided in the electronic database must contain information for each of the frequency-dependent test parameters.
- 7.1.4 A hardcopy summary of the test result report shall be provided that lists all the links that have been tested with the following summary information
 - 7.1.4.1 The identification of the link in accordance with the naming convention defined in the overall system documentation
 - 7.1.4.2 Overall length of the permanent link
 - 7.1.4.3 The overall Pass/Fail evaluation of the link-under-test

END OF SECTION

1 FGeneral

1.1 Overview

- 1.1.1 Supply and install a Public Address System as indicated on drawings and specifications.
- 1.1.2 The existing Health Care and Segregation areas audio amplifier is located in an existing equipment cabinet on the 2nd level T&E room G202. Install conduit and wiring for the PA system from the new addition area to the 2nd level T&E room G202.
- 1.1.3 The contractor shall use the existing public address audio amplifier to drive the new speakers.
- 1.1.4 The existing PA system has two existing inputs. Input one is from an all call source and input two is from a local desktop microphone in the Segregation Area. The local paging microphone pages into the Segregation Area only. The contractor shall connect the new Health Care extension area speakers to the existing Health care speaker wiring connections.
- 1.1.5 Contractor shall adjust all sound levels for the existing speaker zones and the new additional speaker zone to suit the owner's requirements. Coordinate speaker volume levels with the owner's departmental representative.
- 1.1.6 Supply and install vandal resistant speakers as shown on drawings. Supply and install speaker backboxes to suite location. Use recess backboxes for false ceiling areas and use surface mounted speaker backboxes for exposed ceiling areas.
- 1.1.7 All speakers shall have seismic restraints installed.

1.2 Section Includes

- 1.2.1 This section specifies the materials and installation sound systems in various configurations including paging, voice and music operations.

1.3 References

- 1.3.1 Industry Canada - Terminal Attachment Program
 - 1.3.1.1 CS-03-1996, Telecommunication Apparatus Compliance Specification, Issue 8.

1.4 System Description

- 1.4.1 Public address/background music loudspeaker systems to incorporate:
 - 1.4.1.1 Auxiliary wall inputs
 - 1.4.1.2 Volume controls
 - 1.4.1.3 Telephone paging
 - 1.4.1.4 Connection to local fire alarm system for audio muting during fire alarm
- 1.4.2 Operations:
 - 1.4.2.1.1 Telephone paging
 - 1.4.2.2 Volume control via wall mounted controls
 - 1.4.2.3 Automatic muting of audio systems during a fire alarm

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- 1.5 Submittals
 - 1.5.1 Product Data: Submit manufacturer's printed product literature, specifications and data sheets in accordance with Section 01 33 00 Submittal Procedures.
 - 1.5.2 Shop Drawings: Submit in accordance with Section 01 33 00 Submittal Procedures.
 - 1.5.2.1 Submit shop drawings to indicate project layout, device locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labeling scheme including:
 - 1.5.2.1.1 Functional description of equipment
 - 1.5.2.1.2 Technical data sheets of all devices
 - 1.5.2.1.3 Device location plans and cable lists
 - 1.5.2.1.4 Paging zoning
 - 1.5.2.1.5 Sound system interconnection detail drawings
 - 1.5.2.1.6 Programming worksheets
 - 1.5.3 Samples: Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - 1.5.3.1 Submit sample floor plans with device layout that will be used with the sound system.
 - 1.5.4 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 – Submittal Procedures.
 - 1.5.4.1 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - 1.5.4.2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - 1.5.4.2.1 Submit UL/CSA Product Safety Certificates.
 - 1.5.4.3 Instructions: Submit manufacturer's installation instructions.
 - 1.5.5 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 Closeout Submittals. Include following:
 - 1.5.5.1 System configuration and equipment physical layout
 - 1.5.5.2 Functional description of equipment
 - 1.5.5.3 Instructions on operation, adjustment and cleaning
 - 1.5.5.4 Illustrations and diagrams to supplement procedures
 - 1.5.5.5 Manufacturer's operation instructions
 - 1.5.5.6 All programming worksheets
 - 1.6 Warranty
 - 1.6.1 For all materials, the 12-month warranty for parts and labour.
 - 1.6.2 Manufacturer's Warranty: Submit, for Department Representative's Consultant's acceptance, manufacturer's standard warranty document executed by authorized company official.
 - 1.7 Support Services
 - 1.7.1 Provide manufacturer/dealer advice, information and support services for 1 year.

1.8 Closeout Submittals

1.8.1 Provide operation and maintenance data for the sound system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.8.2 Include:

1.8.2.1 Operation/Maintenance manuals for each component.

1.8.2.2 Operation instructions.

1.8.2.3 Description of system operation.

1.8.2.4 Description of each subsystem operation.

1.8.2.5 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

1.8.2.6 Part list specifying parts used in equipment by identification numbers that are standard to electronic industry.

1.9 System Startup

1.9.1 Installation contractor's departmental representative to instruct:

1.9.1.1 Maintenance personnel in maintenance of system.

1.9.1.2 Operating personnel in use of system.

2 Products

2.1 Supply of System Components

2.1.1 Unless otherwise specified in this document, the contractor shall supply all components necessary to complete the system. All materials shall be new and of the latest hardware, software, and firmware versions.

2.1.2 Conduits: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings and Section 26 05 36 - Cable Trays for Electrical.

2.1.3 Communication conductors: as indicated, to Section 27 15 00 - Communication Cables Inside Buildings.

2.1.4 All components shall be new and CSA/UL approved.

2.2 Materials

2.2.1 Public Address System Speakers:

2.2.1.1 Frequency Response: 50 – 15kHz

2.2.1.2 Coverage: 105°

2.2.1.3 Impedance: 8 ohms

2.2.1.4 Transformer Taps: .25, .5, 1, 2, 4 Watts

2.2.1.5 Enclosure Material: steel

2.2.1.6 Dimensions: 290mmH x 298mmW

2.2.1.7 Weight: 2.8kg

2.2.1.8 Referenced Product: Atlas Sound VP14MB Series c/w metal backbox – or approved equal

3 Execution

3.1 Installation

3.1.1 Install equipment in accordance with manufacturer's instructions, and as indicated.

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- 3.1.2 Install equipment in accordance with local bylaw and the Canadian Electrical code.
 - 3.1.3 Coordinate installation of public address system equipment into main security systems equipment rack.
 - 3.1.4 Install cables neatly along building lines.
 - 3.1.5 All cables shall have a permanent label. Label shall match shop drawings.
 - 3.1.6 All cables shall be terminated with permanent crimp type or screw connectors. Marrette or twist-on type connectors are not acceptable.
 - 3.1.7 Provide seismic restraints for equipment cabinets/racks, speakers and suspended equipment.
 - 3.1.8 Shielded cables shall be grounded at the cabinet/rack end only.
 - 3.1.9 Ground all equipment cabinets/racks to a dedicated grounding system.
 - 3.1.10 All cable runs shall be neatly fastened at minimum 4ft spans.
 - 3.1.11 All cables in equipment rack shall be neatly fastened.
 - 3.1.12 All rack mounted equipment shall have a permanent label indicating use.
 - 3.1.13 Route all cables as far away for high voltage sources as possible. Minimum distance for parallel horizontal runs shall be 610 mm.
 - 3.1.14 Adjust speaker taps to suit departmental representative's and consultant's requirements.
- 3.2 Field Quality Control
- 3.2.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
 - 3.2.2 Perform tests using Smaartlive or similar software. Provide consultant with test results for equalizer settings, transfer tests, delays, speaker muting.
 - 3.2.3 Conduct intelligibility test.

END OF SECTION

1.0 GENERAL

1.1 OVERVIEW

- .1 Supply and Install a card access system as described in the specifications and drawings.
 - .2 The card access system shall be an extension of the existing card access system at the Mountain Institution. The contractor shall provide all required hardware and software to integrate the new Healthcare expansion with the existing card access system.
 - .3 The existing card access system is a Lenel Onguard system. All hardware and software shall be compatible with the Lenel Onguard system. The existing card access system software is installed on a PC server that is located in the server room in Building A2. There is also a card access system PC workstation in the SMO office on the 2nd floor of the PE bldg. that hosts the admin client software
 - .4 Install all new door control modules in the T&E room G202. Connect door control modules to local network switch for connection to main card access system server. Coordinate network port assignment with owner's departmental representative.
 - .5 The card access system shall integrate with the existing facility's FAAS system. The existing FAAS system's existing DIN Rail termination block is located in room G202. The contractor shall coordinate with facilities departmental representative regarding connections to existing FAAS system. The contractor shall connect the card access system's output modules to the FAAS system. Provide two groups of zones. Zone one shall indicate the Healthcare building upper zone. Zone two shall indicate the Healthcare building lower zone.
 - .6 The contractor shall provide two (2) intrusion alarm keypads as shown on drawings. The keypad shall indicate all zone status, arm/disarm and supervisory signals.
 - .7 The contractor shall provide motion detectors and door contacts as shown on drawings. The contractor shall connect these devices to the card access system input modules.
 - .8 All alarms shall be annunciated at the keypad and at the FAAS.
 - .9 The existing facility card access system workstation shall administrate the card access system requirements for the new Healthcare expansion. There is a card access system PC workstation located at the Principal Entrance at the door entry desk area. This workstation is connected to the facility network and works with the PC server that is located in building A2 server room.
 - .10 Access cards shall be supplied by CSC.
 - .11 The contractor shall provide all required components to supply a fully functional card access system as described in the contract documents. The contractor shall provide all required components that are not listed in the specification, but are required to supply a fully functional card access system as described in the contract documents.
 - .12 The card access system contractor shall supply and install Ethernet PoE network switches for security systems equipment. CSC LAN system will be used to network the HC system to the existing Lenel system.
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- .13 The contractor shall install all rack mounted security systems equipment in the existing security systems' equipment cabinets located in T&E room G202. All wall mounted security systems equipment shall be installed on walls of the T&E room G202.
- .14 Electric door locks, door contacts, and request-to-exit (REX) door hardware shall be supplied and installed by the door hardware contractor. The card access system contractor shall coordinate the installation of control wiring for the electric door locks, door contacts and REX hardware with the door hardware contractor.

1.2 SUMMARY

- .1 Section Includes:
 - .1 This section of the specification forms part of the contract documents and is to be read, interpreted, and co-ordinated with all other parts.
 - .2 The specifications to supply, install, and operate an integrated security management system.

1.3 RELATED REQUIREMENTS

- .1 Section 01 11 00 – Electrical General Provisions
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 08 71 00 – Finish Hardware
- .5 Section 26 05 00 – Common Work Results – Electrical
- .6 Section 26 05 01 – Seismic Restraints – Electrical
- .7 Section 26 05 07 – Elevators
- .8 Section 26 05 21 – Wire and Cables
- .9 Section 26 05 34 – Conduit, Conduit Fastenings and Fittings
- .10 Section 27 15 00 – Communications Cables Inside Buildings
- .11 Section 27 05 28 – Pathways for Communications Systems

1.4 REFERENCE STANDARDS

- .1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:
 - .1 Building, fire, electrical and labour codes and standards.
 - .2 Workmanship shall meet or exceed nationally accepted workmanship standard.
 - .2 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S301 latest edition, Central and Monitoring Station Burglar Alarm Systems
 - .2 CAN/ULC S302 – latest edition, Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults
 - .3 CAN/ULC S303 latest edition, Local Burglar Alarm Units and Systems
 - .4 CAN/ULC S304 – latest edition, Central and Monitoring Station Burglar Alarm Units
 - .5 ORD C827 – latest edition, Central Stations for Watchman, Fire alarm and Supervisory Services
 - .6 ORG C1076 – latest edition, Proprietary Burglar Alarm Units and Systems
 - .7 ORD C488 – latest edition, Remote Burglar Alarm Signalling Centres
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- .3 Underwriters' Laboratories (UL):
 - .1 UL 294 latest edition, Standard for Safety for Access Control System Units
 - .2 UL 365 – latest edition, The Standard for Police Station Connected Burglar Alarm Units and Systems
 - .3 UL 609 1996, The Standard for Local Burglar Alarm Units and Systems
 - .4 UL 827 1996, Standard for Central Station Alarm Services or (the Standard for Central Station for Watchman, Fire Alarm and Supervisory Services)
 - .5 UL 1076 1995, Standard for Safety for Proprietary Burglar Alarm Units and Systems
 - .6 UL 1610 1998, The Standard for Central Station Burglar Alarm Units
 - .7 UL 1635 1996, The Standard for Digital Alarm Communicator System Units
 - .8 UL 1981 1994, Standard for Central Station Automation Systems

1.5 SCOPE OF WORK

- .1 Supply and installation of a complete and operating system including but not necessarily limited to:
 - .1 Card readers
 - .2 Card reader interface modules
 - .3 Card access system accessories
 - .4 Card access system peripherals
 - .5 Card access transmission methods
 - .6 PC workstations

1.6 DEFINITIONS

- .1 SMS: Security Management System
- .2 CCTV: Closed Circuit Television System
- .3 CA: Card Access System
- .4 CR: Card Reader
- .5 REX: Request-to-exit sensor
- .6 DPS: Door Position Sensor
- .7 P.S.: Power Supply
- .8 ES: Electric Door Strike
- .9 MT: Mortise Door Lock
- .10 UPS: Uninterrupted Power Supply

1.7 CONTRACTOR QUALIFICATIONS

- .1 The Card Access System shall be installed by a qualified Security Systems Contractor, certified by the respective equipment manufacturer, and having a minimum of five (5) years installation and service experience with similar installations. The contractor business, employees, managers and owners must be licensed in the Province of British Columbia under the Private Investigators and Security Agencies Act. The business must be licensed and bonded as an Alarm Service and each employee who is installing and servicing security alarm devices and equipment, must be licensed and bonded as an employee of the company and not as a sub-contractor. The equipment installers must hold a valid Trade Qualification Certificate issued by the Province of British Columbia. Proof of the Company and Installers Certification shall be requested and reviewed prior to contract award.
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- .2 The card access system contractor must be a certified Lenel systems contractor. The card access system contractor's technicians must be trained and certified by Lenel.

1.8 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit manufacture's literature for each system component.
 - .3 Submit:
 - .1 Functional description of equipment
 - .2 Technical data for all devices
 - .3 Device location plans and cable lists
 - .4 Devices mounting location detail drawings
 - .5 Typical devices connection detail drawings
 - .6 Programming worksheets
 - .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit shop drawings to indicate project layout, including details as follows:
 - .1 Indicate mounting heights and locations.
 - .2 Zone layout drawing indicating number and location of zones and areas covered.
 - .3 Wiring diagrams.
 - .4 Complete equipment list.
 - .3 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 - Submittal Procedures:
 - .1 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties:
 - .1 Submit ULC/UL/CSA Product Safety Certificates.
 - .2 Submit verification Certificate that Installation/service Company is ULC/UL Listed alarm service Company.
 - .3 Submit verification Certificate that security access system is "Certified alarm system".
 - .3 Instructions: Submit manufacturer's installation instructions.
 - .4 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .1 Include:
 - .1 System configuration and equipment physical layout
 - .2 Functional description of equipment
 - .3 Instructions of operation of equipment

- .4 Illustrations and diagrams to supplement procedures
- .5 Operation instructions provided by manufacturer.
- .6 Cleaning instructions
- .7 All programming worksheets

1.9 WARRANTY

- .1 All materials shall have a 12-month warranty period.
- .2 Manufacturer's Warranty: Submit, for Department Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

2.0 PRODUCTS

2.1 SUPPLY OF SYSTEM COMPONENTS

- .1 Unless otherwise specified in this document, the contractor shall supply all components necessary to complete the system. All materials shall be new and of the latest hardware, software, and firmware versions.

2.2 MATERIALS

- .1 Provide only ULC/UL Listed access control and security access systems products. Software shall be of most current edition.
 - .2 Intelligent System Controller (ISC):
 - .1 Number of Card Holders: 500,000
 - .2 Permission Profiles: 1000
 - .3 Partitions: 130 Areas
 - .4 Input Points: 1024
 - .5 Output Points: 256
 - .6 Event Buffer: 50,000
 - .7 Doors: 130
 - .8 Access Level: 32,000, up to 128 per badge
 - .9 Holidays: 255
 - .10 Time zones: 250
 - .11 AES Encryption: 128 Bit
 - .12 Diagnostics: Local and remote
 - .13 Main Power Input: 18VAC or 24VDC
 - .14 Secondary Power Input: 12VDC
 - .15 Event memory/clock backup: 3VDC, CR2330
 - .16 Communication Ports: 10/100Base-T Ethernet
 - .17 Inputs: 4-state, N.O., N.C.,
Supervised/Unsupervised
 - .18 Outputs: Wiegand Data1/Data0, Magnetic
clock/data, F/2F single wire, Bioscrypt
RS-485
 - .19 Relay outputs: 3 x Form C, 3 x Form A
 - .20 Reader Power: 12VDC
-

.21	Reader Port Compatibility:	Wiegand Data1/Data0, Magnetic Clock/Data
.22	Operating Temperature:	-10° to 55°C
.23	Dimensions:	160H x 250W x 42mmD
.24	Referenced Product:	Lenel 3300, 2200 Series
.3	Dual Door Interface Module (DDI):	
.1	DC Input Power:	12 to 24VDC
.2	Current Consumption:	1200mA @ 12VDC, 600mA @ 24VDC
.3	BTU/Hour:	49.1
.4	DC Output Power:	400mA @ 12VDC
.5	Relay Outputs:	6 x Form-C
.6	Card formats:	8
.7	Door Contact Supervision:	Supported
.8	REX supervision:	Supported
.9	LED:	Bicolour
.10	Beeper Control:	Supported
.11	Tamper:	Supported
.12	Communication Protocol:	RS-485
.13	Reader Port Compatibility:	Wiegand Data1/Data0, Magnetic Clock/Data, F/2F single wire
.14	Operating Temperature:	-10° to 70°C
.15	Dimensions:	127 x 203 x 32mm
.16	Referenced Product:	Lenel 1320 Series
.4	Input Control Module (ICM):	
.1	DC Input Power:	12 to 24VDC
.2	Current Consumption:	300mA @ 12VDC, 150mA @ 24VDC
.3	Inputs:	16 programmable, supervised
.4	Relays:	2 x Form-C
.5	Supervised Inputs:	Tamper, power failure, low voltage
.6	Line Supervision:	Grade B, A and AA
.7	Referenced Product:	Lenel 1100 Series
.5	Output Control Module (OCM):	
.1	DC Input Power:	12 to 24VDC
.2	Current Consumption:	805mA @ 12VDC, 407mA @ 24VDC
.3	BTU/Hr:	33
.4	Relay Contacts:	16 x Form-C
.5	Operating Temperature:	10° to 70°C
.6	Tamper Input:	Supported
.7	Power Failure Indication:	Supported

- .8 Communication Protocol: RS-485
 - .9 Dimensions: 127 x 203 x 32mm
 - .10 Referenced Product: Lenel 1200 Series

 - .6 Intrusion Alarm Keypads:
 - .1 Characters: 32 backlit LCD
 - .2 Operating voltage: 12VDC @ 175mA
 - .3 Colour: White
 - .4 Dimensions: 172mmW x 127mmH x 25mmD
 - .5 Weight: 400g
 - .6 Mounting: Surface
 - .7 Communications: RS485
 - .8 Referenced Product: Lenel LNL-CK

 - .7 Mortise Locks and Electric Strikes:
 - .1 All mortise locks and electric strikes shall be supplied by Div. 8 door hardware supplier.
 - .2 Mortise locks shall come with proximity reader, door position sensor and request-to-exit sensor built-in.
 - .3 Mortise lock and electric strike power supplies shall be provided by Division 26 & 28.

 - .8 Proximity Reader 1-Gang Style:
 - .1 Read range: 3.8cm to 11.4cm
 - .2 Mounting: 1-gang standard back box
 - .3 Mobile device compatibility: Seos supported
 - .4 Transmitting frequency: 13.56MHz, 125kHz
 - .5 Voltage: 5 to 16VDC
 - .6 Operating temperature: -35° to 65°C (-31° to 150°F)
 - .7 Operating humidity: 0 to 95% non-condensing
 - .8 Dimensions: 122mmH x 84mmW x 24mmD
 - .9 Color: Black or Gray
 - .10 Referenced Product: HID iClass SE RP40 Series

 - .9 Door Position Sensor:
 - .1 Mounting Type: Recessed 1-inch Diameter
 - .2 Gap Distance: 1" in Steel, 2" in Wood
 - .3 Colour: Grey
 - .4 Loop Type: Open and Closed
 - .5 Electrical Configuration: SPDT
 - .6 Form Type: Form C
 - .7 Voltage Rating: 30VDC, 50mA
 - .8 Referenced Product: Sentrol 1076 Series
-

- .10 Request-To-Exit sensors shall be provided in the door hardware equipment. Coordinate the connection to the Division 8 supplied REX hardware with Division 8 contractor.
 - .11 Door Release Push Buttons: (guard post and dispensary)
 - .1 Type: Pushbutton
 - .2 Operation Type: Momentary
 - .3 Mounting Hole Size: 30mm
 - .4 Colour: Green
 - .5 Normally open contacts: 1
 - .6 Normally closed contacts: 1
 - .7 Shape: Round, flush, extended shroud
 - .8 Referenced Product: IDEC ABFD211N-G series
 - .12 Door Release Push Button Enclosures: (Provide Lamacoid labels for Pushbuttons)
 - .1 Mounting and Style: Surface, Sloping
 - .2 Body material: 14-guage steel
 - .3 Colour: Gray, ANSI-61
 - .4 Number of Pushbutton opening: 2 or 1
 - .5 Dimensions: 89mm x 140mm x 121mm
 - .6 Referenced Product: Hubbell/Wiegmann WPBA2 Series
 - .13 2-board Cabinet for Card Access Modules:
 - .1 UL 294 and 1076-Listed
 - .2 Tamper switch
 - .3 Locking cabinet door
 - .4 Switch selectable 12VDC or 24VAC power limited output
 - .5 Class 2 rated
 - .6 Input 115VAC 60Hz, 1.45 amp
 - .7 Maximum charge current .7A
 - .8 4-amps continuous supply current at 12VDC
 - .9 3-amps continuous supply current at 24VDC
 - .10 Filtered and electronically regulated outputs
 - .11 Built-in charger for sealed lead acid or gel type batteries
 - .12 Automatic switchover to standby battery when AC fails
 - .13 AC input and DC output LED indicators
 - .14 AC fail supervision (form C contact)
 - .15 Low battery supervision (form C contact)
 - .16 Thermal overload protection
 - .17 Short circuit protection
 - .18 Enclosure Dimensions: 304 x 406 x 114mm (12 x 16 x 4.4 in)
 - .14 6-board Cabinet for Card Access Modules:
 - .1 UL 294 and 1076-Listed
-

- .2 Tamper switch
 - .3 Locking cabinet door
 - .4 Switch selectable 12VDC or 24VAC power limited output
 - .5 Class 2 rated
 - .6 Input 115VAC 60Hz, 1.9 amp
 - .7 Maximum charge current .7A
 - .8 6-amps continuous supply current at 12VDC or 24VAC
 - .9 Filtered and electronically regulated outputs
 - .10 4 individual circuit breaker outputs
 - .11 Surge protected outputs
 - .12 Built-in charger for sealed lead acid or gel type batteries
 - .13 Automatic switchover to standby battery when AC fails
 - .14 AC input and DC output LED indicators
 - .15 AC fail supervision (form C contact)
 - .16 Low battery supervision (form C contact)
 - .17 Thermal overload protection
 - .18 Short circuit protection
 - .19 Enclosure Dimensions: 610 x 457 x 114mm (24 x 18 x 4.5 in)
- .15 Din Rail Termination Blocks: (Match existing)
- .1 Termination style: Screw
 - .2 Typical wire gauge: 18AWG – 24AWG
 - .3 Referenced Product: Weidmuller WMF 2.5 Series
- .16 Power Supply Backup Battery:
- .1 Gel type battery
 - .2 7AH rated
 - .3 Provide two batteries per power supply
- .17 Power Supply for Electric Door Locks:
- .1 Input Voltage: 120VAC
 - .2 Input Power: 170 Watts
 - .3 Output Voltage: 24VDC/VAC
 - .4 Output Current: 6 Amps
 - .5 Output Channels: 9
 - .6 Battery Charge Capacity: 80Ah
 - .7 BTU Rating: 68 BTU/Hr
 - .8 Fire Alarm Interface: Included
- .18 Wiring:
- .1 All wiring shall be FT6 in accordance with local jurisdiction fire code and the local building codes.
 - .2 All wiring shall be as recommended by the manufacturer of the device/s.
-

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Installation shall comply with all other relevant sections.
- .2 Division 8 shall supply all mortise locks, electric strikes, request-to-exit door handles and push bars, wired hinges, motorized operators and door contacts, and prewire these devices to a junction box above the door. Division 26 & 28 shall install wiring from the card access system control panels to the junction box above doors and connect the devices.
- .3 Division 8 shall provide wiring schematics for all doors.
- .4 Division 26 & 28 shall provide all required power supplies for all low current door hardware devices including the mortise lock and electric strikes. Division 8 shall provide all high current power supplies for motorized operators, electric solenoids, electric push bars, etc. Coordinate with Division 8 for requirements.
- .5 All power supplies and card access control panels shall be installed in communications rooms.
- .6 Install components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .7 Install components secure to walls, ceilings or other substrates.
- .8 The appropriate cable type FT6 shall be used in accordance with local jurisdiction fire code and the local building codes.
- .9 All cabling is to be secured to the rack frames at sufficient intervals to prevent the weight of the cable from contributing to fatigue or early failure of the cable or the device and connector to which it is attached.
- .10 All category 6 and fiber optic cables shall utilize Velcro fasteners in place of Ty-wraps.
- .11 All CAT6 cabling methods and distance shall be in conformance with industry best practices and EIA/TIA 568 and NFPA 73.
- .12 All wiring shall be concealed in conduit.
- .13 All wiring shall be labeled and both ends. Labeling shall match as-built drawings.
- .14 All cabinets shall have tamper switches. Alarms shall report to client workstations.
- .15 Install required boxes in inconspicuous accessible locations.

3.3 PROGRAMMING

- .1 Provide all required programming for security systems, client workstations, field hardware, and all other components of the security system.
-

- .2 Co-ordinate, with owner's departmental representative, on the exact sequence of events, that should occur during alarms and other daily events.
- .3 Program the security system to pop-up alarms on workstations related to any alarm event. The floor map for the same alarm shall also pop-up.

3.4 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum three (3) sessions of four (4) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the security systems.
- .2 The contractor as part of their tendered price shall provide a four (4) hour instruction session 30 days after completion of initial training sessions.

3.5 VERIFICATION

- .1 Perform verification inspections and tests in the presence of Departmental Representative
 - .1 Provide all necessary tools, ladders and equipment.
 - .2 Ensure appropriate subcontractors, manufacturer's representatives are present for verification.
 - .2 Pretesting Procedure:
 - .1 Verify that System is fully operational and meets all System performance requirements of this specification.
 - .2 Measure and record, control carrier levels of every System channel at each of following points in the system:
 - .1 Door located actuating devices.
 - .2 Door control panel functions.
 - .3 Electronic supervisory control unit's inputs and outputs.
 - .4 Distribution system input and output.
 - .5 Telephone system interface input and output.
 - .3 Provide and submit to Departmental Representative two copies of recorded system pre-test measurements, along with pre-test certification.
 - .3 Performance Testing:
 - .1 Test procedure: perform test on a "go-no-go" basis.
 - .1 Make only operator adjustments required to show proof of performance.
 - .2 Test to demonstrate and verify that the installed Systems complies with installation and technical requirements of this specification under operating conditions.
 - .3 Test results to be evaluated by Departmental Representative as either acceptable or unacceptable using following procedures.
 - .2 Documentation Review:
 - .1 This review will determine if information provided is sufficient to meet requirements of this specification.
 - .2 Provide for review all System manuals, as installed drawings, pre-test forms, antenna radiation patterns, equipment cabinet pictorials, antenna pictorial, antenna mount pictorial, video and audio equipment details.
 - .3 Mechanical Inspection:
-

- .1 Departmental Representative and Contractor to tour all areas to ensure that all Systems and Subsystems are installed in place for proof of performance testing.
 - .2 Take system inventory at this time. Verify following items before beginning proof of performance tests:
 - .1 All electrical power circuits designated for system equipment are properly labelled, wired, phased, protected and grounded.
 - .2 Conductor ends are protected by heat shrink wrap; audio spade lugs, barrier strips and punch blocks are used.
 - .3 Dust, debris, solder splatter, etc. are cleaned and removed from site.
 - .4 All equipment is properly labeled.
 - .5 All equipment identified in System's equipment lists are in place and properly installed.
 - .6 Each system ground is installed in accordance with manufacturer's instructions and this specification.
 - .4 Subsystem Functional Test:
 - .1 Conduct operational testing after review of documentation and mechanical inspection completed. Proceed as follows:
 - .1 Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.
 - .2 Control Units:
 - .1 Take S/N readings from control unit's input and output in manual and/or automatic mode. Check output of DC/Data converter for S/N. Evaluate entire signal quality at baseband connector output of control unit and remote equipment.
 - .3 Audio:
 - .1 Take S/N readings from transmitter input and receiver output with equipment placed in manual gain mode. Check output of the audio converter, modulator or demodulator for S/N. Evaluate entire audio signal at baseband connector input and output of control unit.
 - .4 Distribution (or Interface) System:
 - .1 Check each door utilizing a volt/ohm or signal level meter to confirm each function and to ensure that System meets all performance requirements.
 - .2 Test each interconnection point (i.e. Door unit, junction box "cross connection", control unit, etc.) to ensure compliance with this specification.
 - .5 Total System Test:
 - .1 Proceed with testing when System and Subsystems are functionally tested and accepted. Total System tests to verify that requirements have been met for DC and/or audio, sub carrier, and control signals in accordance with this specification.
 - .6 Safety:
 - .1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.
-

- .5 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - .1 Sturdiness of equipment fastening.
 - .2 Non-existence of installation related damages.
 - .3 Compliance of device locations with reviewed shop drawings.
 - .4 Compatibility of equipment installation with physical environment.
 - .5 Inclusion of all accessories.
 - .6 Device and cabling identification.
 - .7 Application and location of ULC approval decals.
 - .6 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
 - .1 Validate sensitivity of readers and applicability and application of cards.
 - .2 Connecting joints and equipment fastening.
 - .3 Compliance with manufacturer's specification, product literature and installation instructions.
 - .7 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
 - .1 Operation of each device individually and within its environment.
 - .2 Operation of each device in relation with programmable schedule and or/specific functions.
- 3.6 CLEANING AND ADJUSTING
- .1 Remove protective coverings from accessories and components.
 - .2 Adjust all components for correct function.
 - .3 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
 - .4 Clean all components free from dirt and fingerprints.

END OF SECTION

1.0 GENERAL

1.1 OVERVIEW

- .1 There is an existing PPA receiver system in the existing HealthCare Building. The receiver is located in the existing Segregation Area. The exact location is to be determined on-site.
- .2 The PPA system is a Senstar system. Any additions or modifications to the PPA system must be done by Certified Senstar technician.
- .3 The new Healthcare building project shall require the addition of a new PPA system receiver. The contractor shall carry the cost of hiring a certified Senstar technician to supply and install a new PPA wireless receiver for the new Healthcare Building project. The contractor shall also carry the cost of hiring a certified Senstar technician to program and commission the additional PPA system wireless receiver.

1.2 SECTION INCLUDES

- .1 This Section specifies the PPA detection system consisting of a control panel, detection accessories, and communications.

1.3 REFERENCE STANDARDS

- .1 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S303-latest edition, Local Burglar Alarm Units and Systems
 - .2 CAN/ULC-S304-latest edition, Intrusion Detection
 - .3 CAN/ULC-S306-latest edition, Intrusion Detection Units
 - .4 ULC-S318-latest edition, Power Supplies for Burglar Alarm Systems.
 - .5 ORD-C634-latest edition, Connectors and Switches for Use with Burglar Alarm Systems

1.4 DEFINITIONS

- .1 PPA: Personal Panic Alarm
- .2 RX: Wireless Receiver
- .3 PAA: Panic alarm annunciator panel
- .4 RL: Relay dry contact

1.5 CONTRACTOR QUALIFICATIONS

- .1 The Personal Panic Alarm System shall be installed by a qualified Security Systems Contractor, certified by Senstar manufacturer, and having a minimum of five (5) years installation and service experience with similar installations. The contractor business, employees, managers and owners must be licensed in the Province of British Columbia under the Private Investigators and Security Agencies Act. The business must be licensed and bonded as an Alarm Service and each employee who is installing and servicing security alarm devices and equipment, must be licensed and bonded as an employee of the company and not as a sub-contractor. The equipment installers must hold a valid Trade Qualification Certificate issued by the Province of British Columbia. Proof of the Company and Installers Certification shall be requested and reviewed prior to contract award.

1.6 PRODUCT DATA

- .1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
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- .1 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit manufacture's literature for each control panel, detection accessory device.
 - .3 Submit:
 - .1 Functional description of equipment
 - .2 Technical data for all devices
 - .3 Device location plans and cable lists
 - .4 Devices mounting location detail drawings
 - .5 Typical devices connection detail drawings
 - .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit shop drawings to indicate project layout, mounting heights and locations, wiring diagrams, detection device coverage patterns, contact operating gaps.
 - .2 Submit zone layout drawing indicating number and location of zones and areas covered.
 - .3 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit UL Product Safety Certificates.
 - .2 Submit verification Certificate that service company is ULC/UL Listed alarm service company.
 - .3 Submit verification Certificate that PPA system is Certified Alarm System.
 - .3 Instructions: Submit manufacturer's installation instructions.
 - .4 Manufacturer's Field Services: Submit copies of manufacturer's field reports.
 - .4 Maintenance Data: Submit maintenance data for incorporation into manual specified in Closeout Submittals.
 - .1 Include:
 - .1 System configuration and equipment physical layout
 - .2 Functional description of equipment
 - .3 Instructions of operation of equipment
 - .4 Illustrations and diagrams to supplement procedures
 - .5 Operation instructions provided by manufacturer
 - .6 Cleaning instructions
- 1.7 WARRANTY
- .1 For all materials, the 12-month warranty for parts and labour.
- 1.8 SUPPORT SERVICES
- .1 Provide manufacturer/dealer advice, information and support services for 1 year.
-

2.0 EXECUTION

2.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.

2.2 MATERIALS AND EQUIPMENT

- .1 All system hardware and software components shall be produced by manufacturers regularly engaged in the production of Correctional equipment to the ISO 9001 standards. Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place.
 - .1 Acceptable Manufacturers:
 - .1 Senstar no substitutions.
- .2 Reference CSC document: ES/SOW-0101 included in Appendix.

2.3 INSTALLATION

- .1 Install panels, PPA detection system and components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .2 Install panels, PPA detection system and components secure to walls, ceilings or other substrates.
- .3 Install required boxes in inconspicuous accessible locations.
- .4 Label all components of the PPA alarm systems. Use laser printed labels designed for wrapping around wires. Use laser printed permanent labels for all other devices. Label all the following:
 - .1 PPA wiring
- .5 All wiring to be enclosed in appropriately sized, thin wall, electrical tubing (EMT) or conduit.
- .6 Conceal conduit and wiring.

2.4 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum two (2) sessions of two (2) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the PPA systems.
- .2 The contractor as part of their tendered price shall provide a one (2) hour instruction session 30 days after completion of initial training sessions.
- .3 Coordinate training schedules with the departmental representative.

2.5 FIELD QUALITY CONTROL

- .1 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .2 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.
-

2.6 VERIFICATION

- .1 Perform verification inspections and test in the presence of Departmental Representative.
 - .1 Provide all necessary tools, ladders and equipment.
 - .2 Ensure appropriate subcontractors and manufacturer's representatives are present for verification.
- .2 Test all programming functions. Provide a written test report showing all the tests that have been completed and the results of the tests. Submit to Departmental Representative for approval. Submit copies of approved test results in shop drawing submittal.
- .3 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - .1 Sturdiness of equipment fastening
 - .2 Non-existence of installation related damages
 - .3 Compliance of device locations with reviewed shop drawings
 - .4 Compatibility of equipment installation with physical environment
 - .5 Inclusion of all accessories
 - .6 Device and cabling identification
 - .7 Application and location of ULC approval decals
- .4 Technical verification: The purpose is to ensure that all systems and devices are properly installed, and free of defects and damage. Technical verification includes:
 - .1 Measurements of coverage patterns
 - .2 Connecting joints and equipment fastening
 - .3 Compliance with manufacturer's specification, product literature and installation instructions
- .5 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
 - .1 Operation of each device individually and within its environment
 - .2 Operation of each device in relation with programmable schedule and or/specific functions.

2.7 CLEANING AND ADJUSTING

- .1 Remove protective coverings from control panels, detection accessories and components.
- .2 Adjust all components for correct function.
Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

END OF SECTION

1.0 GENERAL

1.1 OVERVIEW

- .1 Supply and install a Video Surveillance System (CCTV System) as described in the specifications and drawings.
- .2 The existing Video Surveillance System is a Genetec Omnicast Enterprise version V4.6 System.
- .3 The existing VMS is using a Genetec Pivot3 VSTAC server located in Building D, room 131.
- .4 The existing CCTV network switches are Planet Layer 3 type switches and Black Box PoE injector units.
- .5 The existing CCTV network switch in HC building has 8-spare port that can be used.
- .6 The existing Black Box PoE injector has 11-spare port that can be used.
- .7 The contractor shall provide all required components to supply a fully functional video surveillance system as described in the contract documents. The contractor shall provide all required components that are not listed in the specification but are required to supply a fully functional video surveillance system as described in the contract documents.
- .8 Supply and install all required hardware and software for one (1) client CCTV system PC workstation in Security Office G188 and one (1) client CCTV system PC workstation in the Dispensary G187B. The PC workstations shall come loaded with Genetec Remote Security Desk software.
- .9 The Security Office client workstation shall display camera views C1, C6, C11 and C12. Contractor shall provide all required programming and configurations.
- .10 The Dispensary client workstation shall display camera views C11 and C12. Contractor shall provide all required programming and configurations.
- .11 Provide wall mounted TV articulating mounting brackets for all displays.
- .12 All software and camera licenses shall be valid for 1-year after award of substantial completion.
- .13 All CCTV CAT6 wiring shall have a GREEN coloured outer jacket. All CCTV system CAT6 Patch cords shall have a GREEN coloured outer jacket. Contractor shall supply and install all required patch cords for the new CCTV cameras.
- .14 Video surveillance cameras shall be IP PoE type and shall connect to Ethernet PoE Network switches.
- .15 Contractor shall provide two spare dome cameras for maintenance purposes. Provide cameras to maintenance department and retain receipt.
- .16 The contractor shall supply and install Planet Layer 3 Ethernet PoE network switches as required to provide a complete operating system.
- .17 Supply and install CCTV system head end equipment in existing equipment cabinet in T&E room G202. Coordinate exact mounting locations on-site with departmental representative.

1.2 SECTIONS INCLUDE

- .1 This section of the specification forms part of the contract documents and is to be read, interpreted and co-ordinated with all other parts.
 - .2 This section specifies video components configured as a system, which performs functions related to image acquisition, video display and recording images.
-

1.3 RELATED_SECTIONS

- .1 Section 01 01 50 –General Instructions
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 26 05 00 – Common Work Results – Electrical
- .5 Section 26 05 01 – Seismic Restraints – Electrical
- .6 Section 26 05 07 – Elevators
- .7 Section 26 05 21 – Wire and Cables
- .8 Section 26 05 34 – Conduit, Conduit Fastenings and Fittings
- .9 Section 27 13 00 – Backbone Cabling
- .10 Section 27 15 00 – Communications Cables Inside Buildings
- .11 Section 27 05 28 – Pathways for Communications Systems

1.4 REFERENCE STANDARDS

- .1 The installation shall, as minimum, meet all national, provincial, and municipal, including, but not limited to:
 - .1 Building, fire, electrical and labour codes and standards.
 - .2 Workmanship shall meet or exceed nationally accepted workmanship standard.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.1- latest edition, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations
 - .2 CAN/CSA-C22.3 No.1- latest edition, Overhead Systems
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 ULC-S317- latest edition, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems
- .4 CSC Standards: ES/SOW-0101, attached in Appendix.

1.5 SCOPE OF WORK

- .1 Supply and installation of a complete and operating system including but not necessarily limited to:
 - .1 Video Cameras
 - .2 Video Handling
 - .3 Transmission Methods
 - .4 Video PC Workstations
 - .5 PoE Network Switches
 - .6 Cabling and Terminations
 - .7 Integration Software

1.6 DEFINITIONS

- .1 NVMS: Network Video Management Software
 - .2 NVR: Network Video Recorder
 - .3 CCTV: Closed Circuit Television
 - .4 CCVC: Closed Circuit Video
 - .5 CCD: Charge Coupled Device
 - .6 FOV: Field of View
 - .7 RI: Rough-in conduit only
-

1.7 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and data sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labelling scheme including:
 - .1 Functional description of equipment
 - .2 Technical data sheets of all devices
 - .3 Device location plans and cable lists
 - .4 Video camera surveillance chart
 - .5 Video interconnection detail drawings
 - .6 Programming worksheets
 - .3 Samples: Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit sample floor plans with device layout that will be used with the NVMS.
 - .4 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit UL/CSA Product Safety Certificates.
 - .3 Instructions: Submit manufacturer's installation instructions.
 - .5 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Include following:
 - .1 System configuration and equipment physical layout
 - .2 Functional description of equipment
 - .3 Instructions on operation, adjustment and cleaning
 - .4 Illustrations and diagrams to supplement procedures
 - .5 Manufacturer's operation instructions
 - .6 All programming worksheets
 - .7 All Genetec licenses

1.8 WARRANTY

- .1 For all materials, the 12-month warranty for parts and labour.

1.9 SUPPORT SERVICES

- .1 Provide manufacturer/dealer advice, information and support services for 1 year.

1.10 LICENSING

- .1 Contractor shall pay for all software and camera licenses for 1-year. All software and camera licenses shall be valid for 1-year after substantial completion of project.

1.11 CONTRACTOR QUALIFICATIONS

- .1 The Video Surveillance System shall be installed by a qualified Security Systems Contractor certified by the respective equipment manufacturer, and having a minimum of five (5) years installation, and service experience with similar installations.

- .2 The Video Surveillance system contractor shall be fully certified dealer by Genetec CCTV Systems Manufacturer in the Province of British Columbia. The the contractor and all personnel performing work on CCTV system shall be required to have all the necessary certifications from Genetec to work on the Pivot3 Vstac NVR equipment.
- .3 The contractor business, employees, managers and owners must be licensed in the Province of British Columbia under the Private Investigators and Security Agencies Act.
- .4 The business must be licensed and bonded as an Alarm Service and each employee who is installing and servicing security alarm devices and equipment, must be licensed and bonded as an employee of the company and not as a sub-contractor.
- .5 The equipment installers must hold a valid Trade Qualification Certificate issued by the Province of British Columbia. Proof of the Company and Installers Certification shall be requested and reviewed prior to contract award.
- .6 The contractor shall submit documentations of qualifications as noted in the above prior to start of any work on CCTV system. Failure to provide such documentation will be the basis for rejection of sub-contractor proposed for work under this section.

2.0 PRODUCTS

2.1 SUPPLY OF SYSTEM COMPONENTS

- .1 Unless otherwise specified in this document, the contractor shall supply all components necessary to complete the system. All materials shall be new and of the latest hardware, software, and firmware versions.

2.2 MATERIALS

- .1 Client Workstations:
 - .1 Processor: i5 Quad Core
 - .2 Chipset: Intel H110
 - .3 Operating System: Windows 10 Pro 64-bit
 - .4 Required Software: Genetec Remote Security Desk Software
 - .5 Graphics Options: Intel HD Graphics 530
 - .6 Memory: Standard
 - .7 Networking: Ethernet LAN 10/100/100 + 802.11 + Bluetooth
 - .8 I/O ports: Standard
 - .9 Hard Drive: Solid State, 500GB
- .2 LCD Monitors: (Security office G188)
 - .1 Monitor size: 81 cm
 - .2 Number of Pixels: 1920 (H) x 1080 (V)
 - .3 Brightness: 300cd/m² or better
 - .4 Contrast Ratio: 30,000:1 or better
 - .5 Backlight Type: LED
 - .6 Response Time: 2ms or better
 - .7 Native Resolution: 1920 x 1080
 - .8 Panel Aspect Ratio: 16:9
 - .9 Video Formats: 480p, 576p, 720p, 1080i/p
 - .10 Panel Life: 30,000 hours
 - .11 Display colors: 16.7 million
 - .12 Picture-in-picture: Selectable, sizeable, swappable, moveable

.13	Speakers:	2 internal 3 watts
.14	VESA Mounting:	100mm x 100mm
.15	Video Inputs:	HDMI, DVD-I
.16	Mounting Bracket:	Included – Wall/Ceiling Tilt/swivel
.3	LCD Monitors: (Dispensary G187B)	
.1	Monitor size:	56 cm
.2	Number of Pixels:	1920 (H) x 1080 (V)
.3	Brightness:	300cd/m ² or better
.4	Contrast Ratio:	30,000:1 or better
.5	Backlight Type:	LED
.6	Response Time:	2ms or better
.7	Native Resolution:	1920 x 1080
.8	Panel Aspect Ratio:	16:9
.9	Video Formats:	480p, 576p, 720p, 1080i/p
.10	Panel Life:	30,000 hours
.11	Display colors:	16.7 million
.12	Picture-in-picture:	Selectable, sizeable, swappable, moveable
.13	Speakers:	2 internal 3 watts
.14	VESA Mounting:	100mm x 100mm
.15	Video Inputs:	HDMI, DVD-I
.16	Mounting Bracket:	Included – Wall/Ceiling Tilt/swivel
.4	Full Service Video Wall Mount:	
.1	Access:	Pull-out/Prop-open
.2	VESA Patterns:	100mm increments up to 700mm x 400mm
.3	Dimensions:	890mmW x 508mmH x 78-97mmD
.4	Product Weight:	15kg
.5	Load Capacity:	56.8kg
.6	Finish:	Scratch resistant fused epoxy
.7	Colour:	Black
.8	Mounting Spacers:	Included
.5	Network Video Recorder/Server Uninterrupted Power Supply (UPS)	
.1	Output Capacity:	2000VA/1800Watts
.2	User Interface:	Graphical LCD monitor
.3	Topology:	True online, double-conversion
.4	Input Connection:	5-20P
.5	Output Receptacles:	6 x 5-20R, 1 x L5-20R
.6	Diagnostics:	Full system self-test
.7	UPS Bypass:	Automatic
.8	Remote Power off (REPO):	Yes
.9	Nominal Input Voltage:	120V, 208V, 220-240V
.10	Power Draw:	16.6A @ 120V
.11	Frequency:	50/60Hz
.12	Power Output Factor:	0.9
.13	Voltage Waveform:	Sine Wave
.14	Battery Replacement:	Hot-swappable, internal/external

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- | | | |
|-----|----------------------|---------------------|
| .15 | Serial Port: | RS-232 |
| .16 | USB Port: | HID Standard |
| .17 | Communication Cards: | SNMP/Web |
| .18 | Mounting: | 2U rack mounted |
| .19 | Dimensions: | 87H x 438W x 600mmD |
| .20 | BTU/hr – Normal: | 838 |
| .21 | BTU/hr – On Battery: | 1348 |
- .6 Layer 3 PoE Network Switch:
- | | | |
|-----|----------------------|--------------------------------------|
| .1 | CPU: | ARM A9 400MHz |
| .2 | RAM Size: | 512MB |
| .3 | Flash Size: | 16MB |
| .4 | Ports: | 24 - 10/100/1000Base-T PoE+ |
| .5 | SFP+ Slots: | 4 x 10GBASE-SR/LR SFP+ |
| .6 | PoE Injector Port: | 24 ports with 802.3at/af |
| .7 | Switch Architecture: | Store-and-forward |
| .8 | Switch Fabric: | 128Gbps/non-blocking |
| .9 | Switch Throughput: | 95.24Mpps |
| .10 | Stackable: | Yes |
| .11 | Available PoE Power: | 370 Watts or better |
| .12 | Max Port PoE Power: | 24@9W, 24@15W, 12@30 Watts |
| .13 | Support: | IEEE 802.3af, IEEE 802.3at compliant |
| .14 | Dimensions: | 440mmW x 330mmD x 1U |
| .15 | Weight: | 4860g |
| .16 | Power consumption: | 435W/1484.28BTU Max |
| .17 | Approved Product: | Planet SGS-6341-24P4X Series |
- .7 Fixed Network Colour Dome Camera: (Provide two spare dome cameras for maintenance)
- .1 The camera case and dome must:
- .1 Measure a base diameter less than 200mm;
 - .2 Measure from base to top of dome of less than 175mm excluding any mount;
 - .3 Weight: less than 2.5kg
 - .4 Domes must be smoked. Clear domes not acceptable.
- .2 The camera case and dome must:
- .1 Meet or exceed IEC EN60529 IP66 dust and water resistance when mounted;
 - .2 Meet or exceed IEC EN62262 IK10 impact resistance
 - .3 Have threaded openings for conduits
 - .4 Have a threaded plug to seal all unused openings
 - .5 Have set-screws to secure all conduit and plugs from inside the dome
 - .6 Have tamper resistant heads on all externally accessible screws
 - .7 Have a permanently affixed label on the interior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement
 - .8 Have a permanently affixed label on the exterior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement
- .3 The camera must:
- .1 Be capable of continuous operation;
-

- .2 Start and operate from -40°C to 50°C;
 - .3 Start and operate from 20% to 90% non-condensing humidity
 - .4 Camera Interference:
 - .1 The camera must be certified compliant to IEC EN 61000-4-3, Radiated RF immunity
 - .5 Camera Reliability:
 - .1 The camera must have an MTBF of at least 25,000 hours.
 - .6 Camera Safety:
 - .1 The camera must meet IEC 60950-1 or the CSA equivalent
 - .7 Camera Operations:
 - .1 The camera must retain its configuration over a power cycle.
 - .2 The image sensor must:
 - .1 Include automatic or remote back focus
 - .2 Have a minimum of 480,000 pixels (horizontal x vertical)
 - .3 Have day (colour) and night (black and white) modes
 - .4 Automatic removable infrared cut filter for day/night transition
 - .5 Have 0.5 lux or less minimum illumination for day mode
 - .6 Have 0.1 lux or less minimum illumination for night mode
 - .7 Include Automatic Gain Control (AGC)
 - .8 Include extended dynamic range processing
 - .8 Camera Lens:
 - .1 Have a 35° to 80° or greater horizontal angular view varifocal lens
 - .2 Be approved by the manufacturer of the camera for that camera
 - .9 Camera Video:
 - .1 The video encoding must:
 - .1 Support H.264 configurable I-frame frequency of at least 3 per second
 - .2 Support H.264 constant bit rate transmission mode
 - .3 Support H.264 frame rate transmission mode
 - .4 Support at least 3 levels of H.264 image quality
 - .5 Support at least 3 levels of MJPEG image quality
 - .2 The Video Output Must:
 - .1 Include an on-screen, programmable character generation overlay capability with a minimum of 8 visible characters;
 - .2 Support at least two simultaneous H.264 video streams at 30 frames per second with at least 480,000 pixel resolution;
 - .3 Support at least two simultaneous video streams, one H.264 and one MJPEG at 15 frames per second with at least 480,000 pixel resolution
 - .10 Camera Ports:
 - .1 The camera must:
 - .1 Interface over IPV4 TCP/IP;
 - .2 Be able to operate on 100Base-TX (IEEE 802.3u);
 - .3 Connect using an RJ-45 connector;
 - .4 Be ONVIF compliant
 - .11 Camera Power:
 - .1 The camera must be a Type 1 powered device operating solely from Power over Ethernet (PoE) compliant with IEEE 802.3at Class 0, 1, 2, or 3.
-

- .12 Camera Compatibility:
 - .1 The camera model must be identified as “Certified” or “Supported by Design” in the Genetec Omnicast Supported Hardware camera list.
 - .8 Indoor No-Grip Corner Mount Network Colour Camera:
 - .1 The camera case and dome must:
 - .1 Measure a base diameter less than 300mm;
 - .2 Weight: less than 2.5kg
 - .3 Domes must be smoked. Clear domes not acceptable
 - .2 The camera case must:
 - .1 Meet or exceed IEC EN60529 IP65 dust and water resistance when mounted
 - .2 Meet or exceed IEC EN62262 IK10 impact resistance
 - .3 Have tamper resistant heads on all externally accessible screws
 - .4 Be grip-less and anchor-free
 - .5 Have a permanently affixed label on the interior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement
 - .6 Have a permanently affixed label on the exterior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement
 - .3 The camera must:
 - .1 Be capable of continuous operation;
 - .2 Start and operate from -40°C to 50°C;
 - .3 Start and operate from 20% to 90% non-condensing humidity
 - .4 Camera Interference:
 - .1 The camera must be certified compliant to IEC EN 61000-4-3, Radiated RF immunity
 - .5 Camera Reliability:
 - .1 The camera must have an MTBF of at least 25,000 hours.
 - .6 Camera Safety:
 - .1 The camera must meet IEC 60950-1 or the CSA equivalent
 - .7 Camera Operation:
 - .1 The camera must retain its configuration over a power cycle.
 - .2 The image sensor must:
 - .1 Include automatic or remote back focus;
 - .2 Have a minimum of 480,000 pixels (horizontal x vertical);
 - .3 Have day (colour) and night (black and white) modes;
 - .4 Automatic removable infrared cut filter for day/night transition;
 - .5 Have 0.5 lux or less minimum illumination for day mode;
 - .6 Have 0 lux minimum illumination for night mode;
 - .7 If required for night mode, use invisible illumination (typically infra-red LEDs);
 - .8 Include Automatic Gain Control (AGC)
 - .8 Camera Lens:
 - .1 The camera lens must:
 - .1 Provide a view of the entire floor and all four walls of a room at least 3.5m x 3.5m including the walls to which it is attached from the mounting height to the floor;
 - .2 Be approved by the manufacturer of the camera for that camera
 - .9 Camera Case:
-

- .1 The camera case must:
 - .1 Have a programmatically controlled visible LED indicator to show when the video feed is being observed
 - .10 Camera Video:
 - .1 The video encoding must:
 - .1 Support H.264 configurable I-frame frequency of at least 3 per second
 - .2 Support H.264 constant bit rate transmission mode
 - .3 Support H.264 frame rate transmission mode
 - .4 Support at least 3 levels of H.264 image quality
 - .5 Support at least 3 levels of MJPEG image quality
 - .2 The video output must:
 - .1 Include an on-screen, programmable character generation overlay capability with a minimum of 8 visible characters
 - .2 Support at least two simultaneous H.264 video streams at 30 frames per second with at least 480,000 pixel resolution
 - .3 Support at least two simultaneous video streams, one H.264 and one MJPEG at 15 frames per second with at least 480,000 pixel resolution
 - .11 Camera Ports:
 - .1 The camera must:
 - .1 Interface over IPV4 TCP/IP
 - .2 Be able to operate on 100Base-TX (IEEE 802.3u)
 - .3 Connect using an RJ-45 connector
 - .4 Be ONVIF compliant
 - .12 Camera Power:
 - .1 The camera must be a Type 1 powered device operating solely from Power over Ethernet (PoE) compliant with IEEE 802.3at Class 0, 1, 2, or 3.
 - .13 Camera Compatibility:
 - .1 The camera model must be identified as “Certified” or “Supported by Design” in the Genetec Omnicast Supported Hardware camera list.
- 2.3 CAMERA CABLING:
- .1 Provide all required Copper and Fiber Cabling as shown on drawings.
 - .2 All CCTV system cabling, Patch Cords, and Jacks shall be Green in colour.
- 2.4 CAMERA JUNCTION BOX:
- .1 Metal, sized to handle all system conduit interconnections with appropriate expansion
- 3.0 EXECUTION
- 3.1 MANUFACTURER'S INSTRUCTIONS
- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.
-

3.2 INSTALLATION

- .1 Install video surveillance equipment and components as indicated on drawings and specifications, and in accordance with ULC-S317.
- .2 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.
- .3 Install components secure, properly aligned and in locations shown on reviewed shop drawings.
- .4 Connect cameras to cabling in accordance with installation instructions.
- .5 Install ULC labels where required.
- .6 Adjust camera video for low light levels such as nighttime or when lights have been turned off. Low light level adjustment shall be done in the evening when the sun has gone down for an hour at least.
- .7 The contractor under this Section is responsible for installing, connecting, programming and testing of all system components.
- .8 Install all video surveillance components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .9 Install all video surveillance components secure to walls, ceilings or other substrates.
- .10 Each cable from component to component shall be continuous without any joint or splice.
- .11 Low voltage cables are not permitted to share the same conduits or ducts with line voltage electrical cables.
- .12 All video communication wiring must be in conduit.
- .13 Install a woven nylon pull string in with cables as cables are pulled into conduits.
- .14 All cables shall be CSA approved. All cables shall be FT6 rated.

3.3 PROGRAMMING

- .1 The contractor shall be responsible to program any programmable component related to the video surveillance system, and setup all necessary operating systems.
- .2 The Departmental Representative will inform the contractor of any specific programming requirements. The contractor shall make allowances for custom programming as requested by the Departmental Representative.
- .3 All remote download/upload options shall be enabled co-ordinate with Departmental Representative.
- .4 The contractor shall develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Departmental Representative.
- .5 The contractor is responsible for the entire programming and setup of the system such that no additional programming is required. Programming shall include the setup of all available features of the software.
- .6 The contractor shall perform a full system back-up at completion of initial programming and deliver the configuration to the Departmental Representative.
- .7 The contractor shall perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on any revisions to the Departmental Representative's operating requirements.

3.4 TRAINING

- .1 The contractor as part of their tendered price shall provide a minimum three (3) sessions of four (4) hours each additional time allotted, as needed, to perform thorough instruction on the proper operational features of the video surveillance systems.
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- .2 The contractor as part of their tendered price shall provide a four (4) hour instruction session 30 days after completion of initial training sessions.

3.5 VERIFICATION

- .1 Perform verification inspections and test in the presence of Departmental Representative.
 - .1 Provide all necessary tools, ladders and equipment.
 - .2 Ensure appropriate subcontractors and manufacturer's representatives are present for verification.
- .2 Perform system tests for the following:
 - .1 All camera operations
 - .2 All recording operations
 - .3 All camera labeling
 - .4 All network connections
 - .5 All workstation operations
 - .6 All integrations with other security systems
 - .7 All systems required testing
- .3 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - .1 Sturdiness of equipment fastening
 - .2 Non-existence of installation related damages
 - .3 Compliance of device locations with reviewed shop drawings
 - .4 Compatibility of equipment installation with physical environment
 - .5 Inclusion of all accessories
 - .6 Device and cabling identification
 - .7 Application and location of ULC approval decals
- .4 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
 - .1 Measurements of tension and power
 - .2 Connecting joints and equipment fastening
 - .3 Measurements of signals (dB, lux, baud rate, etc)
 - .4 Compliance with manufacturer's specification, product literature and installation instructions
- .5 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
 - .1 Operation of each device individually and within its environment
 - .2 Operation of each device in relation with programmable schedule and or/specific functions
 - .3 Operation control of camera lens, pan, tilt and zoom
 - .4 Switching of camera to any monitor
 - .5 Switching of system video recorder to selective monitor
 - .6 Set dwell times.
 - .7 Demonstrate:
 - .1 Sequence viewing of cameras on each monitor
 - .2 Bypass capability.

3.6 CLEANING AND ADJUSTING

- .1 Remove protective coverings from cameras and components.
 - .2 Adjust cameras for correct function.
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- .3 Clean camera housings, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section specifies materials and installation for fire detection and fire alarm systems.

1.2 REFERENCES

- .1 NBC-latest edition, National Building Code of Canada.
- .2 Government of Canada
 - .1 TB OSH Chapter 3-03, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
 - .2 TB OSH Chapter 3-04, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-latest edition, Installation of Fire Alarm Systems.
 - .2 ULC-S525- latest edition, Audible Signal Appliances.
 - .3 CAN/ULC-S526- latest edition, Visual Signal Appliances, Fire Alarm.
 - .4 CAN/ULC-S527- latest edition, Control Units.
 - .5 CAN/ULC-S528- latest edition, Manual Pull Stations.
 - .6 CAN/ULC-S529- latest edition, Smoke Detectors.
 - .7 CAN/ULC-S530- latest edition, Heat Actuated Fire Detectors.
 - .8 CAN/ULC-S531- latest edition, Smoke Alarms.
 - .9 CAN/ULC-S536- latest edition, Inspection and Testing of Fire Alarm Systems.
 - .10 CAN/ULC-S537- latest edition, Verification of Fire Alarm Systems.

1.3 DESCRIPTION OF SYSTEM

- .1 System shall be fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital and multiplexing techniques for data transmission.
- .2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to fire department.
- .3 The system shall be fully addressable, zoned, non-coded single stage.
- .4 System to be modular in design to allow for future expansion.
- .5 Operation of system shall not require personnel with special computer skills.
- .6 System to include:
 - .1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main

system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.

- .2 Power supplies.
- .3 Initiating/input circuits.
- .4 Output circuits.
- .5 Auxiliary circuits.
- .6 Wiring.
- .7 Manual and automatic initiating devices.
- .8 Audible and visual signalling devices.
- .9 End-of-line resistors.
- .10 Local and Remote annunciators and displays.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- .1 System:
 - .1 To TB OSH Chapter 3-04.
 - .2 Subject to Fire Commissioner of Canada (FC) approval.
 - .3 Subject to FC inspection for final acceptance.
 - .4 To Canadian Forces Fire Marshal approval.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include:
 - .1 Layout of equipment.
 - .2 Zoning.
 - .3 Complete wiring diagram, including schematics of modules.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual.
- .2 Include:
 - .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.
 - .4 List of recommended spare parts for system.

1.7 EXTRA MATERIALS

- .1 Provide maintenance materials as recommended by the system manufacturer. Submit recommended spare parts list to Consultant for review in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include four (4) spare glass rods for manual pull box stations if applicable.

1.8 MAINTENANCE

- .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Consultant.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 In accordance with applicable CAN/ULC standards.

2.2 SYSTEM OPERATION

- .1 Single stage operation. Operation of any alarm initiating device to:
 - .1 Cause audible signal devices to sound throughout building.
 - .2 Transmit signal to fire department via fire alarm transmitter.
 - .3 Cause zone of alarm device to be indicated on control panel and remote annunciator.
 - .4 Cause air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
 - .5 Cause fire doors and smoke control doors if normally held open, to close automatically.
- .2 Capability to program smoke detector status change confirmation on any or all zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

- .1 Single stage operation.
- .2 Zoned.
- .3 Non-coded.
- .4 Enclosure: CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.
- .5 Provide 120 volt circuit and ceramic heater for all exterior mounted annunciator panels, whether indicated or not.
- .6 Supervised, modular design with plug-in modules:
 - .1 Alarm receiver with [trouble and alarm indications] [provision for remote supervised annunciation], for class A and B initiating circuits.
 - .2 Spare zones: compatible with smoke detectors and open circuit devices.
 - .3 Space for future modules.
 - .4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.
- .7 Components:
 - .1 Coded alarm receiver panel with trouble and alarm indications for class and B initiating circuits.
 - .2 Single stage alarm pulse rate panels:

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- .1 Single stroke control type for output to signal control panel continuously.
 - .3 Common control and power units:
 - .1 Control panel containing following indications and controls:
 - .1 "Power on" LED (green) to monitor primary source of power to system.
 - .2 "Power trouble" indication.
 - .3 "Ground trouble" indication.
 - .4 "Remote annunciator trouble" indication.
 - .5 "System trouble" indication.
 - .6 "System trouble" buzzer and silence switch c/w trouble resound feature.
 - .7 System reset switch.
 - .8 "LED test" switch if applicable.
 - .9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.
 - .10 "Signals silenced" indication.
 - .2 Master power supply panel to provide 24Vdc to system from 120Vac, 60Hz input.
 - .3 Fire department connections:
 - .1 Plug-in module for shunt type municipal box.
 - .2 Fire department bypass switch c/w indicator for trouble at panel.
 - .4 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit.
 - .1 Contacts: 2.0A, 120Vac, for functions such as release of door holders or initiation of fan shut down.
 - .2 Contact terminal size: capable of accepting 22-12AWG wire.
 - .5 Manufacturer: simplex Grinnell, Edwards and Notifier.

2.4 POWER SUPPLY

- .1 120V, ac, 60Hz input, 24Vdc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of 4 years, sized in accordance with BC Building Code.

2.5 MANUAL ALARM STATIONS

- .1 Manual alarm stations: pull lever, glass rod, wall mounted surface] type, non-coded single pole normally open contact for single stage English signage.
- .2 Manufacturer - Addressable manual pull station: GE Edwards #SIGA-270SPO or Notifier MPS-950B with NBG-LX.
- .3 Provide steel protective guards for pull stations installed where required by Departmental Representative.

2.6 AUTOMATIC ALARM INITIATING DEVICES

- .1 Heat detectors, fixed temperature, non-restorable, rated 57°C.
- .2 Thermal detectors, addressable, fixed temperature: 57°C.
- .3 Smoke detector: addressable ionization type.
 - .1 Dual chamber, ionization, twistlock, plug-in type with fixed wire-in base assembly with integral red alarm LED. Detector to be addressable type c/w electronics to communicate detector's status and field adjustable address setting.
 - .2 Smoke detectors located in the cell and general cell area shall have protective guards as defined in the RCMP Cell Standards Manual
- .4 Duct Smoke Detector
 - .1 Dual chamber, multisensor, twistlock, plug-in type with fixed wire-in base assembly with integral red alarm LED. Detector to be addressable type c/w electronics to communicate detector's status and field adjustable address setting. If shaft mounted or obstructed, provide remote indicating LED and access hatch in accordance with Section 26 05 00.
- .5 Remote LED alarm indicator for concealed thermal and smoke detectors.

2.7 AUDIBLE SIGNAL DEVICES

- .1 Signal chimes: heavy duty, single stroke, 24Vdc, with solid striking plunger and resonating chamber, 95dB.
- .2 Bells: vibrating type, gongs of special alloy steel, 24Vdc, 150mm, 95dB.
- .3 Horns: 95dB, weatherproof mounting, 24Vdc.
- .4 Mini-horns: 95dB, surface mounting, red colour, 24Vdc.
- .5 All audible devices must be programmed to a temporal pattern 3, as required by the BC Building Code.

2.8 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.9 REMOTE ANNUNCIATOR PANELS

- .1 LED type with designation cards to indicate zone.
- .2 LEDs to annunciate alarm and trouble.
- .3 Wired in multiple with main control panel.
- .4 Supervised, including trouble signal for open circuit.
- .5 LED test button.

2.10 GRAPHIC DISPLAY

- .1 Provide and install flush mounted LED back-lit remote graphic annunciator complete with driver, LCD display, scroll, acknowledge button, system re-set system trouble, power on, and signal silence. Refer to drawings for location.
- .2 Ensure all annunciator locations are approved by local fire department.
- .3 Display:

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- .1 Alarms and troubles for alarm initiating circuits.
 - .2 Supervisory alarms and troubles common supervisory alarm for supervisory initiating circuits.
 - .3 Common system trouble.
 - .4 Alarms for standby emergency generator.
 - .5 Trouble buzzer
 - .1 Acknowledging trouble at main panel to silence trouble buzzers in system.
 - .6 Supervised, with LED test button and alarm trouble acknowledge button.
 - .7 Minimum wiring configuration with main panel and other remote annunciators.
 - .8 Annunciator to be complete with brushed aluminum trim and hinged lockable cover.
 - .9 Provide 100 watt, 120 volt ceramic strip heater inside annunciator enclosure for exterior weatherproof mounted annunciator panels. Monitor strip heater via the fire alarm system and provide trouble indicator. Provide 120 volt power to heater, whether shown on plans or not.

2.11 VISUAL ALARM SIGNAL DEVICES

- .1 Strobe type: [flashing] [rotating], [red] [blue], 24Vdc.
- .2 Designed for surface mounting on ceiling or walls as indicated.
- .3 Visual alarm signalling devices located in the general cell area shall have protective guards as defined in the RCMP Cell Standards Manual.

2.12 SPRINKLER SYSTEM CONNECTION

- .1 Provide waterflow/tamper modules for connection to sprinkler system for monitoring of flow switches and valves.
- .2 Provide input modules for connection of pressure switches for monitoring.
- .3 Provide alarm/trouble indication of heat tracing system at the control panel and remote annunciator panel.

2.13 ISOLATION MODULES

- .1 Addressable zone isolation modules.

2.14 MAGNETIC DOOR HOLD OPEN DEVICES

- .1 Magnetic two-piece device. One piece flush mounted on wall and the other piece on door, 120V AC.
- .2 Wire through Low Voltage Relay, to de-energize door holder, upon signal from fire alarm system.

2.15 ANCILLARY DEVICES

- .1 Remote relay unit to initiate fan shutdown.
- .2 Provide relay interlocks to fire alarm control panel to shut down fans as indicated on mechanical equipment schedule.

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- .3 Provide relay interlocks and control switches in main control panel and annunciator panels to enable smoke removal fans operation as described in the Mechanical Specifications.
 - .4 Provide relay contact to DDC system to signal the status of the fire alarm system.
 - .5 Provide relay contacts to DDC system to signal the status of the smoke removal switches

2.16 WIRE AND CABLE

- .1 Conductor Insulation: Minimum rating 300 volts. Single conductor RW90XLPE (X-link).
- .2 Multi-conductor cables 105°C with outer PVC jacket, colour coded, FAS rated.
- .3 Conductor sizes as follows:
 - .1 To initiating circuits: #18 AWG minimum, and in accordance with manufacturer's requirements.
 - .2 To signal circuits: #16 AWG minimum, and in accordance with manufacturer's requirements.
 - .3 To control circuits: #12 AWG minimum, and in accordance with manufacturer's requirements.
 - .4 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.
- .4 All wiring to be copper.
- .5 All wiring to be tag identified at the points of connection.
- .6 Provide a ground conductor with all system wiring and bond all metal parts including device boxes.
- .7 All fire alarm system wiring to be in conduit except short drops from ceiling junction box to detectors mounted in T-Bar ceiling may be rated fire alarm system cable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.
- .2 Install main control panel and connect to ac power supply.
- .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5 Connect alarm circuits to main control panel.
- .6 Locate and install signal devices, bells, chimes, horns and visual signal devices and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices at end of alarm and signalling circuits.
- .9 Install remote annunciator panels and connect to annunciator circuit wiring.

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- .10 Locate and install door releasing devices.
 - .11 Locate and install remote relay units to control fan shut down.
 - .12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
 - .13 Provide quantity of six (6) spare gongs and allow for installation to within 10m radius of nearest gong shown on plans to suit final fit-up sound level requirements.
 - .14 Provide quantity of two (2) spare manual pull stations and allow for installation within 10m radius of fire alarm system devices.
 - .15 Provide quantity of two (2) spare heat detectors and allow for installation within 10m radius of fire alarm system devices.
 - .16 Provide quantity of two (2) spare smoke detectors and allow for installation within 10m radius of fire alarm system devices.

3.2 FIRE ALARM ZONES

- .1 Provide zoning for fire alarm detection devices, generally as follows:
 - .1 Main Floor South East area.
 - .2 Main Floor South West area.
 - .3 Main Floor North East area.
 - .4 Main Floor North West area.
 - .5 Second Floor South East area.
 - .6 Second Floor South West area.
 - .7 Second Floor North East area.
 - .8 Second Floor North West area.
 - .9 Atrium.
 - .10 Each floor area sprinkler flow switch and sprinkler valve monitors.
 - .11 Top of stairwells, one zone for each stairwell.
 - .12 Main sprinkler valve.
 - .13 Each Sprinkler Room.
 - .14 Smoke detectors in mechanical air handling units.
 - .15 Elevator shafts, one per shaft, provide smoke detector at top of shaft.
 - .16 Main Floor and Second Floor Electrical Rooms.
 - .17 Main Floor and Second Floor Communication Rooms.
 - .18 Each of twelve (12) cells
 - .19 Others as indicated on the drawings.
- .2 Provide all required connections to all mechanical sprinkler system alarm and supervisory devices. Coordinate with Mechanical drawings and specifications.
- .3 Provide and install minimum two bell circuits per floor. Confirm exact locations.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests as described herein and in accordance CAN/ULC-S537.
- .2 Fire alarm system:

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- .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, and sprinkler system transmit alarm to control panel and actuate general alarm ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
 - .4 Manufacturer's technician to verify all new devices and reconnected existing fire alarm system equipment and components in accordance with ULC Standard S537.
 - .5 Provide a Certification of Verification.
 - .6 After verification, demonstrate and spot test system as required by Consultant and Fire Commissioner.
 - .7 Provide Departmental Representative with written verification report for review and include copies in maintenance manuals
 - .8 Class A circuits.
 - .1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .9 Class B circuits.
 - .1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

3.4 TRAINING

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 32 12 16.02 – Asphalt Paving for Building Sites
- .2 Section 32 16 15 – Concrete Walks, Curbs and Gutters
- .3 Section 32 92 19.13 – Mechanical Seeding
- .4 Section 33 05 13 – Manholes and Catchbasin Structures
- .5 Section 33 11 16 – Site Water Utility Distribution Piping
- .6 Section 33 31 13 – Public Sanitary Utility Sewerage Piping
- .7 Section 33 41 00 – Storm Utility Drainage Piping

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C88, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregate.
 - .3 ASTM C117, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .4 ASTM D1557, Specification for Test Methods for Aggregate Mixtures using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.
 - .5 ASTM D698, Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures using 2.49 kg Rammer and 304.8 mm Drop.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction.
- 3. The Contractor is to examine and comply with the project geotechnical assessment document prepared by Braun Geotechnical Ltd. as follows:
 - 1. November 30, 2015 (rev. 1) Reference 16-6516 report titled “Preliminary Geotechnical Exploration Report; Proposed Health Care Expansion – Mountain Institution 4732 Cemetery Road, Agassiz, BC”.

In the case of any conflict between the requirements of the specification sections and the project geotechnical assessment document referred to above, comply with the more stringent requirement(s).

1.3 SCOPE OF WORK

- .1 General site clearing, grubbing and topsoil stripping.
 - .2 Civil Engineering cut, fill, trenching and grading work exceeding 1m beyond the building footprint inclusive of:
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- .1 Excavating, trenching and backfill for utility services and buried installations.
- .2 General site grading
- .3 Topsoil restoration
- .4 Sub-grading and filling below paved areas
- .3 Exclusions to scope of this specification section:
 - .1 Earthworks inside or 1m beyond the building footprint.

1.4 REGULATIONS

- .1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.
- .2 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.
- .3 Before commencing work, conduct, with the Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

1.5 TESTS AND INSPECTIONS

- .1 The contractor shall retain, at his own cost, the services of an independent and certified testing agency to undertake soil and granular material tests at the following minimum frequencies / intervals:
 - .1 Sieve Analysis prior to commencing and 1 every 200 tonnes on:
 - .1 All materials referred to in item 2.1 of this Section 31 00 99 (Earthworks for Minor works)
 - .2 Base granular and sub-base granular materials referred to in item 2.1.1 of Section 32 12 16.02 (Asphalt Paving for Building Sites).
 - .2 Modified Proctor Analysis on all materials for which density tests are specified below, prior to commencing and 1 every 200 tonnes.
 - .3 Density Tests on placed and compacted fills and granular materials, for which the results are to be expressed as a percentage of Modified Proctor Density, as follows:
 - 1. Compacted imported fill below paved areas: Up to 10 Density tests per 0.3m of fill depth (or part thereof) at locations to be determined by the Departmental Representative.
 - 2. Base granular: Up to 10 Density tests per 0.3m of fill depth (or part thereof) at locations to be determined by the Departmental Representative.

3. Subbase granular: Up to 10 Density tests per 0.3m of fill depth (or part thereof) at locations to be determined by the Departmental Representative.
 4. Compacted trench backfill (trenches up to 1.5m depth): Density tests at 2 per 30 lin.m or part thereof; one at half height and one at pavement subgrade elevation.
 5. Compacted trench backfill (trenches exceeding 1.5m depth): Density tests at 3 per 30 lin.m or part thereof.; one at one-third height, one at two-thirds height and one at just below pavement subgrade elevation.
4. The Contractor shall cooperate with the Departmental Representative in the selection of test samples. Copies of the test results shall be forwarded promptly to Departmental Representative.
 5. The Contractor is responsible for ensuring all materials meet specifications. Where initial tests fail and subsequent testing is deemed necessary by the Departmental Representative, the cost of the subsequent testing will be the responsibility of the Contractor.
 6. In addition to sample testing, the Contractor will undertake proof rolling of subgrade, subbase and base granular surfaces in road construction areas as required and in the presence of the Departmental Representative for which a minimum of 2 complete working days' notice shall be provided by the Contractor.

1.6 BURIED SERVICES

- .1 Before commencing work verify the location of all buried services on and adjacent to the site.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.
- .3 Remove obsolete buried services within 2 m of foundations and elsewhere as shown on drawings or where in conflict with the permanent works. Cap cut-offs.

1.7 PROTECTION

- .1 Protect excavations from freezing.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect all active buried services. Assume all services to be active unless:
 - .1 Stated otherwise in contract documents;
 - .2 Confirmed otherwise by contractor's own investigations in consultation with Departmental Representative.

- .6 Repair at contractor's own cost damage to existing structures or services resulting from the contractor's failure to locate and protect.
- .7 Avoid mixing excavated materials. Protect the condition and suitability of native soil and topsoil materials stockpiled for re-use.

Part 2 Products

2.1 MATERIALS

- .1 Imported granular material to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.
- .2 Imported crushed granular material when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation, conform to following sieve grading and have one or more fractured faces. Determination of the Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.
- .3 Approved native material is to be used only as used as trench backfill or subgrade fills below areas absent from existing or proposed paving. Approved native material to be any workable soil obtained within limits of Contract that is free of organic or foreign matter, subject to the fact that native material is not acceptable if it is impracticable to control its water content or compact to specified density.
- .4 Below paved areas trench backfill and general fill shall consist of imported 75 mm minus sand or gravel, be substantially free of clay lumps, free of organic matter and other extraneous material and meet the gradation requirements below.

Sieve Designation	Percent Passing	
	Pit run gravel	Pit run sand
300mm dia	(100)	
200mm dia	--- (100)	
100mm dia	--- (100)	
75.0mm	--- 100	
50.0mm	70 - 100	
25.0mm	50 - 100	
12.5mm	-----	100
4.75mm	22 - 100	35 - 100
2.36mm	10 - 85	20 - 70
1.18mm	-----	13 - 50
0.600mm	-----	8 - 35
0.300mm	-----	5 - 25
0.150mm	-----	2 - 15
0.075mm	2 - 8	0 - 6

- .5 Granular Pipe Bedding and Surround Material is to consist of crushed or graded gravels conforming to the following gradation:

Sieve Designation	Percent Passing	
	Type 1*	Type*2
25.0mm	100	100
19.0mm	90 - 100	90 - 100
12.5mm	65 - 85	70 - 100
09.5mm	50 - 75	-----
4.75mm	25 - 50	40 - 70
2.36mm	10 - 35	25 - 52
1.18mm	6 - 26	15 - 38
0.600mm	3 - 17	6 - 27
0.300mm	-----	3 - 20
0.075mm	0 - 5	0 - 8

*Type 1: standard gradation

*Type 2: to be used only in dry trench conditions and with Departmental Representative's prior approval.

Part 3 Execution

3.1 SITE PREPRATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated and / or re-graded.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 CLEARING AND GRUBBING

- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas to be excavated, covered with new construction or re-graded.
- .2 Remove stumps and tree roots below footings, slabs, and paving, and to not less than 200 mm below finished grade elsewhere.
- .3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

3.3 EXCAVATION

- .1 Topsoil stripping
- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Strip topsoil over areas to be excavated, areas to be covered by new construction, areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
- .3 Topsoil to be stored for re-use in stockpiles not exceeding 1.5m high in location designated by the Departmental Representative.

- .4 Should insufficient quantity of native topsoil be available for restoring landscaped areas, due to inappropriate handling or storage of topsoil by contractor, the contractor shall import the required balance at his own cost, ensuring imported material is equal or better than native material.
- .5 Avoid mixing topsoil with subsoil.
- .2 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify the Departmental Representative when excavations are complete and obtain Departmental Representative's approval before proceeding further. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .3 Temporary excavations for service trenches and building areas deeper than 1.2m requiring worker entry should be sloped/shored in accordance with Workers' Compensation Board regulations, or as directed on site by a qualified professional engineer. Flatter cut slope inclinations may be required if heavy groundwater seepage is encountered or if the temporary excavations will be open during periods of high precipitation.
- .4 Dewatering may be required, especially if the excavation is carried out during wet weather. The contractor should protect open excavations against flooding and damage from surface runoff. Select dewatering methods based on site conditions and construction techniques, disposing of water in accordance with Environmental procedures via flocculation tanks, settling basins or other treatment facilities to remove suspended solids or other contaminants before discharging to storm sewers. Avoid discharge to permanent existing or proposed soakaways without written approval of the Departmental Representative.
- .5 Excavate trenches to provide uniform continuous bearing and support for 100 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below an elevation 300 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .6 Excavate for slabs and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.
- .7 For trench excavation, unless otherwise authorized by the Departmental Representative in writing, do not excavate more than 30m of trench in advance of installation operations and do not leave open more than 15m at the end of the day's operation.
- .8 Keep excavated and stockpiled materials a safe distance away from edge of trench. Restrict vehicle operations directly adjacent to open trenches.
- .9 Avoid mixing different excavated subsoils.

3.4 BACKFILLING / FILLING

- .1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by the Departmental Representative.

- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 Compaction: place backfill / fill in uniform lifts not exceeding 150mm and compact to following Modified Proctor densities in compliance with ASTM D1557. (All densities in compliance with ASTM D1557).
 - .1 Below boulevards, easements and landscaped areas to minimum 90%
 - .2 Below and within 1:1 sloping zone of influence of ground-bearing structures, roads, driveways, shoulders, re-shaped ditches, parking areas, patios, paved areas and sidewalks to minimum 95%.
 - .3 Use caution in pipe zone to ensure no damage to pipe.
- .5 Under areas to be top-soiled: use compliant native material up to bottom of topsoil.
- .6 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.
- .7 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .8 During backfilling / filling and compaction, compact each layer before placing succeeding layer.
- .9 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing concrete.
 - .3 Place layers simultaneously on both / all sides of installed work to equalize loading.

3.5 CONTAMINATED MATERIALS

- .1 If contaminated materials are detected during excavation operations, immediately notify the Departmental Representative. Any contaminated materials to be disposed of using methods approved by the Departmental Representative.

3.6 GRADING

- .1 Following clearing and topsoil stripping excavate to rough grade any areas requiring cut.
 - .2 Proof roll exposed sub-grade. Excavate soft spots encountered and backfill with permitted materials in maximum 150mm lifts with compaction to specified density.
 - .3 Before placing fill in areas requiring fill, scarify surface to depth of 150mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
 - .4 In areas requiring fill, raise elevations in permitted materials in maximum 150mm lifts with compaction to specified density.
-

- .5 Employ the preceding operations to achieve rough grading to design elevations allowing for depth of pavement structure, topsoil or other surface treatment as indicated. Grade slopes to be consistent and smooth between finished spot elevations shown on drawings. Tolerance on sub-grade elevations is within 30mm of design elevations but not uniformly high or low.
- .6 Slope rough grade away from building at 2% minimum (unless indicated otherwise).
- .7 Do not disturb soil within branch spread of trees and shrubs to remain.

3.7 RESTORATION – TOPSOILED AREAS

- .1 Prepare subgrade as detailed above and verify that all grades are correct.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 remove debris, roots, branches, stones in excess of 50mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75mm above surface. Dispose of removed material to appropriately licensed off-site disposal area.
- .4 Coarse cultivate entire area which is to receive topsoil to a minimum depth of 150mm immediately before placing topsoil. Cross cultivate areas where equipment used for hauling and spreading has compacted soil.
- .5 When sub-grade accepted by Departmental Representative, commence placing topsoil.
- .6 Place topsoil over prepared subgrade and allow to settle or compact by light rolling such that it is firm against deep footprints. Do not compact topsoil more than is necessary to meet this requirement.
- .7 Ensure topsoil is moist (25% to 75% of capacity) but not wet when placed, and do not handle if frozen or so wet that its structure will be altered.
- .8 Manually spread topsoil around trees, shrubs and obstacles.
- .9 Fine grade topsoil after placing to specified elevations and contours. Re-grade rough spots and low areas to ensure positive surface drainage.
- .10 Finish surface smooth, uniform, firm against deep footprinting with a fine loose surface texture. Mechanically seed restored and repaired topsoiled areas in accordance with Section 32 92 19.13 – Mechanical Seeding.

3.8 RESTORATION - GENERAL

- .1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by the Departmental Representative.
 - .2 Reinstate pavement, sidewalks and grass-block areas in layers, materials, densities and to lines and elevations which existed before excavation, in all cases providing smooth transition to adjacent paved areas.
 - .3 Clean all affected surfaces.
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- .4 Scarify and loosen topsoil in areas used for storage, haulage, machinery and the like.

3.9 SHORTAGE AND SURPLUS

- .1 Supply all necessary fill to meet backfilling and grading requirements.
- .2 Dispose of surplus material off site.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for installation and/or restoration for asphalt concrete paved areas.

1.2 RELATED SECTIONS

- .1 Section 31 00 99 – Earthwork for Minor Works.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C88-99a, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-95, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-98, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-01, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .5 ASTM C128-01, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-01, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .9 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D1557-00, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .11 ASTM D1559-89, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus, was withdrawn in 1998 with no replacement.
 - .12 ASTM D2419-02, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .13 ASTM D3203-94(2000), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .14 ASTM D4318-00, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .15 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - .2 Asphalt Institute (AI)
 - .1 AI MS-2-1993 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.
 - .4 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
 - .5 CAN/CGSB-16.3-M90, Asphalt Cements for Road Purposes.
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3. The Contractor is to examine and comply with the project geotechnical assessment document prepared by Braun Geotechnical Ltd. as follows:

November 30, 2015 (rev. 1) Reference 16-6516 report titled "Preliminary Geotechnical Exploration Report; Proposed Health Care Expansion – Mountain Institution 4732 Cemetery Road, Agassiz, BC".

In the case of any conflict between the requirements of the specification sections and the project geotechnical assessment document referred to above, comply with the more stringent requirement(s).

1.4 SUBMITTALS

- .1 Submit asphaltic concrete mix design and trial mix test results to Departmental Representative for review, at least one week before commencing work.
- .2 Materials to be tested by an accredited and independent testing laboratory including:**
- .1 Marshall tests at a minimum rate of 1 per day**
- .2 Up to eight (8) depth / density test cores in new or restored asphalt areas at locations selected by the Departmental Representative.**
- .3 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work, certifying that asphalt cement meets the requirements of this section.
- .4 Inform Departmental Representative of proposed source of aggregates and provide access for sampling, if required, at least 4 weeks prior to commencing work.
- .5 Testing and compliance records for granular base and sub-base materials as identified in Section 31 00 99 - Earthwork for Minor Works.

Part 2 Products

2.1 MATERIALS

- .1 Crushed granular base and crushed granular sub-base material meeting the following requirements:
- .1 Well graded crushed or screened stone, gravel or sand.
- .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117.
 Table:

Sieve Designation	Granular Base (% passing)	Granular Sub-Base (% passing)
75 mm	-	100
50 mm	-	-
38 mm	-	60-100
25 mm	-	-
19 mm	100	35-80
12.5 mm	75-100	-
9.5 mm	60-90	26-60
4.75 mm	40-70	20-40
2.36 mm	27-55	15-30
1.18mm	16-42	10-20
0.600 mm	8-30	5-15
0.300 mm	5-20	3-10
0.150mm	-	-

Sieve Designation	Granular Base (% passing)	Granular Sub-Base (% passing)
0.075 mm	2-8	0-5

- .3 Granular base aggregates:
 - .1 Crushed particles: at least 60 % of particles by mass retained on 4.75 mm sieve to have at least 1 freshly fractured face.
 - .2 Liquid limit: to ASTM D4318, maximum 25.
 - .3 Plasticity index: to ASTM D4318, maximum 6.

- .2 Asphalt concrete aggregates:
 - .1 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C117.
 - .2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.
 - .3 Do not use aggregates having known polishing characteristics in mixes for surface courses.
 - .4 Aggregate: material to following requirements:
 - .1 Well graded crushed stone or gravel, consisting of hard, durable , angular particles free from clay lumps, cementation, organic material, frozen material and deleterious materials.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117.
 - .3 Table:

Sieve Designation	Asphalt Concrete Lower Course (% Passing)	Asphalt Concrete Upper Course (% Passing)
19.0 mm	100	-
12.5mm	84-99	100
9.5 mm	73-88	-
4.75 mm	50-68	55-75
2.36 mm	35-55	38-58
1.18 mm	27-46	28-47
0.600 mm	18-36	20-36
0.300 mm	10-26	10-26
0.150 mm	4-17	4-17
0.075 mm	3-8	3-8

- .4 Sand equivalent: to ASTM D2419, Minimum 40.
- .5 Magnesium Sulphate soundness: to ASTM C88. Max % loss by weight: coarse aggregate 15, fine aggregate 18.
- .6 Los Angeles Degradation: to ASTM C131. Max % loss by weight: coarse aggregate upper course 25, coarse aggregate lower course 35.
- .7 Absorption: to ASTM C127. Max % by weight: coarse aggregate, 1.75.
- .8 Loss by washing: to ASTM C117; Max % passing 0.075mm sieve: Coarse Aggregate 1.5.
- .9 Lightweight particles: to ASTM C123. Max % by mass, with less than 1.95. Relative density (formally Specific Gravity): 1.5.
- .10 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 3): Max % by weight: coarse aggregate, 10.

- .11 Crushed particles: at least 60 % of particles by mass within each of following sieve designation ranges to have at least 2 freshly fractured faces. Material to be divided into ranges using methods of ASTM C136 and ASTM C117.

Passing		Retained on
25 mm	to	12.5 mm
12.5 mm	to	4.75 mm

- .12 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- .3 Mineral filler for asphalt concrete:
 - .1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
 - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.
- .4 Asphalt cement: to CAN/CGSB-16.3, 80 - 100.
- .5 Asphalt prime: to CAN/CGSB-16.1, grade MC-70.
- .6 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
- .7 Asphalt tack coat: to CAN/CGSB-16.2, grade SS-1.

2.2 EQUIPMENT

- .1 Pavers: mechanical (grade controlled) self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveways:
 - .1 Minimum drum diameter: 750 mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .5 Suitable hand tools.

2.3 MIX DESIGN

- .1 Mix design to AI MS-2.
- .2 Design of mix: by Marshall method to requirements below:
 - .1 Compaction blows on each face of test specimens: 75.
 - .2 Mix physical requirements:

Property	Lower Course	Upper Course
Marshall Stability at 60 degrees C, kN minimum.	6.4	5.5
Flow Value, mm.	2-4	2-4
Air Voids in Mixture, %	3-6	3-5

Property	Lower Course	Upper Course
Voids in Mineral Aggregate, % minimum	14	15
Index of Retained Stability, % minimum	75	75

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM D1559.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D3203.
 - .4 Voids in mineral aggregate: to AI MS-2, chapter 4.
 - .5 Index of Retained Stability: measure in accordance with Marshall Immersion Test for Bitumen, ASTM D 1559.
- .4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be approved by Departmental Representative.

Part 3 Execution

3.1 SUBGRADE PREPARATION AND INSPECTION

- .1 Verify grades of subgrade and items set in paving area for conformity with elevations and sections before placing granular base and sub-base material.
- .2 Obtain approval of subgrade by Geotechnical Departmental Representative before placing granular sub-base and base.

3.2 GRANULAR SUB-BASE AND GRANULAR BASE

- .1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.
- .2 Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 95 % Modified Proctor Density in accordance with ASTM D1557.
- .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

3.3 ASPHALT PRIME

- .1 Cutback asphalt:
 - .1 Heat asphalt prime for pumping and spraying in accordance with CAN/CGSB-16.1.
 - .2 Apply cutback asphalt prime to granular base, at rate not exceeding 2 L/m².
 - .3 Apply on damp surface, unless otherwise directed by Departmental Representative.
- .2 Emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved.
 - .2 Apply diluted asphalt emulsion not exceeding 5 L/m².
 - .3 Apply on damp surface unless otherwise directed.
- .3 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within 2 hours.
- .4 If asphalt prime fails to set within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

3.4 ASPHALT TACK COAT

- .1 Apply asphalt tack coat only on approved clean, dry surfaces.
- .2 Dilute asphalt emulsion with water at 1:1 ratio for application. Mix thoroughly by pumping.
- .3 Apply tack coat evenly to pavement surface not exceeding 0.7L/m², when diluted.
- .4 Paint contact surfaces of curbs, edges, headers, gutters, manholes and like structures with thin uniform coat of asphalt tack coat material.
- .5 Do not apply tack coat at air temperature below 5 degrees C or when rain forecast within 2 hours of application.
- .6 Apply tack coat only to surfaces that are to be overlaid same day.
- .7 Evenly distribute localized excessive deposits of tack coat by brooming.
- .8 Where traffic is to be maintained treat no more than one half the width of the surface in one application.
- .9 Keep traffic off tacked areas until asphalt tack coat has set.

3.5 PLANT AND MIXING REQUIREMENTS

- .1 In accordance with ASTM D995.

3.6 ASPHALT CONCRETE PAVING

- .1 Obtain approval of base, tack coated and primed areas before placing asphalt mix.
- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees C. Place overlay pavement only when air temperature is above 10 degrees C.
- .3 Place asphalt concrete in compacted layers not exceeding 50 mm per lift and not less than 35mm per lift.
- .4 **Where the project geotechnical report specifies a total asphalt layer thickness of 50mm, the asphalt concrete paving is to be installed as a single layer complying with the "Upper Course" mix properties specified in this Section.**
- .5 Minimum 135 degrees C mix temperature required when spreading.
- .6 Maximum 160 degrees C mix temperature permitted at any time.
- .7 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .8 Compact parking lot and driveway asphalt concrete to density not less than 97 % of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated.
- .9 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .10 Moisten roller wheels with water to prevent pick up of material.
- .11 Compact mix with hot tampers or other approved equipment, in areas inaccessible to roller.
- .12 Finished surface is to be within 6 mm of design elevations and not uniformly high or low. Surface irregularities are not to exceed 6 mm when checked with a 3m straight edge in any direction. Water ponding on the finished surface is not permitted.
- .13 Repair areas showing checking, rippling, segregation or which are otherwise out of compliance with specified criteria.

3.7 JOINTS

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
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- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

3.8 PROTECTIVE COATING

- .1 Apply 2 coats of protective coating to completed paved areas and asphalt curbs in accordance with manufacturer's instructions.

3.9 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C. Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00.01 – Cast-in-place Concrete (Short Form)
- .2 Section 31 00 99 – Earthworks for Minor Works.
- .3 Section 32 12 16.02 – Asphalt for Building Sites.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
 - .4 ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-3.3-99(March 2004), Kerosene, Amend. No. 1, National Standard of Canada.
 - .2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00.01 - Cast-in-Place Concrete (Short Form) with the following criteria specific to this section:
 - .1 Hand-formed and hand placed concrete:
 - .1 Slump: 80mm
 - .2 Air Entrainment: 5 to 8%
 - .3 Maximum aggregate size: 20mm
 - .4 Minimum cement content: 335kg/m³
 - .5 Minimum 28 day compressive strength: 32 MPa
 - .2 Extruded concrete:
 - .1 Slump: 0-25mm
 - .2 Air Entrainment: 6 to 9%
 - .3 Maximum aggregate size: 10mm
 - .4 Fineness modulus: 2.1 to 2.4
 - .5 Minimum cement content: 335kg/m³
 - .6 Minimum 28 day compressive strength: 32 MPa
-

- .2 Joint filler in accordance with Section 03 30 00.01 - Cast-in-Place Concrete (Short Form).
- .3 Crushed granular base: material to item 2.1.1 of Section 32 12 16.02 – Asphalt for Building Sites.
- .4 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .5 Fill material: to item 2.1.5 of Section 31 00 99 – Earthwork for Minor Works.
- .6 Boiled linseed oil: to ASTM D260.
- .7 Kerosene: to CAN/CGSB-3.3.

Part 3 Execution

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 00 99 – Earthwork for Minor Works.
- .2 In preparing grade allow for width of gravel base including shoulders as detailed, beyond edges of concrete.
- .3 Place fill in maximum 150 mm layers and compact to at least 95% Modified Proctor Density to ASTM D1557.

3.2 GRANULAR BASE

- .1 Obtain Geotechnical Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 95% Modified Proctor Density to ASTM D1557, and to within 10mm of specified grade, but not uniformly high or low.

3.3 FORMWORK

- .1 Ensure steel forms of approved design and free from twists and warp.
 - .2 Ensure wood forms of select dressed lumber, straight and free from defects and thoroughly cleaned.
 - .3 Use flexible forms for all curves less than 60m radius.
 - .4 After obtaining Departmental Representative's approval of compacted base, set forms to line and grade as shown on Contract Drawings. Free from waves or irregularities in line or grade.
 - .5 Set special isolation forms as required around catchbasin, manholes, pole bases or other objects as shown or as required for implementing other items of the Works.
 - .6 Forms to be to shape, lines and full dimensions or the work being formed.
 - .7 Adequately brace forms to maintain specified tolerances after concrete is placed.
 - .8 Treat forms lightly with approved release agent and remove surplus agent.
-

3.4 CONCRETE PLACEMENT

- .1 Obtain Geotechnical Departmental Representative's approval of granular base prior to placing concrete.
- .2 In conjunction with execution of formwork and with reference to sidewalk joint spacing dimensions described in Section 03 30 00.01 – Cast-in-place Concrete (Short Form), layout proposed expansion, control and dummy joints and agree / adjust same to the approval of the Departmental Representative.
- .3 Do concrete work in accordance with Section 03 30 00.01 – Cast-in-Place Concrete (Short Form).
- .4 Do not place during rain or on ponded water or frozen base.
- .5 Do not place concrete when air temperature appears likely to fall below 5 degrees C within 24 hours unless specified precautions are taken and approved by Departmental Representative.
- .6 Schedule concrete placement to ensure sufficient daylight hours available to permit edging and finishing or provide adequate illumination.
- .7 Moisten granular base immediately prior to placing concrete.
- .8 Place concrete within 1.5 hours of batching time.
- .9 Place concrete in forms, ensuring no segregation of aggregate and consolidate with approved mechanical vibrator or power screed.
- .10 Place concrete in continuous operation until entire panel or section completed. Do not place fresh concrete on concrete which has achieved partial set.
- .11 Incorporate all castings into concrete at time of placement.
- .12 Discontinue placement at expansion, construction or isolation joints only.
- .13 Remove face forms as soon as practical to permit face finishing. Do not leave face forms in place overnight.

3.5 EXTRUDED SECTIONS

- .1 Extruding machine to be fitted with approved template consistent with sections shown on Standard Details.
- .2 Extruded sections to be true to line, grade and cross-section.
- .3 Finished appearance, quality and workmanship to comply with Contract Drawings, this specification and Standard Details.
- .4 Where finished product does not conform to specifications, remove defective product and replace.

3.6 TOLERANCES

- .1 Maximum horizontal or vertical deviation = 6mm. Maximum irregularity from finished horizontal or vertical alignment to be 6mm in 3 m.

3.7 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals not exceeding those indicated on contract details.
-

- .2 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- .3 Extend through full depth of concrete.
- .4 Fill with 13mm approved expansion joint material.
- .5 Bond break compound may be used in lieu of expansion joint between sidewalk and back of abutting curb and gutter or where applicable between sidewalk and back of abutting utility strip or sidewalk infill.

3.8 CONTROL JOINTS

- .1 In sidewalks, infill, curbs or curb and gutter construct control joints at maximum 3m intervals. Where sidewalks, infill, curbs or curb and gutter are adjacent, make joints in each coincide.
- .2 Cut such that uncut depth does not exceed 75mm.
- .3 Use proper tool to make cut while concrete is still green or sawcut after concrete has hardened.

3.9 ISOLATION JOINTS

- .1 Form isolation joints around all poles, hydrants, manholes, and all structures or fixed objects located within concrete section by using specified joint filling material.

3.10 FINISHING

- .1 Finish surface of concrete sidewalks and utility strips to smooth surface with magnesium or wood float and then immediately brush or broom to provide uniform non-skid surface complete with regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .2 Broom or brush crossways or as otherwise directed if / as necessary to match adjacent finish.
- .3 Grooves or scoring (dummy joints) used for aesthetic purposes to be marked with proper tools and set 15mm deep.
- .4 Round edges of panels between each expansion, control and/or dummy joint with steel edging tool to a width of between 30 and 50mm (but not varying) around perimeter of each panel.
- .5 Ensure surface of hand-formed curb and gutter is smooth magnesium or wood float finish. Ensure extruded curb and gutter is smooth finished and hand floated as required to correct irregularities.
- .6 Under no circumstances is concrete to be overworked by trowelling, dusted with dry cement or finished with a mortar coat.

3.11 PROTECTION

- .1 Protect freshly finished concrete from dust, rain or frost by using appropriate coverings, kept clear of finished surface.
 - .2 Protect finished concrete from equipment, vehicles, pedestrians and all other potential damage.
-

3.12 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 7 days after placing, or sealing moisture in by curing compound to all exposed concrete surfaces at rate recommended by manufacturer.
- .2 When temperature is below 5 degrees C, maintain all concrete at temperature not less than 10 degrees C for at least 72 hours and protect from freezing for at least another 72 hours or such time as required to ensure proper curing of concrete. Admixtures are not to be used for prevention of freezing.

3.13 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material per Section 31 00 99 – Earthwork for Minor Works.
- .3 Compact and shape to required contours or and / or spot elevations as indicated.

3.14 LINSEED OIL TREATMENT

- .1 Apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters, after concrete has cured for specified curing time and when surface of concrete is clean and dry.
- .2 Linseed oil mixture to consist of 50% boiled linseed oil and 50% mineral spirits by volume.
- .3 Apply treatment when air temperature above 10 degrees C.
- .4 Apply first coat at 135 mL/m².
- .5 Apply second coat at 90 mL/m² when first coat has dried.

3.15 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 Section includes materials and installation for chain link fences and gates.
- .2 Replace existing chain link posts that do not meet the technical criteria.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete.
- .2 Section 09 91 99 – Painting for Minor Works

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A90/A90M-13, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - .3 ASTM A121-13, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
 - .4 ASTM A123/A123M-13, Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products.
 - .5 A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .6 ASTM C618-12a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - .7 ASTM F1664-08(2013), Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-138.1-96 CORR., Fabric for Chain Link Fence.
 - .2 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence.
 - .3 CAN/CGSB-138.3-96, Installation of Chain Link Fence.
 - .4 CAN/CGSB-138.4-96, Gates for Chain Link Fence.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete, Includes Updates No. 1 (2011).
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA-A3000-13, Cementitious Materials Compendium. (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2009), Updated No. 2 (2010).
- .4 Chain Link Fence Manufacturers Institute (CLFMI)

- .1 CLFMI WLG 2445-1999, A Guide for the Selection of Line Post Spacings for Chain Link Fence.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS)
- .7 The Master Painters Institute (MPI) - Architectural Painting Specification Manual
 - .1 MPI # 18, Organic Zinc Rich Primer.
- .8 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.
- .2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Submit locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories; include materials, dimensions, sizes, weights, and finishes of components, plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions. Indicate installation requirements, post foundation and anchor bolt templates.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operations and maintenance information for chain link fences and gates for incorporation into manual specified in Section 01 01 50 – General Instructions, Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver to location as instructed by Contractor in manufacturer's package showing no signs of damage to package or product.
- .2 Investigate delivered damaged packages and if product is damaged, Contractor to not accept and have product returned and replaced. Store boxed products on flat surface and protect from water exposure.

1.7 PROJECT CONDITIONS

- .1 Field Measurements: Verify layout information for chain link fences and gates shown on Drawings in relation to property survey and existing structures.

- .2 Interruption of Existing Utility Service: Notify Departmental Representative a minimum of 2 working days in advance of any interruption to utility services for facilities occupied by Departmental Representative or others; arrange for temporary utility services during period of interruption with appropriate utility providers.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Provide chain link fence in accordance with CAN/CGSB-138.3.

2.2 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete CAN/CSA-A23.1.
 - .1 Nominal coarse aggregate size: 20-5.
 - .2 Compressive strength: 20 MPa minimum at 28 days.
- .2 Chain-link fence fabric: to CAN/CGSB-138.1 and as follows:
 - .1 Wire Size: 4.8 mm (6 gauge) minimum.
 - .2 Size of mesh: 50.8 mm
 - .3 Height of fence fabric: 3600 mm
 - .4 Barbed edges top and bottom
 - .5 Average mass of zinc coating: not less than 610 g/m² of uncoated wire.
 - .6 Breaking Tensile Strength: to be 10 000 N minimum.
 - .7 Wire Mesh: to be continuous from top to bottom and shall be applied on the institutional compound side of the posts.
 - .8 Fence Fabric: to be pulled taut before fixing in place. Tautness, when fixed in place, is to be established by pull tests. The application of a 12 kg perpendicular pull at the midpoint of the mesh panel (midpoint of posts/rails) shall show a displacement of no more than 30 mm from the fence at rest plane.
- .3 Posts (corner, gate, strain, line): conforming to CAN/CGSB-138.2, galvanized schedule 40 steel pipe.
 - .1 Posts: spaced a maximum of 2.5 m apart.
 - .2 Line Posts: minimal size of 73 mm O.D. 8.6 kg/m
 - .3 Strain Post: minimum size of 114.3 mm O.D. 15.92 kg/m. Strain posts shall be spaced not more than 60 m apart.
 - .4 Corner and Gate Posts: minimum size of 143.3 mm O.D. 21.0 kg/m
- .4 Gate Locks and Hinges:
 - .1 Locks: Provide three point lock detail suitable for pad locks.

- .2 Hinges: 36.5 mm diameter x 66.8 mm long, cold rolled steel with 9.5 mm grease nipple, 19 mm x 50 mm deep bore, and 17 mm x hinge hook bolt.
- .5 Provide galvanized steel arms on all posts where barbed concertina is to be installed.
- .6 Bottom and Top Rails: 42.2 mm O.D. minimum, 3.4 kg/m
- .7 Tie Wires: 3.7 mm diameter (9 gauge) galvanized steel wire to secure chain link fabric to bottom rail, top rail and line posts at 300 mm spacing.
- .8 Provide an intermediate galvanized anchor shall be used to secure the bottom rail to the ground barrier, where such a barrier is installed. This anchor shall limit vertical movement of the bottom rail to a maximum of 125 mm.
- .9 Intermediate rails shall not be used.
- .10 Tension Bars: for holding the ends of the fence fabric at the location of strain posts and corner posts shall be 5 mm x 20 mm minimum x 3600 mm galvanized steel.
- .11 Tension Bar Bands: 3 mm x 20 mm minimum galvanized steel and spaced vertically at 300 mm O.C.
- .12 Fasteners (Nuts and Bolts): where required, nuts shall face compound exterior and be torqued tight.
- .13 Tension Cables: where used at corner, end, gate, strain posts, and fittings shall be of galvanized steel.
- .14 Barbed tape concertina (B.T.C.): galvanized tape 20 x 0.5 mm clenched around a 2.5 mm diameter spring steel galvanized core wire to form a concertina coil with a nominal exterior coil diameter of 710 mm. The coil, when installed, shall have a minimum diameter of 635 mm. The barbed concertina shall have 20 mm long blade type barbs measured from tip to tip of the blade, and barb clusters shall be spaced approximately 45 mm on centre. The concertina shall be formed by clipping adjacent loops of single helical coils together at a minimum of three (3) points on the circumference. Clips shall be galvanized. The resulting coil, when stretched, shall form a cylindrical pattern. The loop spacing shall not exceed 230 mm.
- .15 Concertina Coil Support at Fence Top: two barbed wires stretched and fixed to post arms shall be provided. Barbed wire shall consist of two strands of 12 gauge wire with 4 point barbs at 130 mm spacing, all galvanized.
- .16 Concertina Coils: to be turned onto a secondary internal fence for a distance of 2.5 m when such a fence meets the perimeter fence.
- .17 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.
- .18 Grounding Rod: 16 mm diameter copperwell rod, 3 m long.

2.3 FINISHES

- .1 Galvanizing:
 - .1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.
 - .2 For pipe: 550 g/m² minimum to ASTM A90.
 - .3 For barbed wire: to ASTM A121, Class 2.

- .4 For other fittings: to CAN/CSA-G164.

Part 3 Execution

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Grading:
 - .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

3.3 ERECTION OF FENCE

- .1 Erect fence along lines as indicated on Drawings, as directed by Departmental Representative and to CAN/CGSB-138.3.
- .2 Excavate post holes to dimensions indicated and as directed by Departmental Representative.
- .3 Space line posts as indicated above, measured parallel to ground surface.
- .4 Space straining posts as indicated above.
- .5 Install additional straining posts at sharp changes in grade and where directed by Departmental Representative.
- .6 Install corner post where change in alignment exceeds 10 degrees.
- .7 Install end posts at end of fence and at buildings.
 - .1 Install gate posts on both sides of gate openings.
- .8 Place concrete in post holes then embed posts into concrete to depths indicated or as directed by Departmental Representative.
 - .1 Extend concrete 50 mm above ground level and slope to drain away from posts.
 - .2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .9 Do not install fence fabric until concrete has cured minimum of 5 days.
- .10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface and at inclination as indicated.

- .1 Install braces on both sides of corner and straining posts in similar manner.
- .11 Install overhang tops and caps.
- .12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.
- .13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.
- .14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.
 - .1 Knuckled selvedge at bottom.
 - .2 Twisted selvedge at top.
- .15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at intervals indicated above.
 - .1 Give tie wires minimum two twists.
- .16 Install barbed wire strands and clip securely to lugs of each projection.
- .17 Install grounding rods as indicated.

3.4 INSTALLATION OF GATES

- .1 Install gates in locations as indicated or where directed by Departmental Representative.
- .2 Level ground between gate posts and set gate bottom at space above ground surface as directed by Departmental Representative.
- .3 Determine position of centre gate rest for double gate.
 - .1 Cast gate rest in concrete as directed.
 - .2 Dome concrete above ground level to shed water.
- .4 Install gate stops where indicated.

3.5 TOUCH UP

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas as indicated and in accordance with Section 09 91 99 – Painting for Minor Works.
 - .1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.6 CLEANING

- .1 Clean and trim areas disturbed by operations.
 - .1 Dispose of surplus material as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SCOPE OF APPLICATION

- .1 Existing and proposed unpaved landscaped areas (excluding flower beds and planted borders) that are subjected to utility trenching, re-grading, disturbance or degradation due to the Contractor's construction and activities:
 - .1 to be mechanically seeded as described in this section after receiving topsoil restoration in accordance with Section 31 00 99 – Earthwork for Minor Works.

1.2 RELATED SECTIONS

- .1 Section 31 00 99 – Earthwork for Minor Works

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide product data for:
 - .1 Seed mixture complete with supplier's recommended:
 - .1 Mechanical placement rates
 - .2 Fertilization products, rates and frequency.
 - .2 Fertilizer compatible with seed mixture suppliers recommendations.

1.4 QUALITY ASSURANCE

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

1.5 SCHEDULING

- .1 Schedule seeding to coincide with preparation of soil surface.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused fertilizer from landfill to official licensed hazardous material collections site.
 - .2 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.
-

Part 2 Products

2.1 GRASS SEED

- .1 Canada "Certified" "Canada Pedigreed grade" seed, "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
- .2 In packages individually labelled in accordance with "Seeds Regulations" and indicating name of supplier.

2.2 WATER

- .1 Free of impurities that would inhibit germination and growth.

2.3 FERTILIZER

- .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
- .2 Complete synthetic fertilizer with guaranteed minimum analysis as specified.

Part 3 Execution

3.1 QUALITY OF WORK

- .1 Do not perform work under adverse field conditions such as excessive wind speeds, frozen ground or ground covered with snow, ice or standing water.
- .2 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site to a licensed contaminated soils disposal site.

3.2 SEED BED PREPARATION

- .1 Verify that grades are correct. If discrepancies occur, notify and do not commence work until instructed by Departmental Representative.
- .2 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated to tolerance of plus or minus 15mm, surface draining naturally.
- .3 Cultivate fine grade to 25mm depth immediately prior to seeding.

3.3 SEED PLACEMENT

- .1 For mechanical seeding:
 - .1 Use "Brillion" type mechanical landscape seeder which accurately places seed at specified depth and rate and rolls in single operation.
 - .2 For manual seeding only outside of the areas accessible to mechanical seeder:
 - .1 Use "Cyclone" type manually operated seeder.
 - .2 Use manually operated, water ballast, landscaping type, smooth steel drum roller.
-

- .3 On cultivated surfaces, sow seed uniformly at rates recommended by supplier provided at 1.2.1.2 above.
- .4 Blend applications 300mm into adjacent grass areas and previous applications to form uniform surfaces.
- .5 Sow half of required amount of seed in one direction and remainder at right angles as applicable.
- .6 Incorporate seed by light raking in cross directions.
- .7 Consolidate mechanically seeded areas by rolling area if soil conditions warrant immediately after seeding.
- .8 Protect seeded areas from trespass until plants are established.

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment period to as per product data / supplier recommendations provided at 1.2.1.2 above:

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of seed application until acceptance by Departmental Representative:
 - .1 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
 - .2 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
 - .3 Cut grass to 50mm whenever it reaches height of 100mm. Remove clippings which will smother grass.
 - .4 Fertilize seeded areas after first cutting or in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in.
 - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

3.6 FINAL ACCEPTANCE

- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Areas are uniformly established and turf is free of rutted, eroded, bare or dead spots and free of weeds.
 - .2 Areas have been cut at least twice.
 - .3 Areas have been fertilized.
 - .4 Any establishment practices, including scheduled or recommended fertilizations, not yet accomplished to be recorded in the Operations and Maintenance Manual.
- .2 Areas seeded in fall will be accepted in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- | | | |
|----|---|---------------------|
| .1 | Cast-in-place concrete (short form) | Section 03 30 00.01 |
| .2 | Earthwork for Minor Works | Section 31 00 99 |
| .3 | Public Sanitary Utility Sewerage Piping | Section 33 31 13 |
| .4 | Storm Utility Drainage Piping | Section 33 41 00 |

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections.
 - .2 ASTM A48, Specification for Gray Iron Castings.
 - .3 ASTM C-497, Test Methods for Concrete Pipe, Manhole Sections, or Tile
 - .4 ASTM-D-4101, Polypropylene Plastic Injection and Extrusion Materials.
 - .5 ASTM A615M, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - .6 ASTM C443M, Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - .7 ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
 - .8 ASTM A185, Reinforcing steel welded mesh fabric
- .2 Canadian Standards Association (CSA International)
 - .1 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .2 CSA-S157, Strength Design in Aluminum.
 - .3 CSA A82.56, Aggregate for Masonry Mortar.
 - .4 CAN/CSA-A8, Masonry Cement
 - .5 CAN3-A165 Series, CSA Standards on Concrete Masonry Units.
 - .6 CAN/CSA-A3001 - Cementitious Materials for Use in Concrete.Precast manhole units

1.3 MATERIALS

- .1 Precast manhole and catch basin units to: ASTM C478M complete with ladder rungs.
 - .2 Manhole lids: to be precast reinforced concrete designed to withstand H20 loading.
 - .3 Cast iron frame and cover, cast with the word "Storm" or "Sanitary" as applicable:
 - .1 Frame and cover must conform to ASTM A48 be designed to withstand H20 loading.
 - .2 Frame and cover must bear manufacturer identification on castings.
 - .4 Ladder rungs to be:
-

- .1 To conform to ASTM C-497, C-478 load test.
- .2 20 mm cold rolled steel, hot dipped after bending to CSA G164, welded to reinforcing bars and cast with manhole sections or epoxy grouted into manhole walls.
- .3 20 mm aluminum allow #6351-T6 (CSA-S157 and NBC 1977), complete with polyethylene anchor precast or drilled holes in manhole sections.
- .4 Polypropylene encased steel ladder rungs; polypropylene ASTM-D-4101 steel core to be 12.7 mm dia grade 60 as per ASTM A615M.
- .5 Distance from top of manhole cover to top rung to be maximum 500 mm where no handhold provided. Maximum distance may be extended to 660 mm where handhold provided.
- .6 In compliance with all requirements of Workers' Compensation Board.
- .5 Precast catch basin sections: to ASTM C478M.
- .6 Catchbasin leads to be minimum 150 mm diameter and of PVC DR35.
- .7 Catchbasin lids: to be precast reinforced concrete designed to withstand H20 loading.
- .8 Cast iron catchbasin and lawn drain frame and grate:
 - .1 Frame and grate must conform to ASTM A48 and be designed to withstand H20 loading.
 - .2 Frame and grate must bear manufacturers identification on casting.
- .9 Joints: made watertight using cement mortar or rubber gaskets to ASTM C443.
- .10 Mortar:
 - .1 Aggregate: to CSA A82.56
 - .2 Cement: to CAN/CSA-A8.
- .11 Adjusting rings: to ASTM C478.
- .12 Concrete Brick: to CAN3-A165 Series.
- .13 Drop manhole pipe: same as sewer pipe.
- .14 Galvanized iron sheet: approximately 2 mm thick.
- .15 Concrete for cast-in-place bases and benching to be minimum 20 MPa with constituent materials conforming to CAN/CSA-A5, A23.5 and A23.1.
- .16 Precast concrete lawn drain units manufactured to withstand AASHTO H-20 loading, wet-cast from concrete with compressive strength of 4000 PSI at 28 days. Reinforcing mesh to ASTM A185. Reinforcing steel deformed bars to ASTM A615.

Part 2 Execution

2.1 MANUFACTURER'S INSTRUCTIONS

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

2.2 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 00 99 Earthwork for Minor Works and as indicated.
- .2 Obtain approval of the Departmental Representative for manholes or catch basins.

2.3 CONCRETE WORK

- .1 Do cast-in-place concrete work including surface tolerances, finishing and field quality control, in accordance with CAN/CSA-A23.1.
- .2 Position metal inserts in accordance with dimensions and details as indicated.

2.4 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Place minimum 100 mm of 25 mm bedding gravel compacted to minimum 95% Modified Proctor density in compliance with ASTM D1557.
- .3 Set all inlet and outlet pipes to specified alignments and elevations.
- .4 Connect concrete pipe into manhole using spigot or bell precast into manhole wall or, alternatively, grout pipe into pre-formed rough core in manhole wall using fast-setting grout.
- .5 Connect PVC pipe into manhole using "manhole adapter ring" or approved equal.
- .6 Ensure excavation free of water and approved by geotechnical engineer prior to placing concrete.
- .7 Set remaining precast riser sections plumb with joints consisting of cement mortar or gasket to ASTM C443.
- .8 Brace capped inlets or stubs to withstand testing head.
- .9 Set frames by firmly embedding in mortar on a minimum of 1, maximum of 3 courses of bricks or precast concrete riser rings, or cast-in-place form system with due regard to maximum distance to first step.
- .10 Plug lifting holes in pipe.
- .11 Ensure frames conform to design contour of pavement or existing surface.
- .12 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris, silt and contaminants from entering system.

2.5 ADJUSTING TOPS OF EXISTING UNITS

- .1 Remove existing gratings, frames and store for re-use at locations designated by the Departmental Representative.
 - .2 Precast units:
 - .1 Raise or lower precast units by adding or removing precast sections as required.
-

- .2 When amount of raise is less than 300 mm use standard manhole bricks, precast riser rings or cast-in-place form system.
- .3 Re-set gratings and frames to required elevation on not more than 3 courses of brick. Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.
- .4 Ensure adjustments conform to requirements regarding distance to first step.

2.6 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for water mains, hydrants, valves, valve boxes, and valve chambers, including service connections.

1.2 RELATED SECTIONS

- .1 Section 31 00 99 – Earthworks for Minor Works.
- .2 Section 03 30 00.01 – Cast-in-Place Concrete (Short Form) - Civil

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300, Hypochlorites.
 - .2 ANSI/AWWA C500, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
 - .3 ANSI/AWWA C504, Rubber-Seated Butterfly Valves.
 - .4 ANSI/AWWA C651, Disinfecting Water Mains.
 - .5 ANSI/AWWA C800, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .6 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
 - .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .2 ASTM B88M, Standard Specification for Seamless Copper Water Tube [Metric].
 - .3 ASTM C117, Standard Test Method for Material Finer Than 75 [MU] m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C478M, Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].
 - .6 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m³)).
 - .7 ASTM D2310, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
 - .8 ASTM D2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
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- .9 ASTM D2992, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
 - .10 ASTM D2996, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
 - .11 ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - .12 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-1.88, Gloss Alkyd Enamel, Air Drying and Baking.
 - .4 CGSB 41-GP-25M, Pipe, Polyethylene, for the Transport of Liquids.
 - .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A257 Series-M92(R1998), Standards for Concrete Pipe.
 - .2 CAN/CSA-A3000-98(April 2001), Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
 - .1 CAN/CSA-A8, Masonry Cement.
 - .3 CSA B137 Series 02, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CSA B137.1, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CSA B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .4 CAN/CSA-G30.18-M92(R1998), Billet Steel Bars for Concrete Reinforcement.
 - .5 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)
 - .7 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - March 1998(R2002)
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- .8 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S520, Hydrants.
 - .2 CAN4-S543, Internal-Lug, Quick Connect Couplings for Fire Hose.

1.4 SUBMITTALS

- .1 Inform the Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work, in addition to providing test results in accordance with item 1.5 of Section 31 00 99 – Earthwork for Minor Works.
- .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .3 Pipe certification to be on pipe.

1.5 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to the Departmental Representative for approval and adhere to interruption schedule as approved by the Departmental Representative.
- .3 Notify the Departmental Representative minimum of 48 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 h at any one time and schedule this period in consultation with the Departmental Representative.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide 300mm x 300mm x 13mm plywood marker sign clearly stencilled "NOT IN SERVICE" on hydrant not in use.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900. Pressure class 235, **DR 18** unless stated otherwise.
 - .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket and/or coupling.

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- .2 Fittings:
- .1 Ductile iron fittings to AWWA C110 suitable for pressure rating equal to or greater than that of the PVC C900 pipe, cement mortar lined to AWWA C104/A21.4.
 - .2 Compact ductile iron fittings to AWWA C153/A21.53-94 suitable for pressure rating equal to or greater than that of the PVC C900 pipe, cement mortar lined to AWWA C104/A21.4.
 - .3 All fittings shall be provided with integral tie lugs. Weld on lugs are unacceptable.
 - .4 Single rubber gasket for push on bell and spigot type joint and / or mechanical pipe joints: to AWWA C111. All push-on joint hubs to be equipped with tie-rod lugs.
 - .5 Flanged Joints:
 - .1 Flat faced conforming to the face dimension and drilling of ANSI B16.1, Class 125.
 - .2 Pressure pressure rated equal to or greater than that of the PVC C900 pipe.
 - .6 Flange gaskets shall be 3.175 mm thick manufactured from natural rubber with lead tip and a layer of cotton on both sides.
 - .7 Bolts and nuts:
 - .1 Bolts to be carbon steel, Grade B to ASTM, heavy hex style, zinc plated to ASTM B633 or cadmium plated to ASTM B766. Bolt sizes to AWWA C110.
 - .2 Nuts and washers: Nuts to be carbon steel, Grade A to ASTM A563. Washers to be flat hardened steel to ASTM F436. Nuts and washers to be zinc plated to ASTM B633 or cadmium plated to ASTM B766.
 - .8 Tie rods and nuts
 1. Tie rods to be continuous threaded, quenched and tempered alloyed steel to ASTM A354, Grade BC. To be zinc plated to ASTM B633 or cadmium plated to ASTM B766. Tie rod sizes to be minimum 19mm diameter or greater.
 2. Nuts and internally threaded couplings to be heavy hex finish to ASTM A563. Washers to be flat hardened steel to ASTM F436. Nuts and washers to be zinc plated to ASTM B633 or cadmium plated to ASTM B766.
 - .9 Thrust blocks shall be used at all directional change fittings; elbows, tees, etc. where the water pipe installation is of PVC (plastic) materials.
 - .10 Couplings and Flanged Coupling Adapters
 - .1 Suitable for pressure class equal to or exceeding the proposed water main.
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- .2 Flanges and full face flange gaskets as specified elsewhere in this Section.
 - .3 To AWWA C219.
 - .4 Anti-corrosion of interior and exterior centre sleeves and end rings to AWWA C219, AWWA C213, AWWA C210, or AWWA C550 as applicable.
 - .5 Compression gaskets to AWWA C219.
 - .6 Bolts and nuts high strength low alloy steel to AWWA C111, stainless steel to ASTM F593 or ASTM F738 for bolts and ASTM F594 or ASTM F836M for heavy hex nuts. Rolled threads, fit and dimensions to AWWA C111.
 - .7 Ductile iron casings to ASTM A536, Grade 65-45-12.
- .11 Tapping sleeves for branch connections 75mm and larger:
- .1 Pressure class to meet or exceed that specified for proposed watermain piping. Exterior condition of existing water mains as found in the field may alter type and / or materials.
 - .2 To AWWA C219 for sleeve and gasket materials and generally for design, manufacture and performance.
 - .3 Flanges and full face flange gaskets as specified elsewhere in this Section and AWWA C207 and C208 for fabricated carbon steel sleeves. Flange gaskets for use with epoxy coated flanges to be annular ribbed type.
 - .4 Anti-corrosion coating of fabricated carbon steel and ductile iron sleeve assemblies to AWWA C213 (Fusion-Bonded Epoxy) or shop coated to AWWA C219.
 - .5 Bolts and nuts high strength low alloy steel to AWWA C111, stainless steel to ASTM F593 or F738 for bolts and ASTM F594 or F836M for heavy hex nuts. Rolled threads, fit and dimensions to AWWA C111.
 - .6 Ductile iron castings to ASTM A536, grade 65-45-12.
 - .7 Branches shall include a threaded test plug 19mm NPS minimum if tapping machine to be used does not have provision for pressure testing.
 - .8 Tapping sleeves for cast iron, ductile iron, asbestos cement, PVC to AWWA C900, pre-stressed concrete pressure pipe or steel mains for taps other than size-on-size:
 - .1 Split assembly to incorporate an annular gasket cemented or mechanically held in place on the branch end **or** split assembly incorporating ring seal and wrap around sleeve length gasket liner.
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2.2 VALVES AND VALVE BOXES

- .1 Mainline Valves – General Requirements:
 - .1 Valves to open counter-clockwise
 - .2 All valves to have manufacture's name, year of manufacture, size and working pressure on the bonnet or body.
 - .3 Valves 400 mm and larger to have by-pass sized to AWWA 500.
 - .4 Gate valves 400 mm and larger to have gear operators.
 - .2 Mainline Gate valves:
 - .1 To AWWA C500: 75 to 300 mm to working pressure 1380 kPa; 400 mm and larger to working pressure 1035 kPa, gray cast iron or cast ductile iron body, bronze mounted solid wedge, or double disc, non-rising stem, hub or flanged ends.
 - .2 To AWWA C509: 75 to 300 mm to working pressure 1380 kPa; Gray cast iron or ductile iron body resilient seated, non-rising stem, hub or flanged ends.
 - .3 Stem seal to be O-ring type.
 - .4 Valves to be complete with 50 mm square operating nut for underground service.
 - .5 Acceptable products:
 - .1 Fire Service (for combined domestic/fire service or fire service), ULC listed for fire service:
 - 75mm and smaller: Crane 438, Nibco T-1040 or equivalent approved.
 - 100mm and larger: Terminal City Iron Works 583; Darling 55FM or equivalent approved.
 - .3 Mainline Valve Boxes:
 - .1 All valves shall be fitted with minimum 135mm Nelson type cast iron valve box with cap on section of cast or ductile iron pipe down to the valve with a hub of the pipe over the valve.
 - .2 Provide a 20mm dia proprietary valve stem extension with centering disc and 50mm square top nut. Base of extension to have suitable socket to fit over and pin to valve nut. Length of stem extension to be sufficient that top of extension is within 150mm of finished surface.
 - .3 For valve boxes not in concrete or asphalt paved areas, centre valve boxes in 600mm x 600mm x 230mm concrete block set flush with finished grade.
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2.3 FIRE HYDRANTS

- .1 Compression dry-barrel hydrant type with two hose nozzles and one pumper nozzle, ULC listed and conforming to AWWA C502-85.
- .2 Hose and pumper nozzle threads, operating nut and cap nut shall conform to the standards of CSC, PWGSC and the local fire fighting authority.
- .3 Fitted with Storz adaptor conforming to the standards of the local fire fighting authority.
- .4 Yellow enamel finish paint color.
- .5 Acceptable Products: Terminal City C71-P, Clow, Mueller, or equivalent approved.
- .6 Provide 300mm x 300mm x 13mm plywood marker sign clearly stencilled "NOT IN SERVICE" on hydrant not in use.

2.4 PIPE BEDDING AND SURROUND MATERIAL

- .1 Pipe bedding and surround material per Section 31 00 99 – Earthwork for Minor Works.
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks, surround to valve boxes in unpaved areas: to Section 03 30 00.01 - Cast-in-Place Concrete (Short Form) – Civil.

2.5 BACKFILL MATERIAL

- .1 Backfill material per Section 31 00 99 – Earthwork for Minor Works.

2.6 PIPE DISINFECTION

- .1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

Part 3 Execution

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of the Departmental Representative.
 - .2 Remove defective materials from site.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 00 99 – Earthwork for Minor Works.
 - .2 Trench depth to provide cover above crown of pipe of not less than 1.0m from finished grade.
 - .3 Trench alignment and depth require the Departmental Representative's approval prior to placing bedding material and pipe.
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3.3 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% of corrected maximum dry density.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 00 99 – Earthwork for Minor Works.

3.4 PIPE INSTALLATION

- .1 Lay pipes to ANSI/AWWA C600 and manufacturer's standard instructions and specifications. Do not use blocks except as specified / permitted elsewhere in contract documents.
 - .2 Join pipes in accordance with ANSI/AWWA C600 and manufacturer's recommendations.
 - .3 Bevel or taper ends of PVC pipe to match fittings.
 - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
 - .5 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
 - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .9 Position and join pipes with equipment and methods approved by the Departmental Representative.
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- .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .11 Align pipes before jointing.
- .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
- .14 Complete each joint before laying next length of pipe.
- .15 Minimize deflection after joint has been made.
- .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Departmental Representative.
- .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .20 Do not lay pipe on frozen bedding.
- .21 Do hydrostatic and leakage test and have results approved by the Departmental Representative before surrounding and covering joints and fittings with granular material.
- .22 Backfill remainder of trench.

3.5 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
 - .2 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.
 - .3 Install valve boxes or indicator posts on all valves.
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3.6 BUILDING CONNECTIONS

- .1 Terminate building water service 1 m outside building wall. Perform all tests described in this specification section prior to tying in to mechanical plumbing. Following passing of all specified tests:
 - .1 Install coupling necessary for connection to building plumbing.
 - .2 If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Place temporary location marker at ends of plugged or capped unconnected water lines.
 - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
 - .2 Paint exposed portion of stake blue with designation "WATER SERVICE LINE" in black.

3.7 TAPPING SLEEVE INSTALLATION

- .1 Thoroughly clean the exterior of the main to be tapped. Grind or file any protrusions or irregularities in the pipe exterior which may interfere with uniform seating of gaskets or clamping bands. In accordance with Section 10 of AWWA C651, dust interior surface of the tapping sleeve annulus with calcium hypochlorite powder before attaching to main in accordance with manufacturer's instructions.

3.8 FIRE HYDRANTS

- .1 Install fire hydrants with isolation valves at locations indicated on the drawings.
- .2 Fire hydrant installations shall be provided with thrust blocks at the tee and mechanically restrained between the hydrant isolation valve and the hydrant boot using Tyton joints complete with lugs and two tie rods of 25mm diameter.
- .3 Set fire hydrants plumb, with hose outlets parallel with the edge of the pavement or curb line.
- .4 To provide proper drainage for each hydrant standpipe, excavate a pit measuring not less than 1.0 x 1.0 x 0.5 m deep and backfill with drain rock complying with Master Municipal Construction Document 2009 Section 31 05 17 item 2.6 to a level 150 mm above the hydrant drain holes. Hydrant boot to rest on 100 x 300 x 300 mm precast concrete blocks bedded on a minimum of 300 mm of previously stated drain rock in previously stated pit. Generally comply with Master Municipal Construction Document 2009 Standard Drawing W4.

3.9 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place heavy gauge polythene sheet between pipe fitting and concrete.
 - .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed firm bearing soil or as directed by the Departmental Representative.
 - .3 Valves shall be anchored to a block of concrete.
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- .4 Anchors that restrain upward forces or forces in a direction in which no suitable undisturbed bearing surface is available shall consist of inverted U-bars at the joint being restrained set in the concrete of the thrust block. Thrust blocks in this application shall be of that mass or weight required to restrain the forces involved.
- .5 Keep joints and couplings free of concrete.
- .6 Minimum size of thrust blocks shall be as follows:

Largest Pipe Size at thrust location	Dead Ends, Tees and Wet-Tap connections	90° Bends	45° Bends	22.5° Bends
100 mm	0.36 m ²	0.36 m ²	0.27 m ²	0.18 m ²
150 mm	0.54 m ²	0.63 m ²	0.36 m ²	0.36 m ²
200 mm	0.72 m ²	0.81 m ²	0.54 m ²	0.54 m ²
250 mm	1.08 m ²	1.62 m ²	0.90 m ²	0.72 m ²
300 mm	1.62 m ²	2.40 m ²	1.26 m ²	1.08 m ²

- .7 Do not backfill over concrete within 24 hours after placing.
- .8 For restrained joints: only use restrained joints approved by the Departmental Representative.

3.10 PIPE SURROUND

- .1 Upon completion of pipe laying and after the Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 2 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

3.11 BACKFILL

- .1 Backfill and compact per Section 31 00 99 – Earthworks for Minor Works.

3.12 CLEANING AND PRELIMINARY FLUSHING

- .1 Before flushing and pressure testing, ensure waterworks system is completely finished except tie-ins to existing watermains or proposed buildings and make arrangements with Departmental Representative for scheduling of testing and disinfection of mains. Testing and disinfection to be witnessed by Departmental Representative.
- .2 Water may be supplied from on site fire hydrants upon application for a Hydrant Use Permit and presentation of valid test certificate for reduced pressure principle backflow prevention device conforming to AWWA C511.

- .3 Remove foreign material from pipe and related appurtenances by flushing with water. Main to be flushed at water velocities as high as can be obtained from available water sources. Minimum velocity to be 1.5 m/s and / or in accordance with AWWA C651. Open and close valves, hydrants and service connections to ensure thorough flushing. Continue flushing at least until flow from most distant point has reached discharge point and water discharged is clean and clear, or 10 minutes, whichever is greater.

3.13 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests of polyvinyl chloride (PVC) piping to AWWA M23 and AWWA C605.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify the Departmental Representative at least 48 hours in advance of proposed tests. Perform tests in presence of the Departmental Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is evidenced by test results.
- .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Departmental Representative.
- .6 Strut and brace any exposed works to prevent movement when test pressure is applied.
- .7 Open valves.
- .8 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .9 Fill the test section of pipe and allow to remain full of water for at least 24 hours before commencement of any pressure tests.
- .10 Apply leakage test pressure of 1.5 x working pressure applied at highest elevation in test section with a minimum of 1380 kPa applied at lowest point in test section, for period of at least 2 hours. Maximum test pressures should not exceed those specified in CSA B137.3-Table 9.
- .11 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .12 Do not exceed allowable leakage of 1.079 L/mm dia./km/day, including lateral connections.
- .13 Locate and repair defects if leakage is greater than amount specified.
- .14 Repeat test until leakage is within specified allowance for full length of water main.

3.14 DISINFECTING AND FLUSHING

- .1 After mains have passed leakage pressure testing, perform disinfecting and flushing operations: witnessed by the Departmental Representative carried out by specialist contractor.

Notify the Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Do not use granular hypochlorite for disinfection of PVC pipe with solvent welded joints as there is an explosive reaction potential.
- .3 Disinfect water mains as follows. Retain water containing not less than 25 mg/L free chlorine in water system for a period of at least 24 h, in accordance with AWWA C651, Continuous Feed Method. Submit outline of proposed disinfection procedure accompanied by marked up schematic drawing to Departmental Representative for approval at least 2 complete working days in advance of commencement of disinfection. Ensure that chlorine disinfectant does not enter existing watermains during the disinfection procedures.
- .4 Allow water from existing distribution system, isolated by reduced pressure principle backflow prevention device or other approved course of supply, to flow at constant, measured rate into newly laid watermain. In absence of a meter, rate may be approximated by methods such as placing Pitot gauge in discharge, measuring time to fill container of known volume, or measuring trajectory of discharge and using formula presented in AWWA C651. Rate of chlorine application to be proportional to rate of water entering pipe. Chlorine application to be close to point of filling water main and to occur at same time.
- .5 At a point not more than 3 m downstream from beginning of new main, ensure water entering new main receives dose of chlorine fed at constant rate such that water will have not less than 25 mg/L free chlorine. To assure that this concentration is provided, measure chlorine concentration at regular intervals as specified in AWWA C651. Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .6 Amount of chlorine required to produce 25 mg/L concentration in 30 m of pipe of various sizes is given in following table:

Pipe Dia. (mm)	100 Percent Chlorine (kg)	1 Percent Chlorine Solution (Litres)
100	0.006	0.61
150	0.014	1.36
200	0.024	2.46
250	0.039	3.86
300	0.054	5.45
400	0.098	9.85

- .7 Allow flow of water containing chlorine to continue until entire main, all service connections, extremities and hydrants to be treated are filled with 25 mg/L chlorine solution. To ensure that this concentration has been attained throughout, measure free chlorine residual at a number of points and extremities along main. Retain chlorinated water in main for at least 24 h. During this time operate all valves, curb stops and hydrants in section treated in order to disinfect them thoroughly.

- .8 At end of this 24 h period, treated water to contain no less than 10 mg/L free chlorine throughout main. If chlorine content is less than 10 mg/L repeat chlorination procedure until specifications are met.
- .9 After completion of chlorination, flush chlorinated water from system, hydrants and services until chlorine concentration in remaining water is less than 0.3 mg/L chlorine residual.
- .10 Samples to be taken for bacteriological testing, after chlorine solution has been flushed out.
 - .1 Collect samples daily for minimum of two consecutive days, a minimum of 24 hours apart, witnessed by the Departmental Representative or an Independent Certified Testing Agency at:
 - .1 Extreme ends of test section
 - .2 All ends stubbed out for building service plumbing tie-ins
 - .3 All other dead ends or permanent blow offs / hydrants / air release valves.
 - .2 Immediately hand over collected samples to the Departmental Representative or Independent Certified Testing Agency for secure custody of samples during transport to the Independent Certified Testing Laboratory.
 - .3 Should laboratory analysis results exceed the nominal detection limit for coliform organisms or bacteria in any test sample, repeat disinfecting, flushing, sampling and bacteriological testing procedure until absence of bacteria is achieved in all samples taken on consecutive sampling days.

3.15 TIE-IN INSTALLATION

- .1 Ensure all pressure and bacteriological testing is successfully passed and obtain approval of the Departmental Representative before tying in to existing water distribution system.
- .2 Comply with notice periods and approvals stated elsewhere regarding interruptions to services.
- .3 The Contractor is to locate, by physical exposure, the existing watermain at the proposed tie-in location prior to any construction. The Contractor is to ascertain the precise location and elevation of the tie-in as well as the fittings required for the tie-in. Any discrepancies with the contract drawings are to be immediately brought to the attention of the Departmental Representative.
- .4 The Contractor is to ensure that the tie-ins to the existing watermain are witnessed by the Departmental Representative.
- .5 Sterile construction practices must be followed during installation of the final connections so that there is no contamination of the new or existing works with foreign material or groundwater. Clean the exterior of the main to be tied-into. Dewater as necessary to ensure that no part of the entire tie-in arrangement comes into contact with trench water. Grind or file any protrusions or irregularities in the pipe exterior which may interfere with uniform seating of couplings, gaskets or clamping devices. The new pipe and fittings required for the connection are to be spray-disinfected or swabbed with a minimum 1 to 5% solution of chlorine immediately prior to being installed. Comply with AWWA C651.

3.16 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface as specified elsewhere.

END OF SECTION

- .7 Submit manufacturers information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.

1.6 SCHEDULING

- .1 Maintain existing sewage flows during construction. Do not interrupt existing sanitary services or mains during tie-in or at other times. Allow for all methodology and temporary measures required to maintain sewage flows throughout.

Part 2 Products

2.1 PLASTIC PIPE & SERVICE CONNECTIONS

- .1 Type PSM Polyvinyl Chloride (PVC): to CSA-B182.2.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Locked-in or Separate gasket and integral bell system.
 - .3 Nominal lengths: 6 m.

2.2 PIPE BEDDING AND SURROUND MATERIALS

- .1 General requirements for granular pipe bedding are as per Section 31 00 99 articles 2.1.1 or 2.1.2
- .2 Gradation requirements for granular pipe bedding are as per Section 31 00 99 article 2.1.4 (type 1 gradation).

2.3 BACKFILL MATERIAL

- .1 As per Section 31 00 99 item 2.1 (applicable articles).

Part 3 Execution

3.1 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of the Department Representative.

3.2 TRENCHING

- .1 Do not allow contents of sewer or sewer connection to flow into trench.
- .2 Trench alignment and depth as shown on Contract Drawings.
- .3 Water jetting of backfill under haunches of corrugated steel pipe may be permitted if recommended by manufacturer and approved by the Department Representative.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in a uniform layer not exceeding 150 mm compacted thickness, surround material compacted with a hand compactor.

- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
- .4 Compact each layer full width of bed to minimum 95% Modified Proctor Density in compliance with ASTM D1557.
- .5 Shape transverse depressions as required to suit joints.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

3.4 INSTALLATION

- .1 Handle pipe in accordance with manufacturer's recommendations. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
- .2 Lay and join pipes to manufacturer's instructions and specifications except as noted otherwise herein. PVC pipe to CSA B182.11.
- .3 Install Pipes to the following tolerances:
Horizontal tolerances: plus or minus 25 mm from specified alignment;
Vertical tolerances: plus or minus 10 mm from specified grade. Reverse grade is not acceptable.
- .4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Pipes on curved alignments:
 - .1 Smooth profile PVC pipe: for 100 mm to 300 mm sizes conform to required curvature by bending pipe barrel. In no case is radius of curvature to be less than 300 times outside diameter of the barrel. Joint deflection not permitted for smooth profile PVC pipe.
- .7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Whenever work is stopped, install removable watertight bulkhead at open end of last pipe laid to prevent entry of water and foreign materials.
- .8 Cut pipes as required, as recommended by pipe manufacturer, without damaging pipe and leave smooth end at right angles to axis of pipe.
- .9 Joints:
 - .1 Install gaskets as recommended by manufacturer on all pipe unless specified otherwise.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes carefully before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

- .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
- .6 Complete each joint before laying next length of pipe.
- .7 Minimize joint deflection after joint has been made to avoid joint damage.
- .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes of as otherwise specified.
- .11 When any stoppage of work occurs, restrain pipes in an approved manner to prevent "creep" during down time.
- .12 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available. Core neat circular holes in walls of existing manholes. Do not hammer or chip except as approved by the Department Representative.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to underside of pipe to at least 95 % Modified Proctor
- .6 Surround material should be compacted with a hand compactor.

3.6 BACKFILL

- .1 Place unfrozen backfill material in accordance with Section 31 00 99 article 3.4.

3.7 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 After substantially completing backfilling and compaction work, carry out leakage test of each section by means of low pressure air test in the presence of Departmental Representative, as follows:
 - .1 Wet inside perimeter of test section.
 - .2 Seal test section at openings by means of removable water-tight plugs.
 - .3 Increase pressure in test-section to 24kPa above average groundwater pressure and observe rate of drop.

-
- .4 Maintain 25kPa above average groundwater pressure for at least 5 minutes before commencing test. (Do not exceed 35kPa above average groundwater pressure).
 - .5 Commence test when pressure decreases to 24.0kPa above average groundwater pressure. Do not add air to test section during test period. The sewer shall be deemed to have failed the test if the test period is less than:
 - .1 2 minutes and 32 seconds for 100mm pipe.
 - .2 3 minutes and 50 seconds for 150mm pipe.
 - .3 5 minutes and 6 seconds for 200mm pipe.
 - .4 6 minutes and 22 seconds for 250mm pipe.
 - .5 7 minutes and 39 seconds for 300mm pipe.
 - .6 8 minutes and 56 seconds for 350mm pipe.
 - .7 9 minutes and 35 seconds for 375mm pipe.
 - .6 In the case of test failure, repair leaks and repeat low pressure air testing.
 - .7 As the Departmental Representative will not witness the low pressure air test until after backfilling, the contractor is encouraged to check air-tightness regularly throughout pipe-laying and backfilling and to address any leakage issues early. This should minimize the potential for test failure when the witnessed test is done.
 - .3 Acceptable Ponding: Mainline PVC sewers; 300 mm diameter or less: 20 mm maximum ponding over 3m length of pipeline.
 - .4 Remove foreign material from sewers and related appurtenances by flushing with water.
 - .5 Television and photographic inspections:
 - .1 Immediately after flushing, carry out inspection of installed sewers by television camera and provide the Departmental Representative with two copies of inspection report and DVD recorded, logged, produced and coded in accordance with the standards of the Water Research Centre (WRc) / NASSCO Pipeline Assessment Certification Program (PACP).
 - .2 Provide means of access to permit Departmental Representative to do inspections.

END OF SECTION

- .7 Submit manufacturers information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.

1.6 SCHEDULING

- .1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

Part 2 Products

2.1 PLASTIC PIPE

- .1 Polyvinyl chloride pipe up to 1200 mm in diameter, DR35 Pipe to have minimum pipe stiffness (F/Y) of 320 kPa at 5.0% deflection, ASTM D2412. Pipe to be manufactured to specifications for pipe size ranges as follows:
 - 100 mm dia. – 375mm dia. To ASTM D3034
 - Pipes to be certified by Canadian Standards Association to standards for pipe size ranges below.
 - 100 mm dia. – 1200 mm dia. To CSA B182.2
- .2 Joints: To conform to ASTM D3212; pipe to include integral bell and spigot ends with stiffened wall section and formed groove for a rubber gasket; elastomeric gaskets to ASTM F477.
- .3 Maximum installed deflection not to exceed 7.5% of the base inside diameter.

2.2 PIPE BEDDING AND SURROUND MATERIAL

- .1 General requirements for granular pipe bedding are as per Section 31 00 99 articles 2.1.1 or 2.1.2
- .2 Gradation requirements for granular pipe bedding are as per Section 31 00 99 article 2.1.4 (type 1 gradation).
- .3 Concrete encasement, where noted on drawings, to be minimum 20MPa, with constituent materials in conformance to CAN/CSA-A5, A23.5 and A23.1.

2.3 BACKFILL MATERIAL

- .1 As per Section 31 00 99 item 2.1 (applicable articles).

Part 3 Execution

3.1 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Department Representative.

3.2 TRENCHING

- .1 Do not allow contents of sewer or sewer connection to flow into trench.
- .2 Trench alignment and depth as shown on Contract Drawings.

- .3 Water jetting of backfill under haunches of corrugated steel pipe may be permitted if recommended by manufacturer and approved by the Department Representative.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in a uniform layer not exceeding 150 mm compacted thickness, surround material compacted with a hand compactor.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
- .4 Compact each layer full width of bed to minimum 95% Modified Proctor Density in compliance with ASTM D1557.
- .5 Shape transverse depressions as required to suit joints.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

3.4 INSTALLATION

- .1 Handle pipe in accordance with manufacturer's recommendations. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
- .2 Lay and join pipes to manufacturer's instructions and specifications except as noted otherwise herein. PVC pipe to CSA B182.11.
- .3 Install Pipes to the following tolerances:
Horizontal tolerances: plus or minus 25 mm from specified alignment;
Vertical tolerances: plus or minus 10 mm from specified grade. Reverse grade is not acceptable.
- .4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Pipes on curved alignments:
 - .1 Smooth profile PVC pipe: for 100 mm to 300 mm sizes conform to required curvature by bending pipe barrel. In no case is radius of curvature to be less than 300 times outside diameter of the barrel. Joint deflection not permitted for smooth profile PVC pipe.
- .7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials. Whenever work is stopped, install removable watertight bulkhead at open end of last pipe laid to prevent entry of water and foreign materials.
- .8 Cut pipes as required, as recommended by pipe manufacturer, without damaging pipe and leave smooth end at right angles to axis of pipe.
- .9 Joints:

- .1 Install gaskets as recommended by manufacturer on all pipe unless specified otherwise.
- .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .3 Align pipes carefully before joining.
- .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
- .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
- .6 Complete each joint before laying next length of pipe.
- .7 Minimize joint deflection after joint has been made to avoid joint damage.
- .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise specified.
- .11 When any stoppage of work occurs, restrain pipes in an approved manner to prevent "creep" during down time.
- .12 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available. Core neat circular holes in walls of existing manholes. Do not hammer or chip except as approved by the Department Representative.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to underside of pipe to at least 95 % Modified Proctor
- .6 Surround material should be compacted with a hand compactor.

3.6 BACKFILL

- .1 Place backfill material in unfrozen condition and in accordance with Section 31 00 99 article 3.4.

3.7 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 Acceptable Ponding: Mainline PVC sewers; 300 mm diameter or less: 20 mm maximum ponding over 3m length of pipeline.

-
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
 - .4 Flushings to be vacuum pumped for disposal offsite to prevent foreign material, silts etc., from entering interceptors, filter chambers and soakaways. Offsite disposal to comply with environmental legislation / bylaws.
 - .5 Television and photographic inspections:
 - .1 Immediately after flushing, carry out inspection of installed sewers by television camera and provide the Departmental Representative with two copies of inspection report and DVD recorded, logged, produced and coded in accordance with the standards of the Water Research Centre (WRc) / NASSCO Pipeline Assessment Certification Program (PACP).
 - .2 Provide means of access to permit Departmental Representative to do inspections.

END OF SECTION

- .2 Standard Dimensional Ratio (SDR): 35.
- .3 Pipe stiffness: 320 kPa at 5% deflection, ASTM D2412.
- .4 Fitting: solid hub by hub.
- .5 Size: 150mm [6"] unless otherwise noted.

2.2 Cleanout

- .1 Extended ferrule, Dura-Coated cast iron body with gas and water tight ABS countersunk plug.

PART 3 EXECUTION

3.1 Preparation

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

3.2 Excavation

- .1 Do excavation work in accordance with Section 31 00 99.
- .2 Do not place birds-eye gravel material prior to approval of subbase by Departmental Representative.

3.3 Pipe Bedding and Cover

- .1 Subsoil drain shall be laid to on 150 mm drain gravel and covered with 250mm of drain gravel measured from the top of pipe, unless otherwise shown or specified. Do not place material in frozen conditions.
- .2 Shape bed true to grade to provide continuous uniform bearing surface for pipe. Do not use blocks when bedding pipe.
- .3 Shape transverse depressions in bedding as required to suit joints.
- .4 Fill excavation below design elevation to bottom of specified bedding in accordance with Section 31 23 33 with backfill material.

3.4 Installation

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Handle pipe using methods approved by the Departmental Representative. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

-
- .2 Correct pipe which is not in true alignment and grade or pipe which shows differential settlement after installation great than 10 mm in 3 meters.
 - .3 Subsoil drain shall be laid continuous and even falls of not less than 0.5% unless otherwise noted.
 - .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
 - .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
 - .6 Do not allow water to flow through pipe during construction, except as may be permitted by the Departmental Representative.
 - .7 Install plastic pipe and fittings in accordance with CSA B182.11.
 - .8 When stoppage of work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
 - .9 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .10 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available. Stabilize pipe at openings made in rock pit manhole with shrinkage compensating grout.
 - .11 All changes in direction shall be made with solid hub by hub fittings. Vertical drops shall be solid with a minimum of 100mm [4"] gravel curtain around pipe. Branches will be taken off with Y's and catch basin connections shall be made with one length of cast iron pipe.
 - .12 Provide cleanouts at changes in direction, extended to terminate flush with grade.
 - .13 Where noted on drawing, provide geotextile materials.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This section includes requirements for supply and installation of perimeter foundation drainage system with granular filter and/or geotextile filter material.

1.2 RELATED SECTIONS

- .1 Civil Drawings and Specifications

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C4-04(2009), Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile.
 - .2 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM C444M-03(2009), Standard Specification for Perforated Concrete Pipe (Metric).
 - .4 ASTM C654M-11, Standard Specification for Porous Concrete Pipe (Metric).
 - .5 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA):
 - .1 CSA B1800-11, Plastic Non-pressure Pipe Compendium (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .1 CSA B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 CSA-G401-07, Corrugated Steel Pipe Products, Includes Update No. 1 (2008).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals Procedures.
 - .1 Submit manufacturer's product literature for each product listed including manufacturer's recommended installation procedures and any modifications required to suit installation conditions.
- .2 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittal Procedures.
 - .1 Drainage Pipe: Provide a 300 mm length of perforated pipe and end connection.

- .2 Filter Fabric: Provide 600 mm x 600 mm filter cloth sample for review and acceptance.
- .3 Certificates:
 - .1 Submit manufacturer's test data and certification that drain pipe materials meet requirements of this Section at least 2 weeks prior to beginning Work.
 - .2 Submit proposed source of granular bedding and filter materials a minimum of two (2) weeks before beginning work of this Section, indicate gradation and certification of expected flow rate of granular materials.
 - .3 Certification to be marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 01 50 – General Instructions, Common Product Requirements.
- .2 Store materials in accordance with manufacturer's written instructions.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions, Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Corrugated Plastic Drainage Tubing: PVC DR 35 to CAN/CSA B182.1, perforated, tapered ends, sizes as indicated on drawings. Unperforated matching pipe leads.
- .2 Other pipe as indicated on the drawings or as directed by the Departmental Representative.
- .3 Filter Gravel: Coarse aggregates to CSA A23.1-94, Table 3, Group 1, 20 mm to 5 mm nominal size of aggregate.
- .4 Filter Cloth and Sock: Tensile strength minimum 400 N, equivalent opening size 70 microns or less.
- .5 Accessories: Drainage pipe couplings (where pipe does not have bell connectors), end caps, clean-outs, and access covers, all as required for complete system.
- .6 Geotextile filter: Geotextile to be non-woven plastic, non-biodegradable type designed for separation of fill materials while permitting movement of ground water.
 - .1 Acceptable Material: Nilex Nudrain WD15

Part 3 Execution

3.1 TRENCHING

- .1 Do excavating, trenching and backfilling in accordance with Section 31 00 99 – Earthwork for Minor Works.
- .2 Trim and compact trench bottom to provide firm uniform support throughout length of pipe.
- .3 Allow 100 mm clearance on both sides of pipe for filter aggregate.

3.2 BEDDING

- .1 Place 100 to 150 mm layer of bedding filter material as indicated and compact to minimum 95% of maximum density to ASTM D698.

3.3 INSTALLATION OF PIPE SUB-DRAINS

- .1 Lay pipe drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points.
- .2 Place at trench bottom the geotextile fabric of sufficient width to completely wrap around filter aggregate and pipe with minimum 300 mm overlap. Alternatively a sock of approved geotextile fabric may be slipped over the pipe.
- .3 Ensure barrel of each pipe is in contact with bed throughout full length.
- .4 Begin laying at outlet and proceed in upstream direction.
- .5 Lay perforated pipes on fabric with perforations 2/3 down.
- .6 Lay bell and spigot pipe with bell ends facing upstream.
 - .1 Do not mortar joints.
- .7 Make joints tight in accordance with manufacturer's instructions.
- .8 Make watertight connections to existing drains, new or existing manholes and catch basins where indicated or as directed by Departmental Representative. Seal joints with approved sealant.
- .9 Plug open upstream ends of pipes with watertight concrete, steel or wood bulkheads.
- .10 Surround and cover drain with filter material in uniform 150 mm layers to an elevation of at least 150 mm above top of drain and compact to at least 95% maximum density to ASTM D698. Level aggregate surface and overlap the fabric
- .11 Backfill remainder of trench to Section 31 00 99 – Earthwork for Minor Works and as directed by Departmental Representative.
- .12 Do not place bedding surround and backfill materials in frozen condition.
- .13 Protect sub-drains against flotation during installation.
- .14 Install "Y" connections to surface as indicated, for flushing.

END OF SECTION

April 24, 2017 (rev.2)
Reference: 15-6516

Via email: bmonroe@mgb.com

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Shoring
Specialists***

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300 – 7 East 6th Avenue
Vancouver, BC V5T 1J3

Attn: Ben Monroe, AIBC

**Re: Geotechnical Exploration Report
Revised Proposed Health Care Expansion – Mountain Institution
4732 Cemetery Road, Agassiz, BC**

1.0 INTRODUCTION

As requested, Braun Geotechnical Ltd. has completed a geotechnical exploration and assessment for the above-referenced project during 2015. The original geotechnical work was performed in general accordance with Braun's proposal (Ref P15-4642) dated August 10, 2015. A revised building design was prepared during 2016 that included a substantial expansion to the original footprint, and additional site exploration to provide coverage was carried out on March 28, 2017.

The scope of work was to review soil and groundwater conditions at the eastern area of the proposed health care facility expansion and provide geotechnical recommendations for site preparation and foundation design. Architectural drawings were provided by Mallen Gowing Berzins Architecture (MGBA) in a Project Brief forwarded on January 26, 2017.

The original scope of work included a review of hazard mitigation measures carried out at the institution since the 1960's. The facility is located within a debris/ alluvial fan area with a reported history of geotechnical hazards (i.e. debris flows, debris floods, stream avulsion, and debris slides). As such, the scope of work included review of hazard mitigation designs carried out at the institution since the 1960's, and a site reconnaissance of constructed mitigation measures. This information has been provided in this revised report for completeness

The scope of services was limited to the evaluation of geotechnical characteristics of the site and no consideration has been given to any environmental contamination issues.

Should changes be made to the proposed layout or general nature of the project, Braun Geotechnical should be notified to review and modify the recommendations to reflect those changes, as appropriate.

Braun Geotechnical should also be provided with the opportunity to review final architectural, mechanical, structural, and civil drawings for geotechnical considerations.

2.0 SITE DESCRIPTION & PROPOSED DEVELOPMENT

2.1 Geological Hazard Mitigation Measures

Available published and in-house geological and geotechnical information indicated that the Mountain Institution study site area is underlain by alluvial and debris flow/ flood sediments deposited over recent floodplain deposits of overbank silt and sand (Fraser River Sediments). Recorded information indicates that portions of the site were covered by soil, rock and woody debris during separate debris flow events that occurred on November 19, 1962, January 23, 1982, and at an unnamed channel between Channel B and C in 2009 (see Plate 1 below).

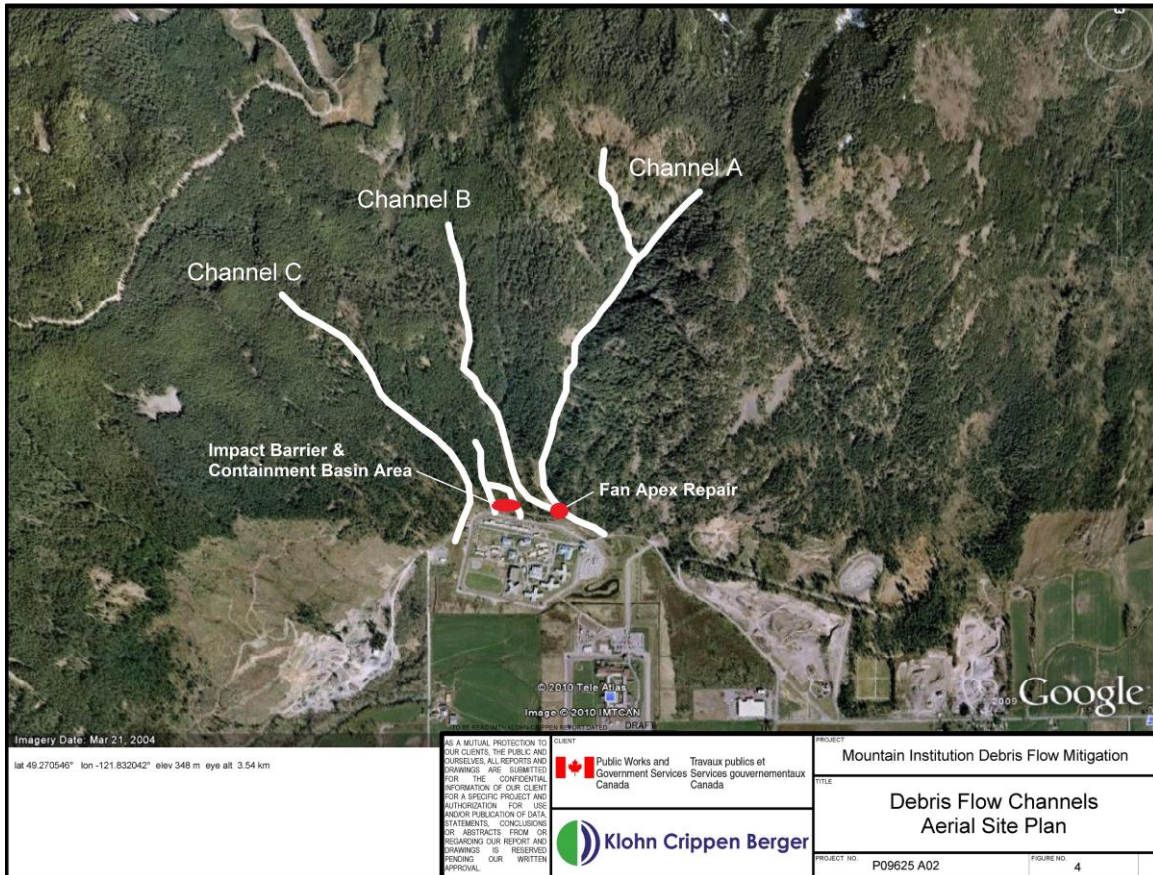


Plate 1 – Trace of debris-flow prone mountain stream channels (Klohn Crippen Berger)

Subsequent to the 1982 event, remedial measures were carried out that included mechanical stabilization of selected large boulder channel blockages, and construction of channelization berms near the apex of the debris fan (D.R. Piteau & Associates, 1983). A review of onsite documentation indicated that the drainage channels of concern have been inspected by Piteau and maintained under their field review on a semi-annual basis.

Subsequent to the 2009 event, an impact berm and containment basin was designed and constructed under design review of Klohn Crippen Berger (2010). At that time, repairs near the apex of the debris fan for Channel A and B were also recommended.

2.2 Proposed Health Care Building Expansion

The subject project includes expansion of the existing health care building (Building G) for additional capacity. It is understood the proposed expansion would comprise a single level

structure approximately 520 square meters in plan located adjacent and to the east of the existing health care building.

Structural drawings for the proposed building structure indicate that it is to be founded on shallow strip and spread footings designed for a soil bearing pressure of 120 kPa SLS (Bush Bohlman & Partners LL Dwg S100).

At the time of the geotechnical exploration the proposed expansion area was covered by grass covered landscape and asphalt paved access areas.

3.0 DESK STUDY INFORMATION

The desk study phase of geotechnical exploration was non-intrusive in nature, and involved update and review of available geological and geotechnical information, update and review of available aerial photographs and a site walkover to review and assess existing site conditions. Preliminary geotechnical comments based on desk study information have been provided below.

A review of historical government air photos available for each decade and dating back to 1939 were reviewed. Primary identity numbers of historical air photos available for review were as follows:

- 2004 SRS 6929-232
- 1999 SRS 6064-366
- 1993 30BCB93032-134
- 1983 30BC83017-160
- 1979 30BC79045-91/92
- 1974 BC5574-151/169
- 1968 BC7104-12
- 1963 BC5061-185/186
- 1959 A16664-113
- 1952 BC1622-92
- 1949 BC718-15
- 1949 BC721-19
- 1939 BC136-11
- 1939 BC148-78

The following comments based on the air photo review are provided:

- On the 1939 air photos, farmland and existing residence and/or barn structures were visible at and in the immediate vicinity of the study site (no obvious facility development was visible). Clearing appeared to be limited to the distal area of the debris fan. Agricultural field development to the south of the study site area appears to be approximately limited to the distal margin of the debris fan, and eastern areas exhibit areas of standing water.
- On the 1949 air photos, the western portion of the debris fan was cleared of trees to approximate mid-slope of the fan.
- On the 1952 air photos, tones were observed near the eastern distal margin considered to be consistent with excavation of a drainage trench.
- On the 1959 air photos, light slope-parallel tones are visible on the cleared area of the western portion of the debris fan to suggest stream avulsion or debris flood activity had occurred.

- On the 1963 air photos, previous buildings located on the debris fan are no longer visible, and the facility development is now visible, including channelization of the debris fan reaches of Channel A, B, and C. Light tones visible below the apex of the debris fan for Channel B and other locations are visible and appear to reflect a recent stream avulsion event and/ or debris flow/ flooding (see Plate 2).



Plate 2 – 1963 Airphoto showing substantial natural and anthropomorphic disturbance of the debris fan

- On the 1983 and earlier air photos, ongoing development of the facility is visible, and on the 1983 air photos, a building is visible at the current health care building location.
- Subsequent to the 1983 air photos, ongoing development of the facility is visible, including additional work on the channelization of Channel A and B.

4.0 SITE RECONNAISSANCE AND GEOTECHNICAL EXPLORATION

The site reconnaissance and geotechnical exploration was conducted on October 23, 2015. The site reconnaissance was carried out with a staff member from the facility, and included a field review of the Channel A and B fan apex, and the impact berm and debris slide area of the unnamed drainage channel between Channel B and C. The geotechnical exploration comprised test pits advanced at accessible areas of the proposed expansion using a small tracked excavator operated by HD Drilling Ltd. Two test pits (TP15-01 and TP15-02) were both advanced to a depth of approximately 2.5m. Test pit locations are shown on the attached Location Plan (Ref 15-6516-01).

The soil conditions were logged in the field and representative disturbed samples were collected from the test pits for routine geotechnical laboratory moisture content testing and further visual classification purposes.

5.0 SOIL AND GROUNDWATER CONDITIONS

Based on published surficial geology information from the Geological Survey of Canada and on in-house geotechnical information, the Mountain Institution facility is underlain by alluvial and debris flow/ flood sediments deposited over recent floodplain deposits of overbank silt and sand (Fraser River Sediments).

The proposed expansion area is located approximately 300m to the south of the apex of the debris fan for Channel A. As such, coarse grained debris flood deposits were anticipated.

The results of the geotechnical exploration were considered to be consistent with anticipated geological conditions and with published information. Natural soils were encountered below landscape fills at relatively shallow depth (approximately 0.9m to 1.4m) and comprised dark grey, poorly sorted, angular to subangular GRAVEL&COBBLES with some sand and silt with lesser pockets/ seams of organic rich sand in compact to dense, moist condition. Maximum particle size at the test pit locations was noted to be approximately 200mm.

Groundwater seepage was not encountered at the test holes at the time of excavation. Groundwater levels and near surface seepage flows are expected to fluctuate seasonally, and with drainage conditions.

The subsurface conditions described above and presented on the test hole logs were encountered at the test pit locations only. It should be noted that subsurface conditions at other locations could vary.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

The natural near-surface compact to dense dark grey gravel & cobble soils (or structural fills placed thereon) would be considered suitable for support of conventional shallow strip and spread footings.

The following sections provide our specific geotechnical recommendations.

6.2 Site Preparation

6.2.1 Stripping

General site stripping below the proposed building and any proposed pavement structures should include removal of any existing surficial vegetation, organic rich soils, and other deleterious materials. Subgrade preparation below proposed building footings should also include removal of any existing granular fills to expose a subgrade comprised of the natural compact to dense angular Gravel & Cobbles.

The exposed subgrade should be reviewed by Braun Geotechnical prior to placement of structural fills and/or building foundations.

6.2.2 Structural Fill

If required, structural fills placed below proposed building footings and parking areas should consist of clean, free draining well graded sand / sand and gravel or equivalent with less than 5% fines (percent passing the #200 sieve). Structural fill should be placed and compacted in

maximum 1 ft (300 mm) loose lifts with each lift compacted to at least 95% Modified Proctor Density (MPD). Structural fills placed under foundations should typically extend beyond the edges of the foundations a distance equal to the thickness of confined structural fill.

Density testing during site fill placement should be carried out on a regular basis to confirm adequacy of compaction, and the results forwarded to Braun Geotechnical for review. Braun Geotechnical should also be contacted to review fill quality, and placement and compaction procedures.

6.3 Foundation Design

It is recommended that foundations for the proposed structure be supported on the natural, undisturbed gravel/ cobbles and/or structural fills placed thereon. The following soil resistance (bearing) values may be adopted for foundation design:

Foundation Subgrade	Limit States Design (ULS)		Working Stress Design
	Factored Ultimate Bearing Resistance	Serviceability Limit State (SLS)	Allowable Bearing Pressure DL + LL
Natural Gravel/ Cobble Soils or Compacted Structural Fill	180 kPa (3750 psf)	120 kPa (2500 psf)	120 kPa (2500 psf)

The above design bearing pressures for soil subgrade assume the following:

- Strip and pad footings have minimum widths of 18” (460mm) and 24” (600mm), respectively.
- Site preparation is completed as indicated above and load-bearing surfaces are reviewed and approved by the Geotechnical Engineer.
- Foundation bearing surfaces are no higher than 1H:1V (Horizontal to Vertical) from the base or toe of adjacent walls, sumps, or buried structures such as utility lines, etc.
- Footings are placed below a 2H:1V line projected up from lower footings.
- Subgrade areas are protected as soon as practical after excavation exposure (as needed).
- Reduced soil bearing resistance should be adopted for footings supporting inclined loads, and should be reviewed by Braun on a case by case basis.
- Perimeter footings are founded at least 18” (460mm) below final finished adjacent grade for frost protection. Interior footings should be founded at least 12” (300mm) below finished adjacent grade for confinement.

It is recommended the underside of the proposed new footings match that of the existing structure to reduce requirements for underpinning. Actual footing depths of the existing structure should be determined at the time of construction and reviewed by Braun Geotechnical and the project structural consultant.

6.4 Liquefaction Potential

The current BC Building Code (2012) identifies the design earthquake as having a 2% probability of exceedance in 50 years (i.e. 1:2,475 year return period). Regional-scale hazard mapping typically identifies recent alluvial fan and Fraser River sediments as potentially liquefiable during the design earthquake event.

However, the proposed expansion is located relatively close to the apex of the debris fan of Channel A, B, and the unnamed drainage channel between Channel B and C. As such, coarse grained sediments were anticipated at the study site location and coarse angular to subangular

grain-supported debris fan type soils were confirmed at shallow depth during the test pit exploration.

In view of the above, this portion of the site is considered to be underlain by relatively high-friction coarse grain-supported material (angular to subangular particles) that are not overlain by a thick sequence of low permeable soils and would be expected to drain rapidly during earthquake shaking and thus unlikely to develop elevated pore-water pressures sufficient to induce liquefaction (Lewis, Arango and Stokoe, 2013).

The current BC Building Code classifies a site as Site Class D where the subgrade soils in the upper 30m consist of “stiff soil” with average SPT N_{60} values ranging 15 to 50 and average undrained shear strength (s_u) ranging 50 to 100 kPa. Available subsurface information indicates that compact to dense coarse granular soils are present below a relatively shallow depth, corresponding to Site Class D.

6.5 Slab on Grade

Slab on grade fills should typically comprise well-compacted clean sand/ sand & gravel (less than 5% passing No. 200 sieve). Additionally, the proposed slab should be underlain by a drainage layer comprising a minimum 100mm (4”) thick layer clear crushed gravel to provide for a capillary break. Polyethylene sheeting should be provided beneath the floor slab to further reduce potential for slab dampness.

Compaction testing should be carried out on any significant underslab fills to confirm that fills placed below the building have been compacted to at least 95% MPD. Prior to placement of any grade restoration fills, the subgrade should be reviewed by the geotechnical consultant.

6.6 Drainage and Backfill

Perimeter drainage should typically consist of perforated 150mm (6”) PVC pipe, placed around the building perimeter, with the invert elevation at footing elevation. The perimeter drain should be surrounded by at least 150mm (6”) of 19mm (¾”) clear crushed gravel. A 150mm (6”) thick layer of birds-eye gravel should be placed over the clear crushed gravel to act as a filter layer. For a proposed slab on grade established at least 200mm (8”) above surrounding grades deletion of the perimeter drainage system could be considered.

Backfill placed around perimeter foundation walls should typically consist of free-draining granular material such as sand or sand and gravel with less than 5% fines. The material should be compacted to at least 95% of MPD for its full depth.

6.7 Temporary Cut Slopes

Excavations up to 1.2m deep can be cut near vertical in accordance with WCB regulations. Deeper unsupported excavation cuts should be sloped no steeper than 1H:1V (Horizontal to Vertical). These recommended cut slopes should be reviewed by the Geotechnical Consultant during excavation and may require modification based on actual site conditions. Flatter slopes may be required if poor soil conditions, sloughing, or significant seepage is encountered.

Deep unsupported excavations may be impractical and/or unachievable where the excavation extends below the water table, and/or where geometric constraints do not permit the proposed excavation cut slopes. In these areas, temporary shoring measures and/or dewatering designs should be provided by a qualified Geotechnical Consultant prior to construction.

6.8 Lateral Earth Pressure

6.8.1 General

General design lateral earth pressures are provided below for retaining walls and buried structures that may be considered in final expansion designs. Lateral earth pressures provided for retaining structures assumed retained soils to be granular, horizontal and fully drained. The effect of surcharge pressure and/ or differential hydrostatic pressures should be added to estimated lateral earth pressures.

Design details on buried structures are not available at this preliminary design stage. However, lateral earth pressures are provided for yielding and non-yielding walls to a depth of approximately 3m below final grades. Conservatively, walls that are permitted to move or rotate at the top of wall at least 0.1% of wall height are considered yielding walls.

Assumed granular backfill properties adopted for lateral earth pressure determinations are presented below:

Material	Unit Weight (kN/m ³)	Internal Friction (degrees)	Young's Modulus (MPa)	Poisson Ratio (%)	Earth Pressure Coefficients	
					Active (K _a)	At Rest (K _o)
Approved Granular Fill (95% MPMD ¹)	20	35	100	0.3	0.27	0.42

1. Achieved compaction at least 95% of Laboratory Modified Proctor Maximum Dry Density (ASTM D1557)

Note that the table is for preliminary design purposes only, and is not intended to rigorously define the geotechnical properties of the backfill.

For lateral earth pressure distributions discussed below, a horizontal wall pressure diagram (Dwg. 15-6516-02) is attached for reference.

6.8.2 Static Lateral Earth Pressures

Retaining walls and buried structures backfilled with drained granular material that are restrained from rotation or lateral movement are considered non-yielding structures. For non-yielding walls, a triangular earth pressure distribution is appropriate and determined using an at-rest earth pressure coefficient (K_o). The triangular earth pressure distribution assumes compaction of backfill within 1m of the wall is carried out using lightweight walk-behind vibratory compaction equipment such that large applied compaction pressures are not 'locked-in'. For preliminary design purposes, a non-factored pressure distribution given by 8.4H kPa may be adopted, where H is the depth in meters below surface.

For retaining walls and buried structures that are yielding, a triangular earth pressure distribution is appropriate and determined using an active earth pressure coefficient (K_a). For preliminary design purposes, a non-factored pressure distribution given by 5.4H kPa may be adopted.

6.8.3 Seismic Lateral Earth Pressure

For non-yielding walls, pressures that may be generated during earthquake shaking may be estimated using methods presented in the ATC document, "Seismic Design Guidelines for Highway Bridges, ATC-6, 1981". These seismic design guidelines recognized that inertial forces in backfill soils against non-yielding walls are not considered in the Mononobe-Okabe (M-O) method which relies on movement sufficient to mobilize soil shear strength. To address this concern at the time of publication, the ATC guidelines suggested a factor of 1.5 be applied to peak ground accelerations (PGA) for preliminary determination of seismic lateral earth pressure. Factored for Site Class D, a PGA of 0.307 was determined at the site for 2,475year ground

motions. Using the simplified ATC approach, a dynamic earth pressure coefficient (K_{ae}) of 0.53 was calculated.

Alternatively, simplified methods developed by Wood (1973) provide an estimate of dynamic earth pressures for rigid walls with non-yielding backfill. Wood's method is considered appropriate solution for the condition where the predominant frequency of shaking is significantly less than the fundamental frequency of the backfill (i.e. $f/(V_s/4H) < 0.5$, where V_s is the shear wave velocity of the backfill material). Using Wood's method and assuming a large backfill width for a 3m wall height (H), a dynamic normal load of 55.3 kN per metre length of wall applied at an approximate height of 1.9m above the base of the wall was calculated for a factored PGA of 0.307g. Note that the Wood's solution neglects the vertical acceleration component in the analysis and ground acceleration at ground surface was utilized, but the findings are considered reasonable for the relatively low wall height.

For yielding walls, the modified M-O method (Richard and Elms, 1979) was used to estimate dynamic lateral earth pressures. A non-factored dynamic earth pressure coefficient (K_{ae}) of 0.43 was determined for 0.1% displacement. The additional earth pressure increment from seismic loading ($K_{ae}-K_a$) should be applied as an inverted triangle distribution.

6.8.4 Compaction-Induced Pressure

As mentioned previously, substantial additional pressures can be imparted on retaining walls and buried structures during soil compaction efforts. Lightweight walk-behind compaction equipment (i.e. a 500 lb plate tamper) is recommended for backfill compaction within approximately 1m of walls. For preliminary design, a uniform 15kPa pressure may be adopted extending from the top of wall to the intersection of the active or at rest earth pressure distribution, as required. The compaction pressure distribution is coincident but not additional to active or at rest earth pressures. Further, compaction pressure distribution should only be considered in structural design of walls, not overall stability (i.e. sliding or overturning resistance).

In the event that larger compaction equipment is considered, structural design of the walls should accommodate higher compaction-induced pressures.

6.8.5 Lateral Resistance

Resistance to lateral loads may be provided through frictional resistance at the underside of concrete foundations. An ultimate friction factor of 0.6 may be used between cast in place concrete and coarse granular foundation subgrade.

6.9 Proposed Asphalt Pavements - Onsite

The minimum recommended pavement structure for proposed pavement restoration areas is outlined below.

Onsite Pavement Thickness	Material
65mm ¹	Hot Mix Asphalt Surface (MMCD Hot Mix Asphalt LC2+UC2, HMA)
100mm	19mm minus Granular Base (MMCD Sec. 2226 & 2223)
300mm	Granular Subbase (SGSB) (MMCD Sec. 2226 & 2234)

Note 1: The proposed asphalt thickness should be increased to 75mm for asphalt pavement areas subjected to regular heavy vehicle traffic (ambulances, garbage trucks, etc).

The gradation of the above materials should comply with the appropriate Master Municipal Specifications outlined above.

The construction materials should be placed and compacted in compliance with the current MMCD specifications. Adequate drainage and/or cross falls should be provided to ensure that the base and subbase materials will not become saturated.

7.0 GEOTECHNICAL FIELD REVIEWS

Geotechnical field reviews are required by the Geotechnical Engineer of Record and to satisfy the requirements of the Letters of Professional Assurance required for the Building Permit. Field reviews are essential to ensure that the recommendations of the geotechnical report are understood and followed.

Geotechnical field reviews will be needed to address the following:

- Confirmation on soil and groundwater conditions;
- Confirm suitability of exposed footing subgrade;
- Field review and density testing of structural fill and perimeter fill.

8.0 CLOSURE

This report is prepared for the exclusive use of MGBA and Public Works Canada (and their designated representatives) and may not be used by other parties without the written permission of Braun Geotechnical.

If the development plans change, or if during construction soil conditions are noted to be different from those described in this report, Braun Geotechnical should be notified immediately in order that the geotechnical recommendations can be confirmed or modified, if required. Further, this report assumes that field reviews will be completed by Braun Geotechnical during construction.

The site contractor should make their own assessment of subsurface conditions and select the construction means and methods most appropriate to the site conditions.

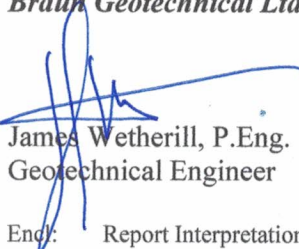
This report should not be included in the specifications without suitable qualifications approved by the geotechnical engineer.

The use of this report is subject to the Report Interpretation and Limitations, which is included with the report. The reader's attention is drawn specifically to those conditions, as it is considered essential that they be followed for proper use and interpretation of this report.

We hope the above meets with your requirements. Should any questions arise, please don't hesitate to contact the undersigned.

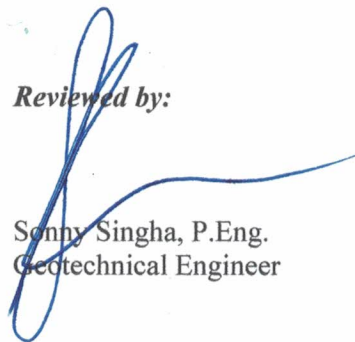
Yours truly,

Braun Geotechnical Ltd.


James Wetherill, P.Eng.
Geotechnical Engineer



Reviewed by:


Sonny Singha, P.Eng.
Geotechnical Engineer

Encl: Report Interpretation and Limitations
Test Hole Location Plan (Dwg. 15-6516-01)
Test Hole Logs (2015 and 2017)
Lateral Earth Pressure Diagram (Dwg. 15-6516-02)

REPORT INTERPRETATION AND LIMITATIONS

1. STANDARD OF CARE

Braun Geotechnical Ltd. (Braun) has prepared this report in a manner consistent with generally accepted engineering consulting practices in this area, subject to the time and physical constraints applicable. No other warranty, expressed or implied, is made.

2. COMPLETENESS OF THIS REPORT

This Report represents a summary of paper, electronic and other documents, records, data and files and is not intended to stand alone without reference to the instructions given to Braun by the Client, communications between Braun and the Client, and/or to any other reports, writings, proposals or documents prepared by Braun for the Client relating to the specific site described herein.

This report is intended to be used and quoted in its entirety. Any references to this report must include the whole of the report and any appendices or supporting material. Braun cannot be responsible for use by any party of portions of this report without reference to the entire report.

3. BASIS OF THIS REPORT

This report has been prepared for the specific site, development, design objective, and purpose described to Braun by the Client or the Client's Representatives or Consultants. The applicability and reliability of any of the factual data, findings, recommendations or opinions expressed in this document pertain to a specific project as described in this report and are not applicable to any other project or site, and are valid only to the extent that there has been no material alteration to or variation from any of the descriptions provided to Braun. Braun cannot be responsible for use of this report, or portions thereof, unless we were specifically requested by the Client to review and revise the Report in light of any alterations or variations to the project description provided by the Client.

If the project does not commence within 18 months of the report date, the report may become invalid and further review may be required.

The recommendations of this report should only be used for design. The extent of exploration including number of test pits or test holes necessary to thoroughly investigate the site for conditions that may affect construction costs will generally be greater than that required for design purposes. Contractors should rely upon their own explorations and interpretation of the factual data provided for costing purposes, equipment requirements, construction techniques, or to establish project schedule.

The information provided in this report is based on limited exploration, for a specific project scope. Braun cannot accept responsibility for independent conclusions, interpretations, interpolations or decisions by the Client or others based on information contained in this Report. This restriction of liability includes decisions made to purchase or sell land.

4. USE OF THIS REPORT

The contents of this report, including plans, data, drawings and all other documents including electronic and hard copies remain the copyright property of Braun Geotechnical Ltd. However, we will consider any reasonable request by the Client to approve the use of this report by other parties as "Approved Users." With regard to the duplication and distribution of this Report or its contents, we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of this Report by those parties. The Client and "Approved Users" may not give, lend, sell or otherwise make this Report or any portion thereof available to any other party without express written permission from Braun. Any use which a third party makes of this Report – in its entirety or portions thereof – is the sole responsibility of such third parties. BRAUN GEOTECHNICAL LTD. ACCEPTS NO RESPONSIBILITY FOR DAMAGES SUFFERED BY ANY PARTY RESULTING FROM THE UNAUTHORIZED USE OF THIS REPORT.

Electronic media is susceptible to unauthorized modification or unintended alteration, and the Client should not rely on electronic versions of reports or other documents. All documents should be obtained directly from Braun.

5. INTERPRETATION OF THIS REPORT

Classification and identification of soils and rock and other geological units, including groundwater conditions have been based on exploration(s) performed in accordance with the standards set out in Paragraph 1. These tasks are judgemental in nature; despite comprehensive sampling and testing programs properly performed by experienced personnel with the appropriate equipment, some conditions may elude detection. As such, all explorations involve an inherent risk that some conditions will not be detected.

Further, all documents or records summarizing such exploration will be based on assumptions of what exists between the actual points sampled at the time of the site exploration. Actual conditions may vary

significantly between the points investigated and all persons making use of such documents or records should be aware of and accept this risk.

The Client and "Approved Users" accept that subsurface conditions may change with time and this report only represents the soil conditions encountered at the time of exploration and/or review. Soil and ground water conditions may change due to construction activity on the site or on adjacent sites, and also from other causes, including climactic conditions.

The exploration and review provided in this report were for geotechnical purposes only. Environmental aspects of soil and groundwater have not been included in the exploration or review, or addressed in any other way.

The exploration and Report is based on information provided by the Client or the Client's Consultants, and conditions observed at the time of our site reconnaissance or exploration. Braun has relied in good faith upon all information provided. Accordingly, Braun cannot accept responsibility for inaccuracies, misstatements, omissions, or deficiencies in this Report resulting from misstatements, omissions, misrepresentations or fraudulent acts of persons or sources providing this information.

6. DESIGN AND CONSTRUCTION REVIEW

This report assumes that Braun will be retained to work and coordinate design and construction with other Design Professionals and the Contractor. Further, it is assumed that Braun will be retained to provide field reviews during construction to confirm adherence to building code guidelines and generally accepted engineering practices, and the recommendations provided in this report. Field services recommended for the project represent the minimum necessary to confirm that the work is being carried out in general conformance with Braun's recommendations and generally accepted engineering standards. It is the Client's or the Client's Contractor's responsibility to provide timely notice to Braun to carry out site reviews. The Client acknowledges that unsatisfactory or unsafe conditions may be missed by intermittent site reviews by Braun. Accordingly, it is the Client's or Client's Contractor's responsibility to inform Braun of any such conditions.

Work that is covered prior to review by Braun may have to be re-exposed at considerable cost to the Client. Review of all Geotechnical aspects of the project are required for submittal of unconditional Letters of Assurance to regulatory authorities. The site reviews are not carried out for the benefit of the Contractor(s) and therefore do not in any way effect the Contractor(s) obligations to perform under the terms of his/her Contract.

7. SAMPLE DISPOSAL

Braun will dispose of all samples 3 months after issuance of this report, or after a longer period of time at the Client's expense if requested by the Client. All contaminated samples remain the property of the Client and it will be the Client's responsibility to dispose of them properly.

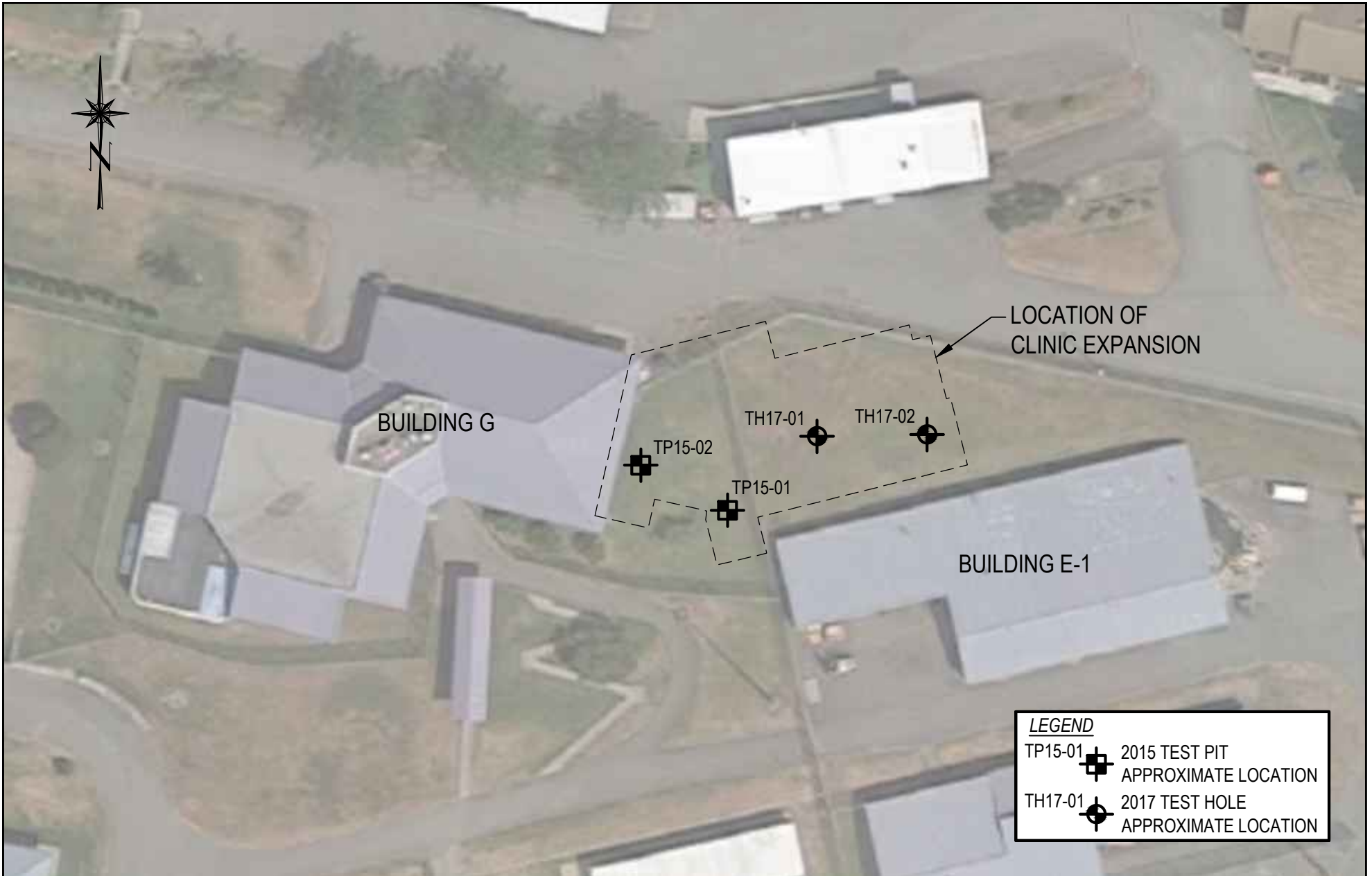
8. SUBCONSULTANTS AND CONTRACTORS

Engineering studies frequently requires hiring the services of individuals and companies with special expertise and/or services which Braun Geotechnical Ltd. does not provide. These services are arranged as a convenience to our Clients, for the Client's benefit. Accordingly, the Client agrees to hold the Company harmless and to indemnify and defend Braun Geotechnical Ltd. from and against all claims arising through such Subconsultants or Contractors as though the Client had retained those services directly. This includes responsibility for payment of services rendered and the pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. These conditions apply to specialized subconsultants and the use of drilling, excavation and laboratory testing services, and any other Subconsultant or Contractor.

9. SITE SAFETY

Braun Geotechnical Ltd. assumes responsibility for site safety solely for the activities of our employees on the jobsite. The Client or any Contractors on the site will be responsible for their own personnel. The Client or his representatives, Contractors or others retain control of the site. It is the Client's or the Client's Contractors responsibility to inform Braun of conditions pertaining to the safety and security of the site – hazardous or otherwise – of which the Client or Contractor is aware.

Exploration or construction activities could uncover previously unknown hazardous conditions, materials, or substances that may result in the necessity to undertake emergency procedures to protect workers, the public or the environment. Additional work may be required that is outside of any previously established budget(s). The Client agrees to reimburse Braun for fees and expenses resulting from such discoveries. The Client acknowledges that some discoveries require that certain regulatory bodies be informed. The Client agrees that notification to such bodies by Braun Geotechnical Ltd. will not be a cause for either action or dispute.



<i>LEGEND</i>	
TP15-01	2015 TEST PIT APPROXIMATE LOCATION
TH17-01	2017 TEST HOLE APPROXIMATE LOCATION



Client				MGB Architecture			Title		
Project				Proposed Health Care Expansion 4732 Cemetery Road, Agassiz, BC			LOCATION PLAN		
Project no.	Drawn	Design	Checked	Date	Scale	Drawing no.			
15-6516	JD	JW	SH	April 24, 2017	1:500	15-6516-01			

Test Pit Log: TP15-01

File: 15-6516
 Project: Proposed Health Care Expansion
 Client: DGBK Architects
 Location: 4732 Cemetery Road, Agassiz, BC



Depth	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 ft		Grass sod overlying organic-rich, silty, 25mm minus SAND and GRAVEL (FILL)			
1		rusty to tan, moist, 50mm minus SAND and GRAVEL, trace silt with isolated seams of dark-brown, organic SILT with trace fine gravel (FILL?)			
2					
3	1	Medium to dark-grey, moist, compact to dense, 100mm minus, sub-angular with occasional flat elongated GRAVEL and COBBLES, some sand, some silt, occasional organic-rich silt zones			
4					
5					
6					
7	2				
8					
9		End of Test Pit @ 2.5m			
10	3				

Equipment: Tracked Excavator
 Sampling Method: Lump Sample

Datum: Ground Surface
 Water Depth: Not Encountered

Logged By: JW
 Exploration Date: October 23, 2015
 Dwg No.: 15-6516-TP01
 Page: 1 of 1

Test Pit Log: TP15-02

File: 15-6516
 Project: Proposed Health Care Expansion
 Client: DGBK Architects
 Location: 4732 Cemetery Road, Agassiz, BC



Depth	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 ft		Grass sod overlying mixed silty SAND and GRAVEL, silt and 20mm crushed gravel (FILL)			
1					
2					
3 1		rust to tan, moist, dense, SAND and GRAVEL, trace silt, trace organic silt seams (FILL?)			
4					
5		Medium to dark-grey, moist, compact to dense, 100mm minus, sub-angular with occasional flat elongated GRAVEL and COBBLES, some sand, some silt, occasional organic-rich silt zones			
6					
7 2					
8					
9		End of Test Pit @ 2.5m			
10 3					

Equipment: Tracked Excavator
 Sampling Method: Lump Sample

Datum: Ground Surface
 Water Depth: Not Encountered

Logged By: JW
 Exploration Date: October 23, 2015
 Dwg No.: 15-6516-TP02
 Page: 1 of 1

Test Pit Log: TP17-01

File: 15-6516
 Project: Proposed Health Care Expansion
 Client: MGB Architects
 Location: 4732 Cemetery Road, Agassiz, BC



Depth	Sample	Soil Description	Sample #	Water Cont.	Remarks
0		Grass sod and ORGANIC SILT (FILL)			
0		rust-brown, moist, compact SAND to gravelly sand (FILL)			
1		dark-grey, moist, compact, sandy angular GRAVEL and COBBLES, trace silt			
2		Medium to dark-grey, moist, compact to dense, 200mm minus, sub-angular with occasional flat elongated GRAVEL and COBBLES, some sand, some silt			
3					
4					
5					
6					
7		End of Test Pit @ 2.1m			
8					
9					
10					

Equipment: Tracked Excavator
 Sampling Method: Lump Sample

Datum: Ground Surface
 Water Depth: Not Encountered

Logged By: JW
 Exploration Date: March 28, 2017
 Dwg No.: 15-6516-TP17-01
 Page: 1 of 1

Test Pit Log: TP17-02

File: 15-6516
 Project: Proposed Health Care Expansion
 Client: MGB Architects
 Location: 4732 Cemetery Road, Agassiz, BC



Depth	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 ft m		Grass sod and ORGANIC SILT (FILL)			
1		rust-brown to dark-grey, moist, compact, sandy angular GRAVEL and COBBLES (FILL)			
2		Medium to dark-grey, moist, compact to dense, 200mm minus, sub-angular with occasional flat elongated GRAVEL and COBBLES, some sand, some silt			- Side of Test Pit exposed Old wood post and cast concrete base @ 1.5m
3 1					
4					
5					
6					
7 2					
8					
9		End of Test Pit @ 2.6m			
10 3					

Equipment: Tracked Excavator
 Sampling Method: Lump Sample

Datum: Ground Surface
 Water Depth: Not Encountered

Logged By: JW
 Exploration Date: March 28, 2017
 Dwg No.: 15-6516-TP17-02
 Page: 1 of 1

NOTES:

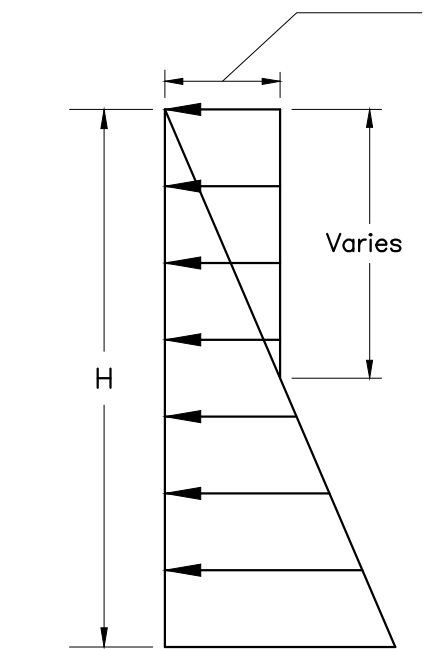
- Granular backfill adjacent to foundation walls as per city requirements and/or the Geotechnical Report.
- Lateral loads indicated are subject to review of actual soil conditions exposed at time of excavation.
- Wall pressures are approximate, actual pressures will depend on wall stiffness, groundwater conditions, backfill slope, type of backfill, compaction equipment, and surcharge pressures.

ASSUMPTIONS:

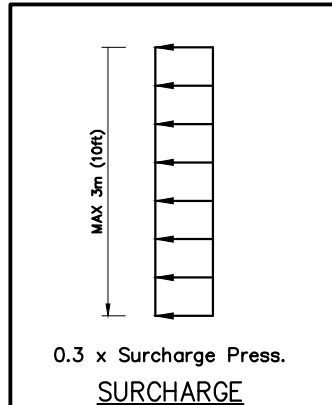
- Horizontal ground surface.
- Active loading conditions (i.e. top of wall is free to rotate 0.1% of wall height). Other conditions subject to review by Braun Geotechnical.
- Fully drained backfill.
- Seismic peak ground acceleration of 0.307g.
- All surcharge loads to be reviewed by Braun Geotechnical.

ALL LOADS ARE UNFACTORED

Metric Units m & kPa Imperial Units ft & psf

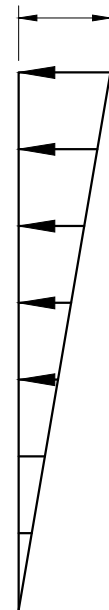


- Compaction Induced Pressure of 15kPa (300psf).
- A lower value may be feasible based on review of compaction equipment and procedure
- Compaction pressure need only be used for structural design not overall stability



8.4H kPa (53.8H psf) NON-YIELDING
5.4H kPa (34.6H psf) YIELDING
STATIC

See Table for Wall Pressure Based on Tolerable Displacement of Wall away from Soil Backfill

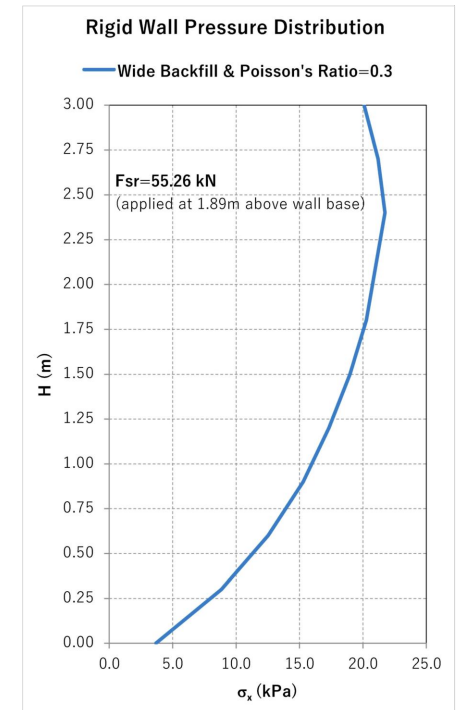


Tolerable Displacement ¹	Wall Pressure
0	3.46H kPa (22H psf)
13mm (0.5")	2.09H kPa (13.3H psf)
25mm (1")	1.77H kPa (11.3H psf)
50mm (2")	1.48H kPa (9.4H psf)

Note:
1. Wall height dependent values provided for 3m wall

(Based on Richard & Elms Procedure)

SEISMIC-YIELDING



SEISMIC-NON-YIELDING



Client MGB Architecture				Title Horizontal Wall Loading Diagram			
Project Proposed Health Care Expansion 4732 Cemetery Road, Agassiz, BC							
Project no. 15-6516	Drawn JD	Design JW	Approved SS	Date April 24, 2017	Scale NTS	Drawing no. 15-6516-02	



**CORRECTIONAL SERVICES CANADA
TECHNICAL SERVICES BRANCH
ELECTRONIC SECURITY SYSTEMS**



ES/STD-0232
Revision 2
February 2014

**ELECTRONIC ENGINEERING STANDARD
FIXED NETWORK COLOUR DOME CAMERA
FOR USE IN FEDERAL CORRECTIONAL INSTITUTIONS**

AUTHORITY

Acquisition of a camera for the identified purposes that is not in compliance with this standard must be approved by the Design Authority.

Recommended corrections, additions or deletions should be addressed to the Design Authority at the following address:

Director, Electronic Security Systems
Correctional Service of Canada
340 Laurier Avenue West,
Ottawa, Ontario
K1A 0P9

Approved by:

A handwritten signature in black ink, appearing to read "Mustard", written over a horizontal line.

Director,
Electronic Security Systems

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Revision	Paragraph	Comment
0	N/A	Original
1	All	New structure and change to merge indoor and outdoor.
2	Definitions	Removed
	2.1	Added reference IEC EN 61000-4-3, Radiated RF immunity
	3.2.2.3	Changed humidity to non-condensing 20%-90%
	3.3.1	Interference now uses IEC EN 61000-4-3, Radiated RF immunity

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TABLE OF ABBREVIATIONS

Abbreviation	Expansion
AGC	Automatic Gain Control
CSC	Correctional Service Canada
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
MJPEG	Motion Joint Photographic Experts Group
MTBF	Mean Time Between Failures
ONVIF	Open Network Video Interface Forum
PoE	Power over Ethernet
TCP/IP	Transmission Control Protocol/Internet Protocol

1 INTRODUCTION

1.1 Overview

- .1 This standard defines the requirements of Correctional Service Canada (CSC) for a fixed focus, network capable, dome camera for use at federal correctional institutions.

1.2 Purpose

- .1 The cameras are deployed for both observation and evidentiary use.
- .2 These cameras are for deployment for all outdoor fixed camera locations **except**:
 - .1 facility perimeter;
- .3 These cameras are for deployment for all indoor fixed camera locations **except**:
 - .1 observation cells;
 - .2 principal entrance panoramic;

2 REFERENCES

2.1 Specifications, Standards, and Statements of Work

- .1 Access to non-government specifications is the responsibility of the contractor.
- IEC EN60529 – International Electrotechnical Commission Degrees of protection provided by enclosures (IP Code)
- IEC EN60950-1 – International Electrotechnical Commission Information technology equipment – Safety
- IEC EN 61000-4-3 – International Electrotechnical Commission Radiated RF immunity
- IEC EN62262 – International Electrotechnical Commission Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts
- IEEE 802.3at – IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Amendment 3: Data Terminal Equipment (DTE) Power via the Media Dependent Interface (MDI) Enhancements
- IEEE 802.3u – IEEE Standards for Local and Metropolitan Area Networks: Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100 Mb/s Operation, Type 100BASE-T

3 PHYSICAL

3.1 Dimensions

- .1 The camera case and dome must:
 - .1 measure a base diameter less than 200mm;
 - .2 measure from base to top of dome of less than 175mm excluding any mount;
 - .3 weigh less than 2.5kg;

3.2 Environment

- .1 The camera case and dome must:
 - .1 meet or exceed IEC EN60529 IP66 dust and water resistance when mounted;
 - .2 meet or exceed IEC EN62262 IK10 impact resistance;
 - .3 have threaded openings for conduits;
 - .4 have a threaded plug to seal all unused openings;
 - .5 have set-screws to secure all conduit and plugs from inside the dome;
 - .6 have tamper resistant heads on all externally accessible screws;
 - .7 have a permanently affixed label on the interior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement;
 - .8 have a permanently affixed label on the exterior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement;
- .2 The camera must:
 - .1 be capable of continuous operation;
 - .2 start and operate from -40°C to 50°C;
 - .3 start and operate from 20% to 90% non-condensing humidity;

3.3 Interference

- .1 The camera must be certified compliant to IEC EN 61000-4-3, Radiated RF immunity

3.4 Reliability

- .1 The camera must have an MTBF of at least 25,000 hours.

3.5 Safety

- .1 The camera must meet IEC 60950-1 or the CSA equivalent.

4 OPERATIONAL

4.1 Camera

- .1 The camera must retain its configuration over a power cycle.
- .2 The image sensor must:
 - .1 include automatic or remote back focus;
 - .2 have a minimum of 480,000 pixels (horizontal x vertical);
 - .3 have day (colour) and night (black and white) modes;
 - .4 automatic removable infrared cut filter for day/night transition;
 - .5 have 0.5 lux or less minimum illumination for day mode;
 - .6 have 0.1 lux or less minimum illumination for night mode;
 - .7 include Automatic Gain Control (AGC);
 - .8 include extended dynamic range processing;

4.2 Lens

- .1 The camera lens must:
 - .1 have a 35° to 80° or greater horizontal angular view varifocal lens
 - .2 be approved by the manufacturer of the camera for that camera;

4.3 Video

- .1 The video encoding must:
 - .1 support H.264 configurable I-frame frequency of at least 3 per second;
 - .2 support H.264 constant bit rate transmission mode;
 - .3 support H.264 frame rate transmission mode;
 - .4 support at least 3 levels of H.264 image quality;
 - .5 support at least 3 levels of MJPEG image quality;
- .2 The video output must:
 - .1 include an on-screen, programmable character generation overlay capability with a minimum of 8 visible characters;
 - .2 support at least two simultaneous H.264 video streams at 30 frames per second with at least 480,000 pixel resolution;
 - .3 support at least two simultaneous video streams, one H.264 and one MJPEG at 15 frames per second with at least 480,000 pixel resolution;

5 INTERFACE

5.1 Ports

- .1 The camera must:
 - .1 interface over IPV4 TCP/IP;
 - .2 be able to operate on 100Base-TX (IEEE 802.3u);
 - .3 connect using an RJ-45 connector;
 - .4 be ONVIF compliant;

5.2 Power

- .1 The camera must be a Type 1 powered device operating solely from Power over Ethernet (PoE) compliant with IEEE 802.3at Class 0, 1, 2, or 3.

5.3 Video Management System Compatibility

- .1 The camera model must be identified as “Certified” or “Supported by Design” in the Genetec Omnicast Supported Hardware camera list.



**CORRECTIONAL SERVICES CANADA
TECHNICAL SERVICES BRANCH
ELECTRONIC SECURITY SYSTEMS**



ES/STD-0233
Revision 2
February 2014

**ELECTRONIC ENGINEERING STANDARD
INDOOR NO-GRIP CORNER MOUNT NETWORK COLOUR CAMERA
FOR USE IN FEDERAL CORRECTIONAL INSTITUTIONS**

AUTHORITY

This Standard is approved by the Correctional Service Canada for the procurement and installation of this item in Canadian federal correctional institutions.

Acquisition of a camera for the identified purposes that is not in compliance with this standard must be approved by the Design Authority.

Recommended corrections, additions or deletions should be addressed to the Design Authority at the following address:

Director, Electronic Security Systems
Correctional Service of Canada
340 Laurier Avenue West,
Ottawa, Ontario
K1A 0P9

Approved by:

A handwritten signature in black ink, appearing to read "Mustard", written over a horizontal line.

Director,
Electronic Security Systems

TABLE OF REVISIONS

Revision	Paragraph	Comment
0	N/A	Original
1	All	New document structure and addition of TCP/IP and PoE interfaces.
2	Definitions	Removed
	2.1	Added reference IEC EN 61000-4-3, Radiated RF immunity
	3.2.2.3	Changed humidity to non-condensing 20%-90%
	3.3.1	Interference now uses IEC EN 61000-4-3, Radiated RF immunity

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CSC	Correctional Service Canada
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
MJPEG	Motion Joint Photographic Experts Group
MTBF	Mean Time Between Failures
ONVIF	Open Network Video Interface Forum
PoE	Power over Ethernet
TCP/IP	Transmission Control Protocol/Internet Protocol

1 INTRODUCTION

1.1 Overview

- .1 This standard defines the requirements of Correctional Service Canada (CSC) for an indoor, fixed focus, network capable, corner mounted, no-grip camera for use at federal correctional institutions.

1.2 Purpose

- .1 The cameras are deployed for both observation and evidentiary use.
- .2 These cameras are for deployment only in:
 - .1 observation cells;

2 REFERENCES

2.1 Specifications, Standards, and Statements of Work

- .1 Access to non-government specifications is the responsibility of the contractor.
- IEC EN60529*International Electrotechnical Commission Degrees of protection provided by enclosures (IP Code)
- IEC EN60950-1*International Electrotechnical Commission Information technology equipment – Safety
- IEC EN 61000-4-3 – International Electrotechnical Commission Radiated RF immunity
- IEC EN62262*International Electrotechnical Commission Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts
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3 PHYSICAL

3.1 Dimensions

- .1 The camera case must:
 - .1 measure less than 300mm in all dimensions;
 - .2 weigh less than 2.5kg;

3.2 Environment

- .1 The camera case must:
 - .1 meet or exceed IEC EN60529 IP65 dust and water resistance when mounted;
 - .2 meet or exceed IEC EN62262 IK10 impact resistance;
 - .3 have tamper resistant heads on all externally accessible screws;
 - .4 be grip-less and anchor-free;
 - .5 have a permanently affixed label on the interior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement;
 - .6 have a permanently affixed label on the exterior of the unit which identifies the manufacturer, the model or assembly number, the serial number and the power requirement;
- .2 The camera must:
 - .1 be capable of continuous operation;
 - .2 start and operate from 0°C to 50°C;
 - .3 start and operate from 20% to 90% non-condensing humidity;

3.3 Interference

- .1 The camera must be certified compliant to IEC EN 61000-4-3, Radiated RF immunity

3.4 Reliability

- .1 The camera must have an MTBF of at least 25,000 hours.

3.5 Safety

- .1 The camera must meet IEC 60950-1 or the CSA equivalent.

4 OPERATIONAL

4.1 Camera

- .1 The camera must retain its configuration over a power cycle.
- .2 The image sensor must:
 - .1 include automatic or remote back focus;
 - .2 have a minimum of 480,000 pixels (horizontal x vertical);
 - .3 have day (colour) and night (black and white) modes;
 - .4 automatic removable infrared cut filter for day/night transition;
 - .5 have 0.5 lux or less minimum illumination for day mode;
 - .6 have 0 lux minimum illumination for night mode;
 - .7 if required for night mode, use invisible illumination (typically infra-red LEDs);
 - .8 include Automatic Gain Control (AGC);

4.2 Lens

- .1 The camera lens must:
 - .1 provide a view of the entire floor and all four walls of a room at least 3.5m x 3.5m including the walls to which it is attached from the mounting height to the floor;
 - .2 be approved by the manufacturer of the camera for that camera;

4.3 Camera Case

- .1 The camera case must:
 - .1 have a programmatically controlled visible LED indicator to show when the video feed is being observed;

4.4 Video

- .1 The video encoding must:
 - .1 support H.264 configurable I-frame frequency of at least 3 per second;
 - .2 support H.264 constant bit rate transmission mode;
 - .3 support H.264 frame rate transmission mode;
 - .4 support at least 3 levels of H.264 image quality;
 - .5 support at least 3 levels of MJPEG image quality;
- .2 The video output must:
 - .1 include an on-screen, programmable character generation overlay capability with a minimum of 8 visible characters;
 - .2 support at least two simultaneous H.264 video streams at 30 frames per second with at least 480,000 pixel resolution;
 - .3 support at least two simultaneous video streams, one H.264 and one MJPEG at 15 frames per second with at least 480,000 pixel resolution;

5 INTERFACE

5.1 Ports

- .1 The camera must:
 - .1 interface over IPV4 TCP/IP;
 - .2 be able to operate on 100Base-TX (IEEE 802.3u);
 - .3 connect using an RJ-45 connector;
 - .4 be ONVIF compliant;

5.2 Power

- .1 The camera must be a Type 1 powered device operating solely from Power over Ethernet (PoE) compliant with IEEE 802.3at Class 0, 1, 2, or 3.

5.3 Video Management System Compatibility

- .1 The camera model must be identified as “Certified” or “Supported by Design” in the Genetec Omnicast Supported Hardware camera list.

Correctional Service Canada
Technical Services Branch
Electronics Systems

ES/SOW-0101
Revision 3
15 April 2004

**ELECTRONICS ENGINEERING
STATEMENT OF WORK**


**PROCUREMENT & INSTALLATION OF
ELECTRONIC SECURITY SYSTEMS**

AUTHORITY


This Statement of Work is approved by Correctional Service Canada for the procurement and installation of all telecommunications and electronic security systems, subsystems, and equipment in Canadian penal institutions.

Recommended corrections, additions or deletions should be addressed to the Design Authority at the following address: Director, Engineering Services, Correctional Service of Canada, 340 Laurier Avenue West, Ottawa, Ontario, K1A 0P9

Prepared by:


Manager,
Electronics Systems Research

Approved by:

Director, 
Engineering Services
15 Apr 04

RECORD OF REVISIONS

Revision	Paragraph	Comment
3	10.1 – Manuals and Drawings	Added equipment operating software
	10.4 – Documentation Format	Added equipment operating software

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ABBREVIATIONS

The following abbreviations are used in this specification:

ATP	Acceptance Test Plan
CM	Corrective Maintenance
COTS	Commercial-Off-The-Shelf
CSC	Correctional Service Canada
DA	Design Authority
DCR	Design Change Request
DES	Director, Engineering Services
DL	Deficiency List
FDR	Final Design Report
MRT	Mean Response Time
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
PDR	Preliminary Design Report
PM	Preventative Maintenance
PW&GSC	Public Works & Government Services Canada
QA	Quality Assurance
RFP	Request For Proposal
SOW	Statement of Work
STR	Statement of Technical Requirement

DEFINITIONS

The following definitions are used in this specification:

Design Authority	Director, Engineering Services (DES) - Correctional Service Canada (CSC) is responsible for all technical aspects of the system design and implementation.
Contract Authority	Public Works and Government Services Canada (PW&GSC) is responsible for all contractual matters associated with the system design and implementation.
Contractor	The company selected as the successful bidder.
Project Officer	A CSC employee or a contracted person designated by DES to be responsible for the implementation of the project.
Off-the-shelf	Equipment currently on the market with available field reliability data, manuals, engineering drawings and parts price list.
Custom Equipment	Equipment designed and/or manufactured specifically for a specific contract.

1.0 INTRODUCTION

This Statement of Work (SOW) defines the work and responsibilities for the design, procurement, installation, test and integration of all telecommunications and electronic security equipment in CSC Institutions.

The SOW provides guidelines, procedures and responsibilities to the contractor and/or the project officer for the implementation of all telecommunications and electronic security systems in CSC facilities.

All work performed shall adhere to this SOW, CSC Specifications, Standards and Statement of Technical Requirements (STRs).

1.1 Commercial-Off-The-Shelf Equipment

The contractor shall use commercial off-the-shelf (COTS) equipment and proven designs to the maximum extent possible. All new equipment shall meet the specified lifespan requirements. New equipment designs shall be restricted to unique interfaces and common control console.

1.2 Technical Acceptability

The Correctional Service Canada (CSC) operational environment is unique for its diversity of locations, climate exposures and the physical restrictive construction techniques of penal institutions. Maintaining national security, the safety of staff and offenders alike is CSC's commitment to the government and public. Electronic security systems operating in this unique environment shall maintain very high standards of dependability and reliability.

The CSC Engineering Services Division has established technical specifications and equipment standards for specific electronic security systems which are based on very specific and restrictive operational performance criteria as detailed in its Electronic Engineering Standard. Technical acceptability of these systems means that the equipment complies with the pertinent CSC specifications and standards.

The technical acceptance process shall involve system and subsystem evaluation in accordance with the applicable CSC specifications in one of CSC facilities or may be tested in a CSC facility to verify the effectiveness of the proposed technologies when subjected to the restrictive operational environment.

CSC shall also verify in depth any of the system technical specifications called up. CSC may when it deems necessary, request the supplier to arrange for a full site demonstration. CSC may rely on manufacturer's test results for specific areas of the specification where an independent test facility has conducted the test, and the facility is deemed acceptable to CSC.

It is the supplier's responsibility to make new developments in products available to CSC for evaluation. Equipment qualification is an ongoing process and can be initiated at any time by a vendor. Any vendor can have access to the CSC specifications and standards. Any new development or products should be submitted to the CSC Engineering Services Division, Technical Authority in a suitable time frame prior to any tendering process to allow for an acceptable evaluation period. The evaluation period may take up to sixteen (16) months.

1.3 Equipment Procurement

Any ordering of equipment/material before the approval of the final design report will be undertaken at the contractor's own risk. The Design Authority may authorize the procurement of certain long lead items at, or shortly after the preliminary design review.

1.4 Quantity of Equipment

The quantity and location of the equipment required for CSC institutions will be contained in the specification identified in the STR.

2.0 **APPLICABLE DOCUMENTS**

CSC Specifications, Standards and STRs are approved by the Director of Engineering Services (DES) for the procurement and installation of all telecommunications and electronic security systems in all CSC facilities. These documents promulgate DES policy and shall not be modified or changed without prior consultation and approval of the Director. The documents of the issue in effect will form part of the Request for Proposal (RFP) issued by the contract authority.

3.0 **REQUIREMENTS**

3.1 The contractor shall:

- a. Design, procure or manufacture, install, test and document the installation of all electronic security and telecommunications systems in accordance with the CSC specifications, standards and STR;
- b. Provide the operator and maintenance training in accordance with the CSC requirements;
- c. Provide the maintenance support and spares in accordance with the CSC maintenance requirements;
- d. Provide quality assurance (QA) to ensure equipment performance and reliability are in accordance to CSC requirements;
- e. Provide warranty coverage to include spare parts provision and equipment repair;
- f. Provide a program schedule to show all major elements from a contract award to completion of the warranty period and shall include anticipated time of occurrence, interrelationships between events, and time scale; and
- g. Be responsible for the integration of the proposed system to any existing telecommunications and electronic security systems.
- h. Provide a lightning protection system for the installation of all electronic security systems/equipment in the CSC facilities. As a minimum, surge suppression type lightning arrestors shall be required for all power, communications and antenna cables/wires entering or leaving a building.

4.0 **SYSTEM DEVELOPMENT**

The contractor shall design systems and equipment to meet all of the requirements stipulated in the applicable CSC specifications. The system design shall be modular and address the following criteria:

- a. ease of operation and maintenance;
- b. optimize and concentrate control functions and capabilities;
- c. enhance the security of the working environment, extend staff capabilities to observe and control; and
- d. minimize the number and types of display and control devices.

4.1 **Preliminary Design**

The preliminary design baseline shall be established by the review and approval of the preliminary design report (PDR) by the Design Authority (DA) or his designate. Specifications, drawings and the approved PDR shall make up the preliminary design baseline.

The contractor shall prepare and submit two (2) copies of the PDR to the Design Authority and one (1) copy to the Contract Authority at least ten (10) days prior to the PDR meeting. The PDR shall consist of:

- a. performance specifications with functional block diagrams of the proposed system. The technical analysis and equipment performance data shall verify system requirements;
- b. preliminary equipment layouts including control consoles and racks;
- c. list of off-the-shelf equipment with part number, model number, manufacturer and the quantity of each item;
- d. list of custom designed equipment with model number and the quantity of each item;
- e. functional schematics for all custom designed equipment;
- f. conceptual drawings for all custom designed equipment;
- g. a proposed product assurance plan;
- h. a proposed maintenance plan;

- i. proposed sparing plan; and
- j. proposed training plan.

4.2 **Preliminary Design Review**

The PDR meeting shall be convened by the contractor to review the PDR contents. The contractor shall provide the venue and all of the necessary facilities. The Design Authority will identify any portions of the PDR that are not acceptable to CSC.

4.3 **Final Design**

The final design baseline shall be established by the review and approval of the Design Authority of the final design report (FDR). It establishes the start of change control in equipment design and performance. The FDR shall consist of:

- a. all elements of the preliminary design baseline;
- b. control console mockups, ergonomics considerations, etc., as necessary;
- c. drawings and operational descriptions for the custom designed equipment including interface specifications;
- d. Installation drawings and instructions; and
- e. availability model and analysis updates to reflect the final system design and hardware selection.

The FDR shall be prepared to good commercial practice. Two (2) copies shall be submitted to the Design Authority at least ten (10) working days before the FDR meeting.

4.4 **Final Design Review**

The final design review meeting shall be convened to review the contents of the FDR. The contractor shall provide the venue and all of the necessary facilities. All of the contractor's staff responsible for the system/equipment engineering shall be available.

4.5 **Design Change Control**

Design changes shall be in accordance with the following procedure:

- 4.5.1 **Type I.** Changes that affect cost, schedule, reliability, maintainability, or availability shall be submitted as a design change request (DCR).

Changes shall not be actioned until specifically directed in writing by the Design Authority through the Contract Authority.

- 4.5.2 **Type II.** Changes to correct a design error without affecting cost, schedule, reliability, maintainability, or availability shall not require a DCR.

Changes shall be reported to the Design Authority and the final design baseline shall be updated by the contractor. The Design Authority will review and acknowledge the change.

4.6 **Design Change Request (DCR)**

Type I changes shall be forwarded to the Design Authority through the Contract Authority on DCRs initiated by either the contractor or the Design Authority.

DCRs shall be reviewed and approved before implementation and shall include:

- a. specification requirement being effected;
- b. final design baseline element being changed;
- c. description of the design change;
- d. reason for the change;
- e. impact on cost, schedule, reliability, maintainability and availability; and
- f. trade-off recommendations.

4.7 **In-Plant Testing**

Details of in-plant tests are contained in the ES/SOW-0102, Statement of Work. In-plant tests shall be performed according to the Design Authority approved procedures.

Equipment with deficiencies as the result of the in-plant tests shall be subject to retest. The Design Authority reserves the right to add or modify tests.

5.0 **SYSTEM INSTALLATION**

The contractor shall be responsible for ensuring that sufficient site utilities are available. No work will be permitted at the site before the approval of the Design Authority. All installation activities shall be conducted in accordance with ES/SOW-0102, Statement of Work.

5.1 **Schedule**

The contractor shall provide a detailed work schedule for the installation activities. This schedule shall reflect the complete implementation plan by identifying the nature of the work to be performed and the area affected.

5.2 **On-Site Inspections**

Design Authority or an appointed CSC representative shall perform ongoing inspections of the contractor's activities. These inspections shall verify compliance with the project requirements, the quality of work performed and assess the contractor's progress in relation to the approved schedule. Installation deficiencies requiring corrective action will be brought immediately to the contractor's attention in writing.

5.3 **On-Site Coordination**

Design Authority shall be responsible for the appointment of an on-site CSC representative. This representative will handle all site related matters and will periodically inspect the installation.

When electronic system installations are part of a construction program or a major redevelopment that involves Public Works & Government Services of Canada, the electronic system installation contractor shall coordinate all activities with the relevant site manager and shall comply with this SOW.

5.4 **Facility Criteria**

The contractor shall provide the facility criteria data in the proposal. Details as to the power, cooling, space and/or other requirements relating to electronic security system installation at the site must be provided. Final facility criteria information must be provided as part of the FDR.

5.5 **Installation Design**

The system installation design and planning shall make maximum use of existing ducts, conduits, and other cable routing facilities. Where this is not possible, the contractor shall design and install facilities in a manner acceptable to the Design Authority.

5.6 Subcontractor Supervision

The contractor shall provide an on-site supervision of all subcontractors. The subcontractors shall abide by the regulations of this Statement of Work and the conditions in the contract.

5.7 System Checkout

Before conducting the formal on-site testing for the CSC acceptance, the contractor shall conduct and document a system checkout to assure the system readiness for formal testing and on-line operations. The test sheets used for the system checkout shall be signed by a company representative and provided to the Design Authority at least seven (7) days prior to the scheduled date of the Acceptance testing. The Design Authority will verify readiness through review of the checkout report. The report may be used as reference during the formal witnessed testing for acceptance.

5.8 As-Built Drawings

Thirty (30) days after the system installation acceptance, the contractor shall deliver a complete set of equipment and installation as-built drawings for Design Authority's review and approval. Within thirty (30) days after CSC approval, two (2) complete sets of revised drawings shall be delivered to the Design Authority.

The contractor shall update these drawings throughout the warranty period by the design control procedures. Within thirty (30) days of completion of the warranty period, the contractor shall deliver one (1) set of final revised drawings reflecting all changes to the Design Authority. Upon final CSC approval, the contractor shall deliver two (2) sets of original prints of the final drawings.

6.0 **SYSTEM ACCEPTANCE**

System acceptance shall occur when the acceptance testing has been completed according to the ES/SOW-0102, Statement of Work and when all of the other requirements of the contract have been completed to the satisfaction of the Design Authority. A final acceptance certificate signed by the Design Authority shall certify the system acceptance.

On-site system acceptance testing shall not begin until all of the on-site installation activities have been completed.

6.1 **Acceptance Test Plans (ATPs)**

The contractor shall provide ATPs for all system, subsystem and equipment tests for Design Authority review and approval. The requirements for the ATP are detailed in the ES/SOW-0102, Statement of Work.

6.2 **System Testing**

The contractor shall conduct the approved ATP and record the results. The Design Authority or an appointed CSC representative shall witness the tests.

6.3 **Deficiency Lists (DL)**

The contractor shall prepare and submit a list of deficiencies divided into three categories:

- a. Visual/Mechanical,
- b. Operational, and
- c. Technical/Functional.

6.4 **Technical Acceptance**

Upon verifying that all of the deficiencies have been corrected, the Design Authority shall issue a letter of Technical Acceptance.

7.0 **QUALITY ASSURANCE (QA)**

The QA program shall include quality control and system tests/verification programs to verify that new design and off-the-shelf equipment requirements have been met. System tests/verification will be conducted by the contractor in-plant and on-site, and may be witnessed by the CSC representatives where appropriate. The system shall pass all tests before approval will be given to commence the operator and maintenance training programs and warranty period.

7.1 **Quality Control Program**

The contractor shall provide a description of their internal quality control programs for CSC review and approval. CSC reserves the right to audit and verify that all materials destined for use in CSC systems have been thoroughly inspected and that QA procedures are applied during production and testing.

7.2 **System Test Program**

The contractor shall prepare and provide the documents describing: number, type and details of equipment, subsystem and system tests for CSC review and approval. These documents must be approved before any formal testing and will consist of the following:

7.2.1 **System Test Plan.**

This plan shall contain the test philosophy, the tests to be conducted, the pass-fail criteria, the retest requirements, and the instructions for the validation and the sign-off of all final design baseline requirements.

Before witnessing these tests, the CSC representative will perform a visual and mechanical inspection to ensure that the system installation meets the requirements of ES/SOW-0102, Statement of Work.

7.2.2 **Test Procedures.** These procedures shall ensure that:

- a. all equipment supplied meets the performance specification;
- b. each subsystem meets the applicable performance requirements; and
- c. the overall system meets the performance requirements.
- d. test procedure contains the step sequence for each test to be conducted, and the expected results.

7.2.3 **Contractor Testing.**

All tests are conducted by the contractor and may be witnessed by an appointed CSC representative. Tests are conducted as stipulated in the approved plan and procedures. The contractor shall inform CSC at least five (5) working days before the test start date.

7.2.4 **Test Reports.**

The contractor shall submit final copies of the test results for CSC review and approval within ten (10) working days of the completion of the testing. Two copies of the report shall be submitted and shall include:

- a. a summary description of the tests;
- b. test results consisting of completed test procedures verified by a CSC representative;
- c. incident reports, including analysis and corrective action; and
- d. results of any retest.

8.0 TRAINING

The contractor shall develop, document and conduct training for both the operational and the technical staff. The training shall be conducted on-site at the institution in the period designated by the schedule.

8.1 Classroom Training

Classroom lectures and demonstrations will be conducted on-site to train operations staff in the use and technical personnel in the maintenance of the systems.

8.2 Training Documentation

The contractor shall develop and deliver a complete training plan to the Design Authority for comments and approval. This plan must be submitted to CSC at least thirty (30) days in advance of the training date to allow for CSC review. As a minimum, the training material shall contain:

- a. training plans for CSC operations trainers and technical personnel;
- b. manuals for each student to add notes;
- c. training aids; and
- d. student materials.

Training material shall be provided in the language that is dominant at the site (French in Quebec). Sufficient copies of all student materials shall be provided by the contractor at the beginning of the training course to assure one copy for each student. CSC shall stipulate the number of staffs who are to be trained. Upon approval by the Design Authority, two (2) copies of all material shall be delivered to CSC.

9.0 **MAINTENANCE and SPARES**

The contractor shall provide maintenance and spares support plans according to the ES/SOW-0102, Statement of Work for the Design Authority approval. These plans shall be submitted according to the schedule.

9.1 **Maintenance Plan**

The maintenance plan shall describe the philosophy, the Preventive Maintenance (PM) procedures and schedules, the Corrective Maintenance (CM) methods and response times, Mean-Time-To-Repair (MTTR) for all systems. The plan shall recommend tools, jigs and test equipment, and detail the recommended manning method for the system. Issue of the final maintenance support plan will be contingent on Design Authority approval.

9.2 **Spares Plan**

The spares plan shall list the required spares and recommended quantities. The quantity recommendations shall be supported by system availability and reliability analysis and available experience data. The bidder shall identify spare parts and components by their original manufacturer's code, cross-referenced to the equipment vendor's part number.

9.3 **Spares List**

The spares list shall identify the following:

- a. the spare parts and the subassemblies with the recommended quantities;
- b. the cross-reference listings between the vendors and the original manufacturer's codes;
- c. the unit and extended prices for stocking; and
- d. the expected life or the annual consumption of each part.

The contractor shall maintain the spares plan through to the end of the warranty period, and shall ensure that any changes because of approved design changes are incorporated in the spares list.

9.4 **Test Equipment**

The contractor shall provide a list of test equipment required for the on-site maintenance of the system within thirty (30) days from Design Authority's acceptance of the final design.

10.0 **DOCUMENTATION**

All final documentation in hard-copy format shall be in a 3-ring binder with all foldout pages having reinforced ring holes.

10.1 **Manuals and Drawings**

The following items make up the final documentation requirements:

- a. Operator Manual,
- b. Maintenance Manual,
- c. Installation As-built Drawings,
- d. Equipment As-built Drawings, and
- e. Equipment Operating Software.

The contractor shall prepare and submit all manuals and drawings to the Design Authority for review and approval. The manuals and drawings will be approved when all changes have been satisfactorily incorporated. All drawings must be produced with AUTOCAD (latest available version)

10.2 **List of Equipment**

The contractor shall provide a list of equipment itemizing the location, quantity, model number, serial number and revision level of all installed equipment.

10.3 **Baseline Measurements**

The contractor shall provide a copy of the final test results. These results will be used as a reference baseline measurement for monitoring system degradation over time.

10.4 **Documentation Format**

All manuals, documentation including as-built drawings, lists of equipment and baseline measurements shall be submitted as per the following schedule:

- One (1) hard-copy version of all documentation.
- One (1) electronic version of all documentation in a 'read-only' format on a 3½ inch diskette medium; suitable for duplication without any special requirements.

- One (1) electronic version of all documentation in a full 'read-write' format to serve as a master of the documents and drawings.
- all software requirements to access the electronic versions of the documentation.
- One (1) CD containing the equipment operating software.

10.5 **Operator Manuals**

The contractor shall provide CSC approved manuals to support the operation of the system in the format as outlined in section 10.4 of this specification. These manuals shall be prepared to the best commercial standards. Photo copies shall not be accepted. All hard-copy versions shall be on paper stock 8 ½" x 11" and shall be presented in a 3-ring binder. The manuals shall comply with the following format and content requirements:

- a. title page;
- b. revision notice page, lined, with columns for revision numbers, dates and initials;
- c. table of contents;
- d. warnings and cautions;
- e. introduction - general information including a description of equipment or system and summary of capabilities;
- f. theory of operation including an explanation of all major system components;
- g. detailed description and use of all user accessible computer screens; and
- h. block diagrams.

A hard copy draft version of the manual(s) shall be submitted for CSC approval on or before the date given in the schedule. Upon acceptance and approval by the Design Authority, a total of two copies shall be provided for use during the warranty period. The contractor shall update these manuals through the warranty period and provide revision bulletins to record manufacturers' recommended modifications, etc. during the life of the equipment.

Within thirty (30) days of the warranty expiry date the contractor shall submit one (1) set of final, updated manuals for CSC approval. Following the final CSC approval, the required number of sets of operator manuals shall be delivered to the Design Authority in the format as specified in section 10.4 of this Statement of Work.

10.6 Maintenance Manuals

The contractor shall provide CSC approved manuals to support the maintenance of the system in the format as outlined in section 10.4 of this specification. These manuals shall be prepared to the best commercial standards. Photo copies shall not be accepted. All hard-copy versions shall be on paper stock 8 ½" x 11" and shall be presented in a 3-ring binder. The manuals shall comply with the following format and content requirements:

- a. title page;
- b. warranty page - explaining the warranty period and expiry dates;
- c. revision notice page, lined, with columns for revision numbers, dates and initials;
- d. table of contents;
- e. introduction - general information including a full description of equipment or system, technical summary, specifications and detailed block diagrams;
- f. theory of operation including a detailed explanation of all circuits and parts;
- g. alignment and test procedures;
- h. repair procedures including step by step fault finding or fault localizing;
- i. block diagrams;
- j. circuit schematics (clear, easy to read, foldout type);
- k. complete parts list;
- l. mechanical drawings, chassis layout illustrations and wiring data lists; and
- m. drawings including as-built and as-installed drawings.

A hard copy draft version of the manual(s) shall be submitted for CSC approval on or before the date given in the schedule. Upon acceptance and approval by the Design Authority, a total of two copies shall be provided for use during the warranty period. The contractor shall update these manuals through the warranty period and provide revision bulletins to record manufacturers' recommended modifications, etc. during the life of the equipment.

Within thirty (30) days of the warranty expiry date the contractor shall submit one (1) set of final, updated manuals for CSC approval. Following the final CSC approval, the required number of sets of maintenance manuals shall be delivered to the Design Authority in the format as specified in section 10.4 of this Statement of Work.

11.0 PROJECT PROVISIONS

11.1 Monthly Progress Reports

The contractor shall submit monthly progress reports. These reports shall report the activities for the previous period. One (1) copy shall be delivered to the Design Authority and one (1) copy to the Contract Authority by the fifth (5th) day of each month. A review meeting may be required.

Monthly reports shall contain the following:

- a. summary of the month's activities;
- b. scheduled shortfalls and rescheduled dates;
- c. problem areas and proposed solutions;
- d. review of next month's activities;
- e. summary of meetings held during the month; and
- f. cash flow forecast.

11.2 Monthly Review Meetings

Review meetings shall be held at the contractor's premises, Design Authority's office, Contract Authority's office, or the site depending on the need. The contractor shall make the design staff members available upon request by the Design Authority.

11.3 Maintenance Support

During the training period, the contractor shall provide maintenance support. This support is expected to be not less than on-site coverage during the normal working day.

11.4 **Shipment and Delivery**

Contractor shall be responsible for the shipment and delivery of equipment and materials to the site. Packing, crating, and shipment of equipment shall be to good commercial practice, and any damage to, or loss of equipment shall be repaired or replaced to the satisfaction of CSC. The contractor must properly label all shipments to assure correct identification and disposition on arrival at the site, as specified in ES/SOW-0102, Statement of Work.

12.0 **SYSTEM AVAILABILITY**

All elements of customed and off-the-shelf equipment shall be designed to operate in a highly reliable fashion, consistent with available technology, with a minimum of system downtime due to scheduled and unscheduled maintenance. System availability will be achieved when each of the included subsystems availabilities have been proved as required.

12.1 **Common Facilities**

Where units or subsystems are integrated into common facilities no single failure of a component, assembly subassembly, or subsystem shall result in the failure of any other subsystem; nor result in reduced capacity or quality of performance of other subsystems or parts of it.

12.2 **Single Point of Failure**

The system shall be designed such that no failure of a single component, unit, subassembly or subsystem will result in failure of the next higher hierarchical elements of that subsystem or the system.

12.3 **Availability Model**

The bidder's technical proposal shall include a complete model and analysis of the availability of each subsystem and of the complete system being offered. This analysis shall include both MTBF and MTTR calculations and shall treat the Mean-Response-Time (MRT) as zero. This availability analysis may be based on either:

- a. summation of failure rates of the individual components; or
- b. the bidder's documented experience with the same equipment operating in a similar physical environment.

In either case, the source of all failure-rate shall be clearly shown.

The contractor shall maintain the availability model and analysis up-to-date throughout the contract period. A statement of impact of the proposed change would have on the availability model and analysis shall be submitted with all Type I DCRs.

12.4 **Availability**

Availability is the probability that the system, or subsystem will meet operational performance requirements at all time. Time includes the operating time, the active repair time and the administrative and logistic time. To calculate this availability, the contractor must include all of the pertinent factors such as:

12.4.1 **Mean Time Between Failure (MTBF).**

The total operating time of the equipment divided by the total number of failures of that equipment.

12.4.2 **Mean Time To Repair (MTTR).**

The repair time divided by the number of failures.

12.4.3 **Mean Response Time (MRT).**

The time to respond to a call for service divided by the number of calls.

12.5 **Expected Life Duration**

This is the time during which the equipment is expected to provide useful service, without an unusual amount of service and without becoming obsolete.

13.0 INTERFERENCE

13.1 Interference to the System

Performance of the system shall not be affected by the use of standard electronic equipment used at the institution. Distance limits of standard electronic equipment are as follows:

13.1.1 CB transceivers at 1 metre or more;

13.1.2 VHF and UHF transceivers at 1 metre or more;

13.1.3 Other radio frequency transmitting, receiving and re-distribution equipment at 5 metres or more;
and

13.1.4 Personal computer and/or computer work stations at 5 metres or more.

13.2 Interference by the System

The system shall not interfere with any standard electronic equipment used at the institution, any commercial TV or radio equipment at a minimum distance of 5 metres, or any other electronic security systems at a distance of 1 metre or more.

14.0 **LIGHTNING PROTECTION**

Surge suppression-type lightning arrestors shall be installed to protect all power, communications and antenna cables or wires entering or leaving a building.

These arrestors must be installed where the cable enters the building i.e. not in the CER or other equipment room.