



Public Services and Procurement Canada

Requisition No. _____

DRAWINGS & SPECIFICATIONS
for

Matsqui Institution, Building M 4 & 5
Finish Kitchen Floor Finish and
Piping Replacement

Project No. : R106227.001

APPROVED BY:

| | |
|---------------------------------|-------|
| _____ | _____ |
| Regional Manager, AES | Date |
| _____ | _____ |
| Construction Safety Coordinator | Date |

TENDER:

| | |
|-----------------|-------|
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| Project Manager | Date |

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PART 1 GENERAL

1.1 SUMMARY OF WORK

- .1 Work covered by Contract Documents:
 - .1 This Contract covers the following work at the Matsqui Institution, Abbotsford, BC:
 - .1 Provide temporary rental of mobile kitchen for use by the Institution to provide food service during construction. Including delivery, propane fuel, temporary services, setup and installation, maintenance during construction and decommissioning and return at the end of the project, and related fixtures as shown on the attached drawings and specified.
 - .2 Provide temporary stairs and ramps for access to the mobile kitchen and serving areas as indicated on the documents. Includes delivery, assembly, maintenance during construction and disassembly and return upon construction completion.
 - .3 Demolish section of exterior wall and window to provide temporary service access during construction. Maintain opening during construction and restore wall, provide new window and security screen at the end of the project, as described in the documents.
 - .4 Replace portion of floor finishes in the existing kitchen in a two phased process, includes temporary disconnection and removal and storage of all equipment, as shown on the attached drawings. Provide temporary hoarding during phased construction work.
 - .5 Replace piping of water and sanitary plumbing system, including valves and fittings, provide temporary services for mobile kitchen, provide new mixing valves for fixtures, to extent as shown on the attached drawings. Document final piping layout.
 - .2 Additional 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 plumbing services; and provide a 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 Part 1.11 Temporary Barriers and Enclosures.
- .5 Security Requirements: refer to Section 01 14 10 - Security Requirements.
- .6 Hours of work:
 - .1 Perform work during normal working hours of the Institution 0730 to 1600, Monday through Friday except holidays.
 - .2 When it is necessary, arrange in advance with Departmental Representative to work outside of normal working hours.

1.3 CONSTRUCTION WORK SCHEDULE

- .1 Commence work immediately upon official notification of acceptance of offer, and reach Substantial Performance of the Work and Closeout within eighteen (18) work weeks from the date of such notification. All work indicated must be fully installed and operational before the inspection of approval by the Departmental Representative.
- .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.

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- .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 Public Works and Government Services Canada (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.

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- .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.
 - .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.

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- .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 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 Health and Safety Requirements.

1.6 ENVIRONMENTAL PROCEDURES

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

1.7 REGULATORY REQUIREMENTS

- .1 References and Codes:
 - .1 Perform Work in accordance with National Building Code of Canada (NBCC2015) and where applicable British Columbia Building Code (BCBC2018) including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.8 QUALITY CONTROL

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

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- .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:
 - .1 Refer to Section 02 81 01 Hazardous Materials and Abatement for air quality sampling test requirements.
 - .2 Furnish test results as may be requested.
 - .7 Test Certificates:
 - .1 Submit test certificates as requested and as required of specification Sections.
 - .8 Equipment and Systems:
 - .1 Submit adjustment and test reports for plumbing systems.
 - .2 Refer to specific Section for definitive requirements.

1.9 TEMPORARY UTILITIES

- .1 Installation and Removal:
 - .1 Provide temporary utilities controls in order to execute work expeditiously.
 - .2 Remove from site all such work after use.
- .2 Water Supply:
 - .1 Existing water supply system may be used for construction requirements, provided that guarantees and existing functions are not affected thereby. Replace damaged components.
 - .2 Provide and maintain temporary water connection to the kitchen trailer throughout project.
- .3 Temporary sanitary connection:
 - .1 Provide and maintain temporary sanitary connection for the kitchen trailer throughout project.
- .4 Temporary propane supply:
 - .1 Provide and maintain temporary propane supply (tank) and connection to the kitchen trailer throughout project.

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- .5 Temporary Ventilation:
 - .1 Provide temporary ventilation in enclosed areas as required to provide adequate ventilation to meet health regulations for safe working environment and to prevent unpleasant odour from reaching the adjacent areas.
 - .6 Temporary Power and Light:
 - .1 Existing electrical power and lighting may be used for construction purposes at no extra cost, provided that guarantees and existing functions are not affected thereby, and electrical components used for temporary power are replaced when damaged.
 - .2 Provide and maintain temporary power connection to the kitchen trailer throughout project.
 - .7 Temporary Communication Facilities:
 - .1 Provide and pay for temporary cellular phone(s) necessary for own use.
 - .2 Refer to Section 01 14 10 Security Requirements for additional communication system limitations within a Correctional Institution.
 - .8 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.

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- .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 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 Facility:
 - .1 Inmate Change/Washroom, Room #164, may be used on approval of Departmental Representative. Maintain facility to Institution standard and replenish supplies to full capacities. Replace any damaged equipment.

1.11 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Exterior Hoarding:
 - .1 Erect temporary site enclosure using new 1.8 m high temporary construction fencing. Provide lockable truck gate. Maintain fence in good repair.
- .2 Enclosure of Structure:
 - .1 Provide temporary weathertight enclosures and protection for exterior openings until permanently enclosed. Design enclosures to withstand wind pressure. Provide lockable entry as required for moving personnel equipment and materials.
 - .2 Provide temporary enclosures to secure building from entry of unauthorized personnel during construction period.
- .3 Interior Hoarding:
 - .1 Erect temporary enclosures using 38 x 152 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm plywood to one side and a polyethylene vapour barrier film on the other side.
 - .2 Apply plywood panels flush and butt jointed.
 - .3 Apply joint sealing adhesive tapes to vapour barrier to create perimeter and lap joint seals, to maintain barrier continuity.
 - .3 Protect from damage by equipment and construction procedures.
- .4 Guardrails and barriers:
 - .1 Provide secure, rigid guard rails, hand rails and barricades around deep excavations, open edges of floors, and stair wells etc.
 - .2 Provide as required by governing authorities.

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- .5 Dust Tight Barriers
 - .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and people.
 - .2 Maintain and relocate protection until such work is complete.
 - .6 Access to Site:
 - .1 Maintain immediate local access roads in clean condition used during work of this contract.
 - .7 Protection for Off-Site and CSC Property:
 - .1 Protect surrounding CSC property from damage during performance of Work.
 - .2 Be responsible for damage incurred.
 - .8 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 minimum three (3) working 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.

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- .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.
 - .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.

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- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
 - .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.
 - .7 Co-ordination:
 - .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
 - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
 - 8 Concealment:
 - .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
 - .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.
 - .9 Remedial Work:
 - .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
 - .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner neither to damage nor to put at risk any portion of Work.
 - .10 Location of Fixtures:
 - .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
 - .2 Inform Departmental Representative of conflicting installation. Install as directed.
 - .3 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.
 - .11 Fastenings:
 - .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
 - .2 Prevent electrolytic action between dissimilar metals and materials.
 - .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
 - .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
 - .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
 - .6 All exposed fasteners to have security/tamper-proof heads.
 - .7 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

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- .12 Fastenings - Equipment:
- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
 - .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
 - .3 Bolts may not project more than one diameter beyond nuts.
 - .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.
- .13 Protection of Work in Progress:
- .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.
- .14 Existing Utilities:
- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.
 - .2 Before commencing work, establish location and extent of service lines in areas of work and notify Departmental Representative of findings.
 - .3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
 - .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
 - .5 Record locations of maintained, capped and re-routed services lines.
- .15 Contractors Options for Selection of Products:
- .1 Products specified by "**Prescriptive**" specifications: select any product meeting or exceeding specifications.
 - .2 Products specified under "**Acceptable Products**" (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.

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- .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.

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- .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.

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- .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.

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- .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 Operation of systems have been demonstrated to Departments personnel.
 - .5 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.

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- .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;

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- .2 Include identifications and instructions on intended use of tools.
 - .6 Spare parts:
 - .1 Assemble parts as specified;
 - .2 Include part number, identification of equipment or system for which parts are applicable;
 - .3 Installation instructions;
 - .4 Name and address of nearest supplier.
 - .4 Warranties and Bonds:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing in maintenance manual.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
 - .4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Interim Completion is determined.
 - .5 Verify that documents are in proper form, contain full information, and are notarized.
 - .6 Retain warranties and bonds until time specified for submittal.

1.19 DEMONSTRATION AND TRAINING

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

1.20 GENERAL COMMISSIONING

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

END OF SECTION

PART 1 GENERAL

1.1 Purpose

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

1.2 Purpose

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
 - .3 an explosive or a bomb or a component thereof,
 - .4 currency over any applicable prescribed limit, \$25.00, and
 - .5 any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 Unauthorized smoking and related Items@ means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, and 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 Gate Pass application 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 Division.
- .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 Division 1.
- .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 Use standard construction cylinders for locks for this 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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.

1.17 Access and Removal from Institution Property

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

1.18 Movement Vehicles

- .1 Construction vehicles are not to leave the Institution until an inmate count is completed. Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:
 - .1 AM: 0745 hrs. to 1100 hrs.
 - .2 PM: 1300 hrs. 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.

1.19 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.

1.20 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.

1.21 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.

1.22 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.

1.23 Completion of Construction Project

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

END OF SECTION

Part 1 General

1.1 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 Use Letters of Assurance, Schedule S-B & S-C, 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 04 22 00 – Concrete Unit Masonry
- .2 Section 05 50 00 – Metal Fabrications
- .3 Section 08 11 16 – Aluminum Frames
- .4 Section 13 34 00 – Mobile Kitchen

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 metal furniture).

- .4 Cost of delegated design shall be included in the contract price.

Part 2 Products

2.1 LETTERS OF ASSURANCE

- .1 Submit a signed and sealed Schedule S-B addressed to Professional of Record, prior to starting Work requiring design and seal of a professional engineer.
- .2 Submit a signed and sealed Schedule S-C addressed to Professional of Record, on completion of Work requiring design and seal of a professional engineer.

Part 3 Execution

3.1 IMPLEMENTATION

- .1 Include summary of Work as a part of the required Letters of Assurance.
- .2 Prepare required submittals and present to Consultant within sufficient time to allow for Consultant's detailed review and acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 Government of Canada.
 - .1 Canada Labour Code - Part II (as amended).
 - .2 Canada Occupational Health and Safety Regulations (as amended).
- .2 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 The Canadian Electrical Code (as amended).
- .4 Canadian Standards Association (CSA) as amended:
 - .1 CSA Z797-2009 Code of Practice for Access Scaffold
 - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
 - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
 - .4 CSA Z1006-10 Management of Work in Confined Spaces.
 - .5 CSA Z462- Workplace Electrical Safety Standard.
- .5 National Fire Code of Canada 2010 (as amended)
 - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
- .6 American National Standards Institute (ANSI): (as amended)
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .7 Province of British Columbia:
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety (as amended).
 - .2 Occupational Health and Safety Regulation (as amended)
- .8 Appendix:
 - .1 Hazardous Building Materials Assessment, prepared by DST Consulting Engineers Inc., dated December 11, 2019

1.2 Related Sections

1. Section 01 01 50 - General Instructions
2. Section 02 07 50 – Cutting and Patching
3. Section 02 44 99 – Demolition of Minor Works
4. Section 02 81 01 – Hazardous Materials and Abatement

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.
- .3 Contractor to include COVID-19 Protocols and Procedures, in alignment with Provincial and Federal requirements, in the Health and Safety Plan submittal for Departmental Representative approval.

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. Organizations Health and Safety Plan.
 2. Site Specific Safety Plan or Health and Safety Plan (SSSP or HASP), including Asbestos Exposure Control Plan, Silica & Rock Dust Exposure Control Plan, TVOC Control Plan, Crawl Space Safety Plan, and COVID-19 Protocols and Procedures.
 3. Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 4. Copies of incident and accident reports.
 5. Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 6. Project-specific Hazardous Material Exposure Control Plan, in accordance with Section 02 81 01 – Hazardous Material and Abatement.
 7. Emergency Response Procedures.
- .4 The Departmental Representative will review the Contractor's Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP) and emergency response 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 Safety Plan or Health and Safety Plan, Hazardous Materials Exposure Control Plans, and any revised versions, 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.
- .7 Submit final air quality report for the indicated material.

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. Provide staff with required safety training and protective equipment, including the ones for entering and working in asbestos and silica exposure control, and in conformance with COVID-19 Protocols and Procedures.
4. 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 Assign a competent and qualified Health and Safety Coordinator who shall:
 - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
 - .2 Be responsible for implementing, daily enforcing, and monitoring the Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP).
 - .3 Be on site during execution of work.
 - .4 Have minimum two (2) years of site-related working experience.
 - .5 Have working knowledge of the applicable occupational safety and health regulations.

1.8 General Conditions

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

1.9 Project/Site Conditions

- .1 Work at site will involve contact with:

- .1 Multi-employer work site.
- .2 Federal employees and general public.
- .3 Energized electrical services.
- .4 Working from heights.
- .5 Persons incarcerated in the federal institutional system.
- .6 Hazards - Hazardous Building Materials Assessment included as an Appendix to Specifications

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 specialty permit related to project before start of work.

1.13 Filing of Notice

- .1 The General Contractor is to file Notice of Project with Provincial authorities prior to commencement of work. (All construction projects require a Notice of Work)
- .2 Provide copies of all notices to the Departmental Representative.

1.14 Site Specific Health and Safety Plan

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards. Assessment to include review of crawl space and identify its hazard level.
- .2 Prepare and comply with the Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP) based on the required 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.
 - .11 COVID-19 Protocols and 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 Summary of crawl space hazard level and the protocols and procedures necessary to work in it.
 - .4 List hazardous materials to be brought on site as required by work.
 - .5 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .6 Identify personal protective equipment (PPE) to be used by workers.
 - .7 Identify personnel and alternates responsible for site safety and health.
 - .8 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 Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP) as required, and re-submit to the Departmental Representative.
 - .5 Departmental Representative's review: the review of Site Specific Safety Plan and/or Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Safety Plan and/or 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.
 - .5 A route map with written directions to the nearest hospital or medical clinic.
- .2 Include the following provisions in the emergency procedures:

- .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
- .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.
- .6 Contractors must not rely solely upon 911 for emergency rescue in a confined space, working at heights, etc.

1.16 Hazardous Products

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS, current edition) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 01 50.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
 - .3 Provide adequate means of ventilation in accordance with Section 01 51 00 and Section 02 81 01.
 - .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 Federal and Provincial Regulations.
2. Submit Exposure Control Plan in accordance with Section 02 81 01 – Hazardous Materials and Abatement.
3. Coordinate with Client's air sampling procedures in accordance with Section 02 81 01.
4. Removal and handling of asbestos will be performed in accordance with Section 02 81 01.
5. Submit final air quality report to Departmental Representative.

1.18 PCB Removals

- .1 Removal, handling, or disposal of PCB-containing equipment is not anticipated to be required during the Work.

1.19 Removal of Lead-Containing Paint

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition activities involving lead-containing paints in accordance with applicable provincial regulations.
- .3 Work with lead containing paints shall be completed as per provincial and federal regulations.
- .4 Dry Scraping/Sanding of any materials containing lead is strictly prohibited.
- .5 The use of Methylene Chloride based paint removal products is strictly prohibited.

1.20 Silica Exposure Control

- .1 If silica-containing materials are to be disturbed, control exposure of respirable crystalline silica and rock dust in compliance with Provincial regulations and with Section 02 81 01.
- .2 Submit Exposure Control Plan in accordance with Section 02 81 01 – Hazardous Materials and Abatement.
- .3 Coordinate with Client's air sampling procedures in accordance with Section 02 81 01.

1.21 Volatile Organic Compounds

1. Resinous flooring product may emit volatile organic compounds.
2. Submit Exposure Control Plan in accordance with Section 02 81 01 – Hazardous Materials and Abatement.
3. Coordinate with Client's air sampling procedures in accordance with Section 02 81 01.
4. Submit final air quality report to Departmental Representative.

1.22 Electrical Safety Requirements

(Reference: Worksafe BC OHS Regulation Part 19 – Electrical Safety)

- .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.

1.23 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.

1.24 Overloading

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

1.25 Falsework

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

1.26 Scaffolding

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

1.27 Confined Spaces

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

1.28 Power-Actuated Devices

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

1.29 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.

1.30 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 (as amended).
- .3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the Departmental Representative is required prior to any gas or diesel tank being brought onto the work site.

1.31 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.

1.32 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.

1.33 Posted Documents

- .1 Post legible versions of the following documents on site:
 - .1 Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP).
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans. Must be posted in an area not accessible by inmates and locked up when not being used.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS, current edition) 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.
- .11 All Hazardous Material and Substance Reports including Lab Analysis.
- .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.

1.34 Meetings

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

1.35 Correction of Non-Compliance

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

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 33 – Health and Safety Requirements
- .2 Section 02 41 99 – Demolition for Minor Works
- .3 Section 02 81 01 – Hazardous Materials and Abatement
- .4 Section 04 22 00 – Concrete Unit Masonry
- .5 Section 07 84 00 – Firestopping and Smoke seals
- .6 Section 07 92 00 – Sealants
- .7 Section 09 69 00 – Resinous Flooring

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.

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- .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.
- .3 Exposed gaps on surfaces or between fixture and walls: use pick-proof security sealant as per Section 07 92 00.

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 GPR 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.

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- .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 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 81 01 – Hazardous Materials and Abatement
- .3 Section 09 67 23 – Resinous Flooring
- .4 Division 22 – Plumbing

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 continual occupancy of existing building. The existing building will be occupied and operational by the Institution during work of this Contract.
 - .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 in the Institution, 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:

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- .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 tipping.
 - .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.

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- .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: <ul style="list-style-type: none">.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: <ul style="list-style-type: none">.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.

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- .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 or 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.

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- .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.

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- .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

Part 1 GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing the following work:
 - .1 Removal of existing pipe wraps in crawl space.
 - .2 Cutting of existing concrete walls and blocks, and provide air monitoring for silica.
 - .3 Removal of existing window caulking.
 - .4 Application of new resinous flooring and air monitoring for Total Volatile Organic Compounds (TVOCs).

1.2 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions, Part 1.4 Submittal Procedures
- .2 Section 03 53 33 – Health and Safety Requirements
- .3 Section 02 07 50 – Cutting and Patching
- .4 Section 02 41 99 – Demolition for Minor Works
- .5 Section 09 67 23 – Resinous Flooring

1.3 REFERENCES

- .1 Reports:
 - .1 “Hazardous Building Materials Assessment, Building “M4” Mechanical Systems / Flooring Upgrade Matsqui Institution, Abbotsford, BC”, prepared by DST Consulting Engineers Inc., dated December 11, 2019. (further referred to herein as the Assessment Report) – Attached in the Appendix of the Project Specifications.
- .2 Definitions:
 - .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
 - .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
 - .3 Hazardous waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
 - .4 Hazardous Building Material: component of a building or structure that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when altered, disturbed or removed during maintenance, renovation or demolition.
 - .5 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
 - .6 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

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- .7 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.
 - .8 Friable material: means materials that:
 - .1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
 - .2 Is crumbled, pulverized or powdered.
 - .9 Non-Firable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
 - .10 Airlock: system for permitting ingress or egress without permitting air movement between work area and adjacent areas.
 - .11 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as:
 - .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
 - .2 Reinforce free edges pf polyethylene with duct tape and weight bottom edge to ensure proper closing.
 - .3 Overlap each polyethylene sheet at openings not less than 1.5m on each side.
 - .12 DOP test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) or other test agent HEPA-filter leak test,
 - .13 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges air directly outside work area to exterior of building.
 - .14 Differential Pressure Recorder: Instrument to monitor and record the differential pressure between the Work Area and Clean Areas.
 - .1 Sensitivity: 0.025 mm (0.001 inches) WC increments between +0.25 mm to -0.25 mm (+0.010 to 0.100 inches) WC.
 - .2 Accuracy: +/- 1%.
 - .3 Pressure alarms: audible high and low level alarm programmable within operating range.
 - .4 Printout: minimum 24 hr period at 15 minute intervals.
 - .15 Authorized Visitors: Departmental Representative or designated representative.
 - .16 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.
 - .17 Departmental Representative: an organization or individual retained by the Client to aid in project oversight on the Client's behalf, receive and review project submittals and conduct activities as described below.
 - .18 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation.

1.4 REFERENCE STANDARDS

- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999)

- .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
- .2 Department of Justice Canada
 - .1 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).
 - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 WorkSafe BC
 - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work).
 - .2 "Safe Work Practices for Handling Asbestos" (2012)
 - .3 Developing a Silica Exposure Control Plan.
- .5 British Columbia Hazardous Waste Regulation (BC Reg. 63/88).

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 – General Instructions, Part 1.4 Submittal Procedures.
- .2 Product Data for hazardous materials to be used by the Contractor to complete the Work:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
 - .3 Submit site specific Exposure Control Plans (ECPs), including, but not limited to, asbestos-containing materials (ACMs), silica, and resinous flooring/TVOCs, to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements. The ECPs must include all measures for the control of ACMs during material removal, airborne dust and silica during concrete cutting, and the control of vapours/odours during the application of the resinous flooring.
 - .4 Construction/Demolition Waste Management:
 - .1 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentage of construction/demolition wastes were recycled or salvaged
 - .5 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.
 - .6 Provide proof of Contractor's General and Environmental Liability Insurance.
- .3 Removal of Asbestos-Containing Materials (ACMs) is to be conducted in accordance with the requirements of the 2012 WorkSafe BC publication "Safe Work Practices for Handling Asbestos".

- .1 Submit Provincial and/or local requirements for Notice of Project Form to Department Representative.
 - .2 Submit Contractor's Notification and Acknowledgement to Department Representative.
 - .3 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.
 - .4 Submit to Departmental Representative the necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
 - .5 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
 - .6 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested with respirator that is personally issued.
- .4 Submit proof that all asbestos, silica, and TVOCs workers and/or supervisor have received appropriate training and education by a competent person in the hazards of material exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Refer to additional information in Part 1.7 PERSONNEL TRAINING below.
 - .5 Submit final air quality report to Departmental Representative. Refer to Part 3.1 HAZARDOUS MATERIALS ABATEMENT below for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, and store materials in accordance with manufacturer's written instructions.
- .2 Deliver containers and packaging to site in original factory packaging, labelled and sealed with manufacturer's name and address.
- .3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials to be used by the Contractor to complete the Work with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
 - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

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- .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
 - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
 - .7 Solvents or cleaning agents must be non-flammable or have flash point above 38°C.
 - .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
 - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
 - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
 - .11 When hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Departmental Representative.
 - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

- .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
- .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
- .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
- .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
- .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.7 PERSONNEL TRAINING

- .1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos and silica exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, as a minimum:
 - .1 Proper fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions Part 1.16 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 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness [6] mils bags or leak proof drums. Label containers with appropriate warning labels.
- .6 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.9 EXISTING CONDITIONS

- .1 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending written instructions from Departmental Representative.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 The Contractor shall provide all equipment and materials necessary to complete the work as outlined in this section.
- .2 All equipment used shall be maintained in good condition and suitable for the task.
- .3 Electrical equipment shall be CSA approved and properly grounded using ground fault panels.
- .4 Bring on site only quantities hazardous material required to perform Work.
- .5 Provide product data and MSDS' for any chemical products proposed for use to the Departmental Representative for review and approval.

Part 3 EXECUTION

3.1 HAZARDOUS MATERIALS ABATEMENT

- .1 Scope of Abatement Activities:
 - .1 Abatement shall be conducted to handle, alter, remove and/or dispose of hazardous building materials as identified in the Assessment Reports in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such identified hazardous building materials will be impacted (handled, altered, damaged, removed) by the Work.
 - .2 Contractor is responsible for reviewing plans, specifications and reports such that they understand the locations and amounts of hazardous materials that will be impacted by the Work of this contract, and such that appropriate plans and budgets can be included in their overall bids.
 - .3 For preparation of the asbestos abatement Work:
 - .1 Isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.
 - .1 Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.
 - .2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
 - .3 Do not use compressed air to clean up or remove dust from any surface.
 - .2 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
 - .4 For preparation of the Total volatile organic compounds (TVOCs) Work:
 - .1 Remove and store items to be salvaged or reused.

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- .2 Protect and wrap items and transport to an area specified by the Departmental Representative.
 - .3 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
 - .4 Pre-clean fixed casework and equipment within Work Area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
 - .5 Seal off openings with polyethylene sheeting and seal with tape.
 - .6 Protect all surfaces with polyethylene sheets.
 - .7 Install HEPA filter/fan units and establish negative pressure differential. All filter/fan units are to be exhausted directly outdoors.
 - .8 All electrical equipment must be intrinsically safe that does not present a fire or explosion hazard when used in an environment containing airborne VOC vapours.
 - .9 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
 - .10 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with CSA Standard.
- .5 Do not start work until:
 - .1 Arrangements have been made for disposal of waste.
 - .2 Tools, equipment, and materials waste containers are on site.
 - .3 Notifications have been completed and preparatory steps have been taken.
 - .4 The Departmental Representative has reviewed the Work Area enclosure and provided approval to proceed.
 - .6 The listing below is a summary of the identified hazardous building material categories and associated handling, removal and disposal regulations, guidelines and/or standards.
 - .1 Asbestos-Containing Materials (ACMs)
 - .1 According to the Assessment Report, the following ACMs are present, and will require removal if the contract documents shown to remove the associated fixtures, prior to renovation.
 - .1 Insulation within crawlspace pipe elbows and mastic within crawlspace pipe insulation.
 - .2 Tar paper jacketing over pipes throughout.
 - .3 Packing material on pipe elbows within crawlspace.
 - .4 Caulking on the window panes.
 - .2 Removal of ACMs is to be conducted in accordance with the requirements of the 2012 WorkSafe BC publication "Safe Work Practices for Handling Asbestos". Refer to Part 1.5 ACTION AND ACTION AND INFORMATIONAL SUBMITTALS above for required submittals.
 - .3 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

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- .1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
 - .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.
 - .4 Eating or drinking are not permitted in Asbestos Work Area.
 - .5 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
 - .6 The Contractor is responsible for setting up facilities for washing hands and face, within or close to the Asbestos Work Area. Coordinate exact locations with Departmental Representative
 - .7 Ensure workers wash hands and face when leaving Asbestos Work Area.
 - .8 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

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- .9 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.
 - .1 Use garden reservoir type low - velocity fine - mist sprayer.
 - .2 Perform Work to reduce dust creation to lowest levels practicable.
 - .3 Work will be subject to visual inspection and air monitoring.
 - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
 - .10 Frequently and at regular intervals during Work and immediately on completion of work:
 - .1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and
 - .2 Drop sheets to be wetted and placed in a waste container as soon as practicable.
 - .11 Coordinate with Client's air quality sampling efforts:
 - .1 Background samples will be collected prior to the start of the asbestos removal activities. The samples will be transported to a laboratory for asbestos analysis.
 - .2 Daily, ambient air samples will be collected for the duration of the removal of asbestos. The samples will be transported to the same laboratory for asbestos analysis. The laboratory would generate a report within 24 hours from receiving the sample.
 - .3 If laboratory result shows that the areas outside Asbestos Work Area enclosure are contaminated, the Contractor shall immediately enclose, maintain, and clean these areas in same matter as that applicable to Asbestos Work Area.
 - .4 Ensure that respiratory safety factors are not exceeded.
 - .12 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.
 - .13 Notify Departmental Representative of suspected ACM discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.
 - .14 Provide final air quality report to Departmental Representative.
 - .2 Lead and Lead-Containing Paints (LCPs)
 - .1 Removal, alteration and/or disposal of LCPs is not anticipated to be required during the Work.
 - .3 Ozone-Depleting Substances (ODSs)

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- .1 Removal and/or disposal of refrigeration or air conditioning equipment with ODS refrigerants is not anticipated to be required.
 - .4 Mercury
 - .1 Removal, alteration and/or disposal of mercury-containing equipment is not anticipated to be required.
 - .5 Polychlorinated Biphenyls (PCBs)
 - .1 Removal, alteration and/or disposal of PCB-containing equipment is not anticipated to be required during the Work.
 - .6 Mould
 - .1 Removal and/or disposal of mould-impacted materials is not anticipated to be required.
 - .7 Animal Wastes
 - .1 Removal and/or disposal of animal waste is not anticipated to be required.
 - .8 Silica
 - .1 According to Assessment Report, silica is assumed to be present in concrete foundations, walls, floor, cinderblocks, ceramic tiles, grouts, and mortars.
 - .2 The Contractor shall prepare and submit a silica ECP to the Departmental Representative for review and approval. Refer to Part 1.5 ACTION AND ACTION AND INFORMATIONAL SUBMITTALS above for additional requirements.
 - .3 If silica-containing materials are to be disturbed during renovation, ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by BC Reg. 296/97 (Cristobalite and Quartz – each 0.025 mg/m³). This would include, but not be limited to, the following:
 - .1 Providing workers with respiratory protection
 - .2 Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
 - .3 Providing workers with facilities to properly wash prior to exiting the work area.
 - .4 Work Area Air Sampling: The Client may choose to collect air samples to for Silica. Background samples may be collected prior to the start of the silica construction activities. Daily, ambient air samples may be collected for the duration of the silica-containing work. The samples would be sent to the same laboratory for silica analysis. The turnaround time for the silica analyses will be 24 hours. If the reports indicate Silica level exceeds the allowable limit, the Contractor shall take immediate action to reduce the airborne levels of silica.
 - .9 Total volatile organic compounds (TVOCs)
 - .1 TVOCs Sampling – Work Area: In addition to the Work Area Preparation indicated above, the Contractor shall coordinate with Client’s air sample collection efforts to measure total volatile

organic compounds (TVOCs). Sampling will be conducted at the end of working hours during the application of the new resinous flooring as follows:

- .1 Monitoring instrument will be set up in a pre-determined location outside of the work area adjacent to the temporary construction barrier specified under Section 01 01 50 for continuous monitoring. A second unit will also be used to take spot readings at various locations outside the Work Area.
- .2 At 60 minutes prior to the end of working hours of the resinous flooring completion, the monitor will be switched on. The monitor will be left in the data-logging mode until the completion of the work.
- .3 TVOCs data will be reviewed on a regular basis each day. A guideline Action Level of 5,000 parts per billion (ppb) will be used for the comparison of the TVOCs results.
- .4 If TVOCs levels exceed 5,000 ppb outside the Work Area at any time, the Contractor shall take all necessary steps to reduce the TVOCs levels to an acceptable level.
- .5 Provide final air quality report to Departmental Representative.

.10 Inspection

- .1 Perform inspection to confirm compliance with specification. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to the Owner.
- .2 Departmental Representative will inspect work for:
 - .1 Adherence to specific procedures and materials.
 - .2 Final cleanliness and completion.
 - .3 No additional costs will be allowed by the Contractor for additional labour or materials required to provide specified performance level.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 – General Instruction; leave Work area clean at end of each day.
- .2 Asbestos-Containing Material specific procedures:
 - .1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.
 - .2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.
 - .3 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous

- nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.
- .4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.
 - .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment, in accordance with Section 01 01 50 – General Instructions.
 - .4 Waste Management: separate waste materials for reuse and recycling:
 - .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
 - .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
 - .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
 - .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
 - .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
 - .6 Dispose of hazardous wastes in timely fashion in accordance with applicable federal and provincial regulations.
 - .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
 - .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 00 – Delegated Design
- .2 Section 05 50 00 - Metal Fabrications
- .3 Section 07 92 00 - Sealants
- .4 Section 08 11 16 - Aluminum Frames
- .5 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-09, 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 A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - .5 ASTM A641/A641M-09a, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .6 ASTM A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .7 ASTM A951/A951M-11, Standard Specification for Steel Wire for Masonry Joint Reinforcement
 - .8 ASTM A1011/A1011M-10, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - .9 ASTM C140-11a, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - .10 ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete, Includes Update No.1 (2011).
 - .2 CAN/CSA-A165 Series-04 (R2009), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2, and A165.3).
 - .3 CSA A179-04 (2009), Mortar and Grout for Unit Masonry.
 - .4 CSA A370-04 (2009), Connectors for Masonry.
 - .5 CAN/CSA A371-04 (R2009), Masonry Construction for Buildings.

- .6 CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2009), Update No. 2 (2010), Update No. 3 (2011).
- .7 CSA S304.1-04, Design of Masonry Structures.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate lines, levels and coursing with existing wall assembly.
 - .2 Obtain built-in items prior to start of this work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 - General Instructions.
- .2 Provide manufacturer's printed product literature, specifications and data sheet. Indicate masonry types, shapes, sizes, and textures.
- .3 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).
- .4 Shop drawings:
 - .1 Shop drawings shall bear the signature and stamp of a qualified Professional Structural Engineer experienced in design of this Work and registered in Province of Work, responsible for the reinforcement design. Cost of engineering service shall be included in the work of this section.
 - .2 Indicate materials and profiles and provide full-size, scaled details including:
 - .1 Junctions with adjacent construction.
 - .2 Elevations of units.
 - .3 Core thicknesses of components.
 - .4 Method of anchorage, number of anchors, supports, reinforcement, and accessories.
 - .5 Locations of sealant.
- .5 Schedules from Sub-Contractor's Engineer:
 - .1 Provide Schedule S-B and S-C to Departmental Representative.

1.5 QUALITY ASSURANCE

- .1 Conform to CAN/CSA A371, except as modified by this specification.
- .2 Masonry contractor qualifications:
 - .1 Member in good standing of Masonry Institute of BC, and be qualified under the Technical Masonry Certification (TMC) program.
 - .2 Minimum five years of experience on projects of similar size and magnitude.
 - .3 Masonry work shall be performed by experienced, qualified journeyman masons under the direct and continual full-time supervision of certified masons.

- .3 Before starting masonry work establish mix proportions based on the limitations set out in Table 2 of CSA A179.
- .4 Test laboratory prepared samples of the proposed mortar(s) for compressive strength in accordance with CSA A179.
- .5 Connectors and joint reinforcement shall conform to CSA A370.
- .6 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.
- .7 Trade Contractor: 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 Site review of installed components.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 - General Instructions.
- .2 Deliver masonry units on pallets or cubes, suitably protected from road grime and moisture absorption due to exposure to rain or melting snow.
- .3 Unload and store on dry, level areas.
- .4 Remove plastic wrappings from concrete masonry units and cover with waterproof coverings which will provide protection from the elements but allow for air circulation.
- .5 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.

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/A/15/M.
 - .2 Size (Nominal): Match existing.
 - .3 Special shapes: provide plain end, bull-nosed, double bull-nosed units for exposed corners to match existing.

2.2 MORTAR AND GROUT MATERIALS

- .1 Grout: Sub-contractor's Structural Engineer to specify type, slump, mix, and testing requirements.
- .2 Mortar: Type: S.

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:
 - .2 Mill Galvanized (Interior Use): In accordance with ASTM A116, Class 3.
 - .3 Hot Dip Hardware and Bolts: In accordance with ASTM A153, Class B-2 regardless of location.
 - .4 Hot Dip Sheet Steel: In accordance with ASTM A653, Coating Designation Z600, regardless of location.
 - .5 Structural Shapes and Pipes: In accordance with ASTM A123, Grade 85, regardless of location.

2.4 REINFORCEMENT

- .1 Horizontal Ladder Wire: to ASTM A951, mill galvanized to ASTM A641, 9 gauge, cross rods at 400 mm o.c.
- .2 Bar reinforcement: as specified by Sub-Contractor's Structural Engineer

2.5 ACCESSORIES

- .1 Sealants: As specified under Section 07 92 00 – Sealants.
- .2 Joint Filler: Control Joint Fillers: Preformed rubber, neoprene or polyvinylchloride, size and profile to suit intended application and as indicated on drawings.
- .3 Painting: As specified under Section 09 91 99 – Painting for Minor Works.

2.6 CLEANING COMPOUNDS

- .1 Compatible with substrate and acceptable to concrete masonry manufacturer for use on products.

- .2 Cleaning compounds compatible with clay brick masonry units and in accordance with manufacturer's written recommendations and instructions.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify surfaces and conditions are ready to accept work of this Section.
- .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.

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: running.
 - .2 Coursing height: 200 mm for one block and one joint.
 - .3 Jointing: concave where exposed or where paint or other finish coating is specified.
- .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 and as indicated on drawings.
 - .4 Install special site cut and shaped units.
- .3 Cull out masonry units, in accordance with CAN/CSA A165 with chips, cracks, broken corners, excessive colour and texture variation.

- .4 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, and inserts.
- .5 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .6 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .7 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 bridging of airspace between brick veneer and backup wall with mortar.
- .8 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .9 Tamp units firmly into place.
- .10 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .11 Tool exposed joints concave; strike concealed joints flush.
- .12 After mortar has achieved initial set up, tool joints.
- .13 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 and grout, obtain Departmental Representative's approval of placement of reinforcement and connectors.
- .3 Supply and install additional reinforcement to masonry as indicated.

3.8 REINFORCED LINTELS AND BOND BEAMS

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

3.9 GROUTING

- .1 Grout masonry in accordance with CSA-S304.1, CAN/CSA A371 and CAN/CSA A179 and as indicated.

3.10 ANCHORS

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

3.11 LATERAL SUPPORT AND ANCHORAGE

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

3.12 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.

3.13 REPAIR/RESTORATION

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

3.14 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: provide compressive strength tests accordance with CSA A179. Notify inspection agency minimum of 24 hours in advance of requirement for tests.

3.15 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 - General Instructions.
- .2 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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 00 – Delegated Design
- .2 Section 04 22 00 – Concrete Unit Masonry

1.2 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 A123/A 123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .4 ASTM E935, Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .3 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, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .4 CSA W59-13, Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).
- .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).
- .5 National Research Council Canada (NRC)
 - .1 National Building Code of Canada, 2015 (NBC).
- .6 The Society for Protective Coatings (SSPC)
 - .1 Systems and Specifications Manual, Volume 2.

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 Provide submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Shop drawings:
 - .1 Shop drawings shall bear the signature and stamp of a qualified Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located, in the Province of British Columbia. Cost of engineering shall be included in the work of this section.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .3 Schedules from Sub-Contractor's Engineer:
 - .1 Provide Schedules S-B and S-C to Departmental Representative.

1.5 QUALITY ASSURANCE

- .1 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 555.
- .2 Details shall be designed by the Sub-Contractor's Professional Engineer.
- .3 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.
- .4 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.
- .5 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 Deliver, store, and handle materials in accordance with Section 01 01 50 General Instructions.
- .2 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 damaged structurally or visibly.
- .3 Correct damaged material and where the Departmental Representative deems damage irreparable, replace the affected items at no additional expense to the Departmental Representative.
- .4 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed.
- .5 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 SYSETEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design stair rail and guard rail construction and connections to National Building Code of Canada (NBC) vertical and horizontal live load requirements.
 - .2 Detail and fabricate to NAAMM Metal Stairs Manual.

2.2 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.
- .2 Welding materials: to CSA W59.
- .3 Welding electrodes: to CSA W48 Series.
- .4 Fasteners: Bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws, and machine bolts to be hot-dipped galvanized in accordance with ASTM A153/A153M or CAN/CSA-G164.

2.3 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Where possible, fit and shop assemble work, ready for installation.
- .3 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.
- .4 Accurately form connections with exposed faces flush, and make mitres and joints tight.
- .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. Smooth all corners and returns.
- .7 Shop fabricate in sections as large and complete as practical.

- .8 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.
- .9 Provide fastenings, including anchor bolts, bolts, lag screws, expansion bolts, straps, brackets, etc. required for the installation of work of this Section.

2.4 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating to CAN/CSA-G164.
- .2 Zinc primer: ready mix to CAN/CGSB-1.181, alkyd resin, containing 97% pure zinc metal, minimum 88% solid by weight.

2.5 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.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 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 Fasteners to draw adjoining sections together in proper, true alignment, and are capable of field adjustment.
- .5 All fasteners, mountings to be non-loosening.
- .6 Install all Work to true, straight lines, accurate to profile, all properly aligned.
- .7 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .8 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

- .9 Make field connections with high tensile bolts to CSA-S16.1 and weld to prevent loosening.
- .10 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with zinc-rich paint.

3.3 MISCELLANEOUS ITEMS

- .1 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 Progress Cleaning: clean in accordance with Section 01 01 50 General Instructions, and leave work area clean at end of each day.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 01 50 General Instructions.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 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 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
 - .3 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
 - .4 ASTM D5456-14a, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .5 ASTM E1333-10, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
 - .6 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 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.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O112 Series-M1977 (R2006), CSA Standards for Wood Adhesives.
 - .3 CSA O121-08, Douglas Fir Plywood.
 - .4 CSA O141-05 (R2009), Softwood Lumber.
 - .5 CSA O151-09, Canadian Softwood Plywood.
 - .6 CAN/CSA-O325-07, Construction Sheathing.
- .4 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.
- .5 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.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S102-10, Method of Test for Surface Burning Characteristics of Building Materials and 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 MSDS sheets or official manufacturer literature stating no urea-formaldehyde was used in the manufacturing of composite wood.

1.3 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.

1.4 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.

1.5 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.

2.2 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 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.
- .5 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.
- .6 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.

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 rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .7 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.

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 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 Division 22 Plumbing
- .2 Division 23 Heating, Ventilation & Air Conditioning

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 existing fire resistance rating:
 - .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.
- .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 not requiring removal of insulation for penetrations involving insulated piping.
 - .3 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 existing fire resistance rating.

2.2 FIRESTOPPING AND SMOKE SEALS: 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 existing fire resistance rating.
 - .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.

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- .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 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 its fire resistance ratings.

- .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 for Metallic Pipes, Conduit, or Tubing: Select one or more of the following fill materials:
 - .1 Intumescent putty.
 - .2 Intumescent foam blocks or boards.
 - .3 Intumescent spray foam.
 - .2 Systems for Non-metallic Pipe, Conduit, or Tubing: Select one or more of the following fill materials:
 - .1 Intumescent putty.
 - .2 Intumescent wrap strips.

- .3 Firestopping and Smoke seals device.
- .4 Intumescent spray foam.
- .3 Re-enterable and Cable Managed Systems for Electrical, and Data and Communications Cables.
- .4 Systems for Electrical, and Data and Communications Cables: Select one or more of the following fill materials:
 - .1 Intumescent putty.
 - .2 Intumescent foam blocks or boards.
 - .3 Intumescent spray foam.
- .5 Systems for Insulated Pipes: Select one or more of the following fill materials:
 - .1 Intumescent putty.
 - .2 Intumescent wrap strips.
 - .3 Intumescent foam blocks or boards.
 - .4 Intumescent spray foam.
- .6 Systems for Miscellaneous Electrical Penetrations: Select one or more of the following fill materials:
 - .1 Intumescent putty.
 - .2 Intumescent foam blocks or boards.
 - .3 Intumescent spray foam.
- .7 Systems for Miscellaneous Mechanical Penetrations: Select one or more of the following fill materials:
 - .1 Intumescent foam blocks or boards.
 - .2 Intumescent spray foam.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 02 07 50 – Cutting and Patching
- .2 Section 02 41 99 – Demolition for Minor Works
- .3 Section 08 11 16 – Aluminum Frames
- .4 Section 09 67 23 – Resinous Flooring
- .5 Division 22 - Plumbing
- .6 Electrical Drawings

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 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.

1.6 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.

1.7 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 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.

1.8 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 All Other Applications:
 - .1 Sealants: VOC content limit 420 g/L.
 - .2 Sealant Primers: VOC content limit 750 g/L.

2.2 ACCESSORIES

- .1 Primer: Non-staining type as recommended by sealant manufacturer.
- .2 Joint Cleaner: Non-corrosive solvent type recommended by sealant manufacturer for applicable substrate materials.

2.3 COLOURS

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

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 Form surface of sealant smooth, free from ridges, wrinkles, sags, or air pockets and imbedded impurities. Neatly tool surface to a slight concave appearance.
- .4 Tool sealants to achieve air tight joints. Use wet tools as required.
- .5 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.
- .6 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
- .7 Seal holes in masonry block wall.
- .8 Seal gaps between fixtures and walls.
- .9 Seal gaps between surface-mounted electrical boxes and walls.
- .10 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 SUMMARY

- .1 Work of this section includes provision of the exterior aluminum framed glazing system.

1.2 RELATED REQUIREMENTS

- .1 Section 01 35 00 – Delegated Design
- .2 Section 07 92 00 - Sealants
- .3 Section 08 80 50 - Glazing

1.3 REFERENCES

- .1 Aluminum Association (AA)
 - .1 DAF 45-2003 (R2009), Designation System for Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA 501-15, Methods of Test for Exterior Walls.
 - .2 AAMA 609/610-15, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
 - .3 AAMA 611-14, Voluntary Specifications for Anodized Finishes 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-91, 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 A480/A480M-16b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - .3 ASTM B209-14, 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.
 - .7 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .4 Canadian Standards Association (CSA International)

- .1 AAMA/WDMA/CSA 101/I.S.2/A440-08, NAFS - North American Fenestration Standard/Specification for windows, doors, and skylights, Includes Update No. 1 (2008), Update No. 3 (2009)
- .2 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS # North American Fenestration Standard/Specification for windows, doors, and skylights, Includes Update No. 1 (2013).
- .3 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014)
- .4 CSA-S157/S157.1-05 (R2015), Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum
- .5 Glazing Association of North America (GANA)
- .6 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International)

1.4 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 to:
 - .1 Verify project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
- .2 Coordination: coordinate with Work of Section 08 80 50 – Glazing.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 - General Instructions.
- .2 Product data:
 - .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.
- .3 Samples:
 - .1 Submit for review and acceptance by Departmental Representative.
- .4 Shop drawings:
 - .1 Shop Drawings shall bear the signature and stamp of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located, in the Province of British Columbia. Cost of engineering shall be included in the work of this section.
 - .2 Indicate materials and profiles and provide full-size, scaled details of components for each type of 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 sealant.
- .3 Submit catalogue details for frame illustrating profiles, dimensions and methods of assembly.
- .5 Schedules from Sub-Contractor's Engineer:
 - .1 Provide Schedules S-B and S-C to Departmental Representative.
- .6 Thermal modelling: submit calculations to verify assembly meets specified performances.
- .7 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .8 Manufacturers' Field Reports: Submit two copies of manufacturers field reports.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 - General Instructions.

1.7 QUALITY ASSURANCE

- .1 Fabricator:
 - .1 Shall have minimum of ten (10) 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 Shall be authorized by aluminum framing system manufacturer to install and warranty installation.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Trade Contractor: 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 Site review of installed components.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 - General Instructions.
- .2 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.

1.9 WASTE MANAGEMENT AND DISPOSAL

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

1.10 WARRANTY

- .1 Provide manufacturers written guarantee, signed and issued in name of Owner, 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 specified in Contract Documents; 2 years.
 - .2 Sealed glass units: misting, dusting and seal failure; refer to Section 08 80 50.
 - .3 Sealants, caulking: failure to maintain seal; 2 years.
 - .4 Aluminum brashes: oil canning and delaminating; 2 years.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Vertical aluminum glazed window system includes thermally broken exterior tubular aluminum sections with self supporting framing, factory prefinished, glazing as specified in Section 08 80 50, related flashings, anchorage and attachment devices.
- .2 Assembled system to permit re-glazing of individual glass units from interior without requiring removal of structural mullion sections.

2.2 DESIGN REQUIREMENTS

- .1 Thermal performance shall be determined in conformance with CSA A440.2-09/A440.3-09, Thermal Performance Evaluation of Windows and Sliding Glass Doors, and Appendix A - Overview of the Procedure for Determining the U-Value by Computer Simulation.
- .2 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with BC Building Code and as indicated on Structural Drawings.
- .3 Design structural support framing components to CAN3 S157 under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located, in the Province of British Columbia.
- .4 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with British Columbia Building Code.
- .5 Limit mullion deflection to flexure limit of glass L/175 with full recovery of glazing materials under wind load as prescribed by BC Building Code for geographic area of the project.
- .6 Provide system to accommodate, without damage to components or deterioration of seals:
 - .1 Movement within system.
 - .2 Movement between system and perimeter framing components.

- .3 Dynamic loading and release of loads.
- .4 Deflection of structural support framing.
- .5 Building structure deflections as indicated on structural drawings.

- .7 Vapour seal with interior atmospheric pressure of 25 mm sp, 22 degrees C, 40% RH: No failure.
- .8 System to provide for expansion and contraction within system components caused by a cycling temperature range of 95 degrees C over a 12 hour period without causing detrimental affect to system components.
- .9 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- .10 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
- .11 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur

2.3 PERFORMANCE CRITERIA

- .1 Air, Water and Load resistance:
 - .1 Air: 0.3 l/s/m² tested to ASTM E283 at pressure differential of minimum 300 Pa.(Fixed)
 - .2 Water: no leakage tested to ASTM E331 at pressure differential of minimum 300 Pa.
 - .3 Load resistance: tested to ASTM E330, inward 7.16mm, outward 7.75 mm.
- .2 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.
- .3 Thermal Performance of window products including frame and glass:
 - .1 Design and build system to provide overall thermal resistance of U Value metric: 0.38.

2.4 MATERIALS

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T5, T6, or T54 anodizing quality.
- .2 Sheet aluminum: Alloy 1100, F temper, 1.5 mm, or 3 mm minimum thickness exposed sheet finished to match frames as specified.
- .3 Steel reinforcement: to 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 Pressure Plate: aluminum and fastened to the mullion with stainless steel screws.
- .5 Anti-Rotation Channels: PVC anti-rotation channel designed to mechanically retain air seal membrane to the face of the tubular back section.
- .6 Stainless steel: to ASTM A167, 316; of one type throughout.
- .7 Fasteners: to ASTM A167, stainless steel, type 316, finished to match adjacent material and selected to prevent galvanic action with fastened materials of suitable size to sustain imposed loads.

- .8 Isolation coating: bituminous paint, acid and alkali resistant asphaltic paint in accordance with MPI Architectural Painting Specification Manual approved product listing.
- .9 Glazing materials: refer to Section 08 80 50.
- .10 Glass Gaskets: EPDM extrusions, manufacturer's standard.
- .11 Spacers for glazing, backpans/aluminum spandrels to be full length, purpose made, aluminum channels.
- .12 Sealant: Including primer, joint filler, as specified in Section 07 92 00.
- .13 Thermal separator: Polyvinylchloride, 50 Shore A durometer hardness +5.
- .14 Fibrous insulation: mineral wool to CAN/ULC S702.

2.5 FRAMING

- .1 Exterior Framing: thermally broken to profiles indicated and as required to performance requirements, but not less than 3 mm thick unless otherwise shown, suitable alloy and proper temper for extruding and adequate structural characteristics; clear anodized finish as specified below; frame dimension to be nominal 50 mm wide x 112 mm deep.

2.6 ALUMINUM FINISHES

- .1 Clear Anodized: Exposed aluminum surfaces shall be Aluminum Association (AA) Architectural Class I, AA-M12C22A31.
- .2 Unexposed aluminum: Mill finish.

2.7 STEEL FINISHES

- .1 Finish steel clips and reinforcing steel with zinc coating to CSA G164.

2.8 RELATED COMPONENTS

- .1 Thermally broken extrusions: deflection head receptor, sill track.
- .2 Sill flashings: 1.29 mm thick extruded aluminum, finish to match curtain wall mullion sections where exposed, secured with concealed fastening method.
- .3 Aluminum retaining and fastening angles: 2 mm thick extruded.
- .4 Concealed Flashing: Manufacturer's standard corrosion resistant, non staining, non bleeding flashing compatible with adjacent materials.

2.9 FABRICATION GENERAL

- .1 Fit and assemble all Work in the shop insofar as practical

- .2 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.
- .3 Fit joints tightly and secure mechanically.
- .4 Provide cut-outs and integral reinforcing as required to receive hardware.
- .5 Separate unlike metals or alloys with a heavy coating of bituminous paint, separator gaskets or slip gaskets as required to prevent galvanic action.
- .6 Provide weepholes in glazing recess and an airseal at interior glassline.
- .7 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 frames 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 Perform work in accordance with IGMAC and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

- .2 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.
- .3 Conceal all anchors and fitments. Exposed heads of fasteners not permitted. All joints in exposed work to be flush hairline butt joints.
- .4 Use anchors that will permit sufficient adjustment for accurate alignment. Make allowance for deflection of building structure.
- .5 Build in and provide any supplementary reinforcing and bracing required by assembly loads and deflections.
- .6 Secure Work adequately to structure in a manner not restricting thermal and wind movement.
- .7 Correctly locate and install flashings, deflectors and weep holes and verify proper drainage of moisture to exterior.
- .8 Maintain alignment with adjacent Work.
- .9 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coatings of bituminous paint.
- .10 Verify all stops, gaskets, splines, seals, etc. are perfectly aligned and ready to receive glazing and insulated panels as specified herein.
- .11 Install glazing to details and instruction, using material specified.
- .12 Glazing stops, snap covers and pressure plates shall be of a continuous length from corner to corner, and be fitted at corners.
- .13 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 Install sealants and back-up materials in strict accordance with manufacturer's written instruction.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 - General Instructions.
- .2 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
- .3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .4 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .5 Remove traces of primer, caulking, epoxy and filler materials; clean frames.

- .6 Clean glass and glazing materials with approved non-abrasive cleaner.
- .7 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 – Sealants
- .2 Section 08 11 16 – Aluminum Frames

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C542-05(2011), Specification for Lock-Strip Gaskets.
 - .2 ASTM D2240-15, Standard Test Method for Rubber Property - Durometer Hardness.
 - .3 ASTM D790-15e2, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .4 ASTM D2240-15, Standard Test Method for Rubber Property - Durometer Hardness.
 - .5 ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .6 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.1-2017, Safety Glazing.
 - .2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .3 CAN/CGSB-12.8-97 AMEND, Insulating Glass Units.
 - .4 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
 - .5 CAN/CGSB 12.20, Structural Design of Glass for Buildings
- .3 Glass Association of North American (GANA)
 - .1 GANA Glazing Manual.
 - .2 GANA Laminated Glazing Reference Manual.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 01 50 - General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance by Departmental Representative.
- .4 Shop drawings:
 - .1 Shop drawings shall bear the signature and stamp of a qualified Professional Structural Engineer experienced in design of this Work and registered in Province of Work,

- responsible for the reinforcement design. Cost of engineering service shall be included in the work of this section.
- .2 Detail fabrication and assembly of insulated glazed units (IGUs) for installation into glazed aluminum storefront system. Indicate material and profiles and provide all construction details including; but not limited to, the following:
 - .1 Sizes of IGUs.
 - .2 Wind loading.
 - .3 Thicknesses of glass.
 - .4 Performance coatings.
 - .5 Information Submittals:
 - .1 Calculations:
 - .1 Submit complete design study calculations, certified by Sub-Contractor's engineer including pertinent information affecting design, wind reactions, shading effects and failure probability for thermal glazing units, to Departmental Representative as evidence of compliance with design criteria, prior to manufacture.
 - .2 Sealant Data:
 - .1 Submit product information on the sealants to be used, complete with all recommendations and installation instructions, including cleaning and priming procedures.
 - .2 Submit sealant manufacturer's test reports on adhesion to metal and glass production samples tested in accordance with ASTM C794, 7 day cure and 7 day water submersion, tensile strength at 100% elongation and bite size of sealants.
 - .3 Submit sealant manufacturer's statement and test data indicating that stress on the sealants when exposed to maximum load does not exceed 38 kPa and a safety factor of 5:1.
 - .4 Submit sealant manufacturer's compatibility statement that all materials in contact with the sealants are compatible with the sealants in accordance with procedures of ASTM C1087.
 - .5 Submit sealant manufacturer's verification that sealants are suitable for purposes intended.
 - .6 Stress analysis: provide analysis on heat absorbing glass and light and heat reflecting glass. Submit prior to ordering glass.
 - .7 Schedules from Sub-Contractor's Engineer:
 - .1 Provide Schedules S-B and S-C to Departmental Representative (CRP - Coordinating Registered Professional).
 - .8 Field Review Reports: provided by professional engineer providing Schedules S-B and S-C.

1.4 QUALITY ASSURANCE

- .1 Qualifications: The firm producing and executing the Work of this Section shall have a minimum of 10 years successful experience in the fabrication and erection of systems 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 the province of British Columbia to design fabrication and erection of the Work of this Section:

- .1 Engineer shall be experienced in structural design in glass and aluminum window units and connections to building, to ensure the adequacy of the structural aspects of the design, manufacture, and installation of complete assembly. General scope shall include:
 - .1 Seal and signature to shop drawings and design submittals.
 - .2 Field review of installed components.
 - .3 Submission of schedules.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 - General Instructions and as specified in Sections 08 11 16.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground, protected in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
 - .3 Protect prefinished aluminum surfaces with strippable coating.
 - .4 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

1.7 AMBIENT CONDITIONS

- .1 Ambient Requirements:
 - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

- .1 Provide manufacturers written guarantee, signed and issued in name of Owner, to replace the sealed glass units for defective material and workmanship for time stated from date of Substantial Performance:
 - .1 Misting, dusting, and seal failure; 2 years.

Part 2 Products

2.1 MATERIALS

- .1 Tempered Glass: clear, 6mm thick.
- .2 Laminated glass:
 - .1 Two clear float glass, 6mm thick each.
 - .2 Interlayer: Polyvinyl Butyral (PVB), clear, 0.78mm (30mil) thick.

2.2 MATERIALS: SEALED INSULATING GLASS

- .1 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).
- .2 Other Glazing Accessories: setting blocks to CAN/CSA-A440.
- .3 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.
- .4 Tempered glass in sealed units: to CAN/CGSB-12.1, transparent, 6 mm minimum thickness unless otherwise determined by sub-Contractor's engineering.
 - .1 Type: 2-tempered.
 - .2 Class: B-float.
 - .3 Category: II - 540 J impact resistance.
 - .4 Fully tempered glass: Optical Distortion Limits.
 - .1 Optical Distortion Limits: Maximum peak-to-valley roll wave 0.005" (0.127mm) in the central area of the glass lite, excluding the leading and trailing 12"; per ASTM C 1651.
 - .2 Maximum center-kink of 0.001" (0.025 mm) when roll wave is measured over the surface of the glass perpendicular to the direction of travel through the tempering furnace.
 - .3 Maximum localized bow (warp) per lite shall be 1/32" (0.79 mm) per lineal foot, one-half of the ASTM C 1048 allowance. Maximum overall bow (warp) per lite shall also be one-half of the ASTM C 1048 allowance.
- .5 Assembly of insulated glass units:
 - .1 Exterior light:
 - .1 Laminated.
 - .2 Low-E coating on No.2 surface. Triple silver, magnetic sputter vacuum deposition (MSVD).
 - .3 Roller Wave Orientation: Orient parallel to ground, glaze all lights in all systems to same direction.
 - .2 Spacer/separator to provide continuous vapour barrier between interior of sealed unit and secondary seal: warm edge spacer, black.
 - .3 Space between lights: Argon filled.
 - .4 Interior light:
 - .1 Tempered.
 - .2 Thickness: 6 mm.
 - .3 Roller Wave Orientation: Orient parallel to ground, glaze all lights in all systems to same direction.
- .6 Performances of double glazed unit.
 - .1 SHGC: 0.27.
 - .2 VLT: 64%
 - .3 U-Value SI COG summer: 1.47 (0.26 Imp)
 - .4 U-Value SI COG winter: 1.57 (0.28 Imp)

2.3 ACCESSORIES

- .1 Corner Blocks and Setting blocks: neoprene EPDM silicone, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .2 Setting blocks: EPDM, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area length of 25 mm for each square meter of glazing.
- .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.
- .4 Sealant: in accordance with Section 07 92 00 - Sealants.
 - .1 VOC limit 250 g/L maximum.
- .5 Glazing tape:
 - .1 Preformed butyl compound 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
- .6 Glazing splines: resilient EPDM, extruded shape to suit glazing channel retaining slot, black.
- .7 Glazing clips: manufacturer's standard type.
- .8 Lock-strip gaskets: to ASTM C542.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

- .1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.

- .3 Cut glazing spline to length; install on glazing light in aluminum extrusions in accordance with manufacturer's instructions. Seal corners by butting spline and sealing junctions with sealant.
- .4 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .5 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .6 Trim protruding tape edge.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 - General Instructions.
 - .1 Leave Work area clean at end of each shift.
 - .1 Remove traces of primer, caulking.
 - .2 Remove glazing materials from finish surfaces.
 - .3 Remove labels.
 - .4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 01 50 - General Instructions.

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 07 84 00 – Firestopping and Smoke seals
- .2 Section 07 92 00 – Sealants
- .3 Section 09 91 99 – Painting for Minor Works

1.2 REFERENCES

- .1 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 C1396/C1396M-14a, Standard Specification for Gypsum Board.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86., Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 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 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.
- .3 Cementitious backer board: to ASTM C1325 and as follows:
 - .1 Size: 1200 mm x maximum practical length.
 - .2 Thickness: as indicated on Drawings.
- .4 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 ACCESSORIES

- .1 Nails: to ASTM C514.
- .2 Steel drill screws: to ASTM C1002.
- .3 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.
- .4 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.
- .5 Sealants: in accordance with Section 07 92 00 - Sealants.
- .6 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.
- .7 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.

2.3 FINISHES

- .1 Paint: in accordance with Section 09 91 99 – Painting for Minor Works.

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 Install work level to tolerance of 1:1200.
- .4 Furr gypsum board faced vertical bulkheads within and at termination of ceilings.
- .5 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .6 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .7 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .8 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.
- .9 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 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.
- .7 Install gypsum board with face side out.
- .8 Do not install damaged or damp boards.
- .9 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 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.
- .5 Provide continuous polyethylene dust barrier behind and across control joints.
- .6 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.
- .7 Install control joints straight and true.
- .8 Construct expansion joints at building expansion and construction joints. Provide continuous dust barrier.
- .9 Install expansion joint straight and true.
- .10 Splice corners and intersections together and secure to each member with 3 screws.
- .11 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .12 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.

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- .13 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.
 - .14 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.
 - .15 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.
 - .16 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
 - .17 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
 - .18 Mix joint compound slightly thinner than for joint taping.
 - .19 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
 - .20 Allow skim coat to dry completely.
 - .21 Remove ridges by light sanding or wiping with damp cloth.
 - .22 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 SUMMARY

- .1 Work of this section includes preparation of floor surface, application of methyl methacrylate patching mortar, and application of self-leveling methyl methacrylate floor finish.

1.2 RELATED SECTIONS

- .1 Section 02 07 50 – Cutting and Patching
- .2 Section 02 41 99 – Demolition of Minor Works
- .3 Section 02 81 01 – Hazardous Materials and Abatement
- .4 Section 07 92 00 – Sealants

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- .2 American National Standards Institute, (ANSI)
 - .1 ANSI A326.3, Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials.
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM E-1907, Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings.
 - .2 ASTM D4414-95(2013), Measurement of Wet Film Thickness by Notch Gages.
 - .3 ASTM C1583/C1583M-13, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
- .4 International Concrete Repair Institute (ICRI)
 - .1 ICRI No. 310.2R-2013, Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning work of this Section, with General Contractor, Departmental Representative, and installer to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions, including fume extraction system design.
 - .3 Arrange third party air monitoring service.
 - .4 Coordinate transition joint locations.
 - .5 Coordinate with other building subtrades.
 - .6 Review manufacturer's installation instructions and warranty requirements.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions
- .2 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.
- .3 Installer Certificates: Signed by manufacturer certifying that installer is a current “approved applicator”, who is fully trained in the installation of the specified materials.
- .4 Submit samples in accordance with Section 01 01 50 – General Instructions, Submittals:
 - .1 Colour chart: submit manufacturer's color chart showing full range of colors and finishes available.
 - .2 Verification Sample: submit 150 mm x 150 mm sample resinous flooring with “River Rock” CQ 1 or “Ash” quartz aggregate blend, applied to a rigid backing.
- .5 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.
- .6 Submit forced air extraction system design.
- .7 Submit third party air monitoring provider’s procedures.
- .8 Closeout Submittals: Submit in accordance with Section 01 01 50 – General Instructions., including manufacturer’s warranty information and maintenance instructions for inclusion in the operations manual, and 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, quartz aggregate, 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:
 - .1 Use experienced applicator who is an “Approved Applicator” of the materials manufacturer at the time of bid submittal.
 - .2 Applicator shall have been trained by the Manufacturer in all phases of surface preparation and application of the specified flooring system. Approved applicator must possess proper surface preparation equipment as recommended by manufacturer.
 - .3 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.

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- .3 Regulatory Requirements: materials, including primers, resins, curing agents, finish coats, quartz 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 Propose location of mockup to Departmental Representative for approval.
 - .2 Apply mockups to verify selection made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .3 Apply full-thickness mockups on 10 m² floor area selected by Departmental Representative.
 - .4 Include 1 m length of integral cove base.
 - .5 Reviewed mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 01 50 - General Instructions.
- .2 Materials shall be delivered to the project in unopened containers, bearing the manufacturers name, product identification and colour. The applicator must record and retain for future reference the batch numbers of all materials used.
- .3 Provide materials that are factory blended and packaged in single, easy to manage batches to eliminate site blending errors. Only the on-site weighing of catalyst is acceptable.
- .4 Store materials in original undamaged condition and in a dry, enclosed area protected from exposure to moisture and direct sunlight. Maintain temperature of storage area between 15°C and 21°C.

1.9 WASTE MANAGEMENT AND DISPOSAL

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

1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Evaluate the substrate condition, including moisture content and extent of substrate leveling and repairs required, if any.
 - .1 Provide moisture testing and submit report to Departmental Representative.
 - .2 Perform three tests for the first 93 square meters and then one test per subsequent 93 square meters.
 - .3 Application may only proceed when the vapor/moisture emission rates does not exceed 1.36 kg per 93 square meters in 24 hours.
 - .4 Install manufacturer's recommended vapor mitigation system to lower the value to the acceptable limit should vapor drive exceeds limit specified above.
 - .5 Testing shall be done in the design occupancy environment for temperature and humidity.

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- .2 Provide utilities including electric, water, heat and lighting.
 - .3 Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and cure period of the floor.
 - .4 Maintain room temperature at 20°C (68°F) for 48 hours before, during and 48 hours after installation, or until cured.
 - .5 At the time of application ensure the minimum substrate temperature is above 7°C (45°F) and the substrate temperature is 3°C (5.5°F) above the measured dew point.
 - .6 Provide forced ventilation system design to Departmental Representative, system shall be designed to control and direct odour.
 - .7 Conduct total volatile organic compound sampling by third party company at the end of working hours as per Section 02 81 01.
 - .8 Job area to be free of other trades during, and for a period of 4 hours, after flooring system installation. Maintain a dust free environment.
 - .9 Protect finish flooring from damage by subsequent trades.

1.11 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 Methyl methacrylate based polymer mortar: fast cure, 100% solid, methyl methacrylate primer and resin mortar.
- .2 Nominal 3 mm, fast cure, 100% solids, methyl methacrylate resin flooring system with decorative quartz aggregate broadcasts. Comprised of the following components:
 - .1 Primer
 - .2 Undercoat
 - .3 Coving Compound
 - .4 Self leveling material
 - .5 Colour stable, decorative coloured quartz aggregate broadcast layer
 - .6 Clear, UV resistant sealer.
- .3 Physical Properties: Provide flooring system in which minimum physical properties of the complete system, including primers, fillers, chips, and sealers, and when tested in accordance with standards or procedures referenced below, are as follows:
 - .1 Tensile Strength (ASTM D638): 3,550 psi
 - .2 Hardness (ASTM D2240, Shore D): 80
 - .3 Abrasive Resistance (ASTM C4060, CS-17, 1 kg load, 1000 cycles): 0.06 gm max weight loss.
- .4 Colour: to be approved by Departmental Representative as per submitted sample and mock-up.
- .5 Waterproofing Membrane: where required, provide manufacturer's methyl methacrylate compatible membrane system.

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- .6 Resinous finish to cove base: material and colour to match flooring system, smooth finish without the broadcast system and layer.
 - .7 Accessory Materials: Fill cracks, depressions, or any other surface irregularities using additional materials produced by resinous flooring system manufacturer

Part 3 EXECUTION

3.1 PREWORK INSPECTION

- .1 Prior to commencing work, applicator shall inspect and test all surfaces to be coated with MMA material systems and report immediately to Architect and Departmental Representative in writing any unsatisfactory conditions that will adversely affect the appearance or performance of these coating systems and that cannot be put into acceptable condition by the preparatory work.
- .2 When the surface preparation is complete and before application of flooring begins, complete the following test procedures to confirm the suitability of the concrete:
 - .1 Review moisture test results.
 - .2 Determine if the surface texture of the concrete is comparable to I.C.R.I. Texture CSP 3-6.
 - .3 Determine the tensile bond strength of the concrete before application begins in accordance with ASTM C 1583. Minimum acceptable test result is 1.5 Mpa (210 psi).
 - .4 Determine the Dew Point of the surface to be coated before application. The contractor must monitor the Dew Point during application and initial cure. The surface must be at least 3°C (5.5°F) above the measured Dew Point at all times during application and cure.
- .3 Do not proceed with application until the surface is in an acceptable condition.

3.2 PREPARATION

- .1 Concrete Substrate must be clean, dry, and sound: prepare concrete by mechanical means including use of diamond grinder, sander, shotblast method and / or other mechanical means and dust recycling machine for removal of bond inhibiting materials such as curing compounds, dust, paint, surface coating, form release agents or laitance; leaving a bare concrete surface having a profile similar to 40 grit sandpaper.
- .2 Mechanically abrade floor areas inaccessible to mobile blast machines to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, scabblers, bush hammers, or other suitable equipment.
- .3 Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/8 inch (3.175 mm) key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
- .4 After mechanical abrasion, traces or accumulations of spent abrasive, laitance, removed toppings, and other debris shall be removed with brush or vacuum.
- .5 Remove projections and other conditions which affect installation of flooring.
- .6 Protect adjacent surfaces, fixtures and equipment with a drop cloth or adequately cover to prevent damage from splatter, spillage or any other damage resulting from work of this trade.

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- .7 Moving cracks and expansion joints must be extended across the flooring system and filled with a flexible product recommended by manufacturer.
 - .8 Verify that moisture content is within range acceptable to flooring manufacturer.
 - .9 Install ventilation system approved by Departmental Representative.
 - .10 Arrange for third party air sampling.

3.3 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. Follow manufacturer's instructions for required curing time for each component.
- .2 Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures, mixing proportions, coverage rates, and curing procedures. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion.
- .3 Patching where required: measure, add, and mix mortar components in strict accordance with manufacturer's instructions. Repair damaged area and re-prime the exposed mortar surface once cured.
- .4 Coving: apply coving where required; trowel-on cove base consisting of a trowel applied radius/base mix with a termination strip installed at the top of the base. Cove base will receive the coating consistent with flooring.
- .5 Waterproofing: where required, apply manufacturer's methyl methacrylate compatible membrane system, with strict adherence to manufacturer's application instructions.
- .6 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.
- .7 Broadcast Chip: apply chips according to manufacturer's recommended procedures.
- .8 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.

3.4 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.

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- .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.

3.5 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 Air sampling:
 - .1 Conduct sampling for total volatile organic compounds as per Section 02 81 01.
 - .2 Submit sampling report to Departmental Representative.
- .3 Protection:
 - .1 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.
 - .2 Protect completed work from contact with water until cured, approximately twenty-four hours at 20 °C.
 - .3 Protect completed flooring from chemical exposure until fully cured, approximately five days at 20°C.
- .4 Cleaning:
 - .1 Progress cleaning in accordance with Section 01 01 50 – General Instructions.
 - .2 Remove any material spatters and other material that is not where it should be.
 - .3 Remove temporary masking and covers, taking care not to contaminate surrounding area.
 - .4 Clean resinous flooring system prior to final inspection.
 - .5 Remove fume extraction system, restore existing assemblies.
 - .6 Repair any damage that should arise from either the application or cleaning effort.
 - .7 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 painting preparation.
- .2 Surface preparation for this section will be limited specific pre-treatments noted in this section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.

1.2 REFERENCES

- .1 The Master Painters Institute (MPI):
 - .1 Existing Surfaces: Interior Maintenance Repainting Manuals.
- .2 The Society for Protective Coatings (SSPC):
 - .1 Surface Preparation Guidelines

1.3 QUALITY ASSURANCE

- .1 Conform to the standards contained in the MPI Manual.
- .2 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 and in performance.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Conform to MPI Manual and manufacturer's requirements.

Part 2 Products

2.1 MATERIALS

- .1 Materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.

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 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.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions
- .2 Section 01 35 00 – Delegated Design
- .3 Division 22 – Plumbing
- .4 Mechanical Drawings
- .5 Division 26 – Electrical
- .6 Electrical Drawings

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-delivery Meeting: Convene meeting one (1) week prior to kitchen arrival with Departmental Representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Review Supplier's written operation instructions.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 01 50 – General Instructions, Submittals.
- .2 Product data:
 - .1 Submit Supplier's printed product literature, including following information:
 - .1 Specifications and data sheets for mobile kitchen and temporary ramps, railings, and stair.
 - .2 Physical size
 - .3 Kitchen equipment layout and detailed equipment list
 - .4 Description of mechanical, electrical, and other requirements
 - .5 Finish and limitations
 - .2 Alternate mobile kitchen model may only be proposed during Tendering period, to Departmental Representative for approval.
 - .3 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for sealants. Indicate VOC content.
- .3 Shop drawings:
 - .1 Shop Drawings shall bear the signature and stamp of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located, in the Province of British Columbia. Cost of engineering shall be included in the work of this section.
 - .2 Indicate materials and profiles and provide full-size, scaled details of components for:
 - .1 Temporary mobile kitchen support footings and pads

- .2 Temporary ramps, railings, and stair; meeting the load resistance required by the current edition of National Building Code.
- .3 Submit catalogue details for temporary ramps, railings, and stair, illustrating profiles, dimensions and methods of assembly.
- .4 Schedules from Sub-Contractor's Engineer:
 - .1 Provide Schedules S-B and S-C to Departmental Representative.
- .5 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Include a scheduled site inspection by the Supplier and Departmental Representative after delivery, placement, completion of necessary connections, and testing of kitchen equipment.
- .2 Trade Contractor: Retain a Professional Engineer, registered in the Province of the Work, to design the erection of temporary mobile kitchen support footings and pads, and temporary ramps, railings, and stair 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 Site review of installed components.

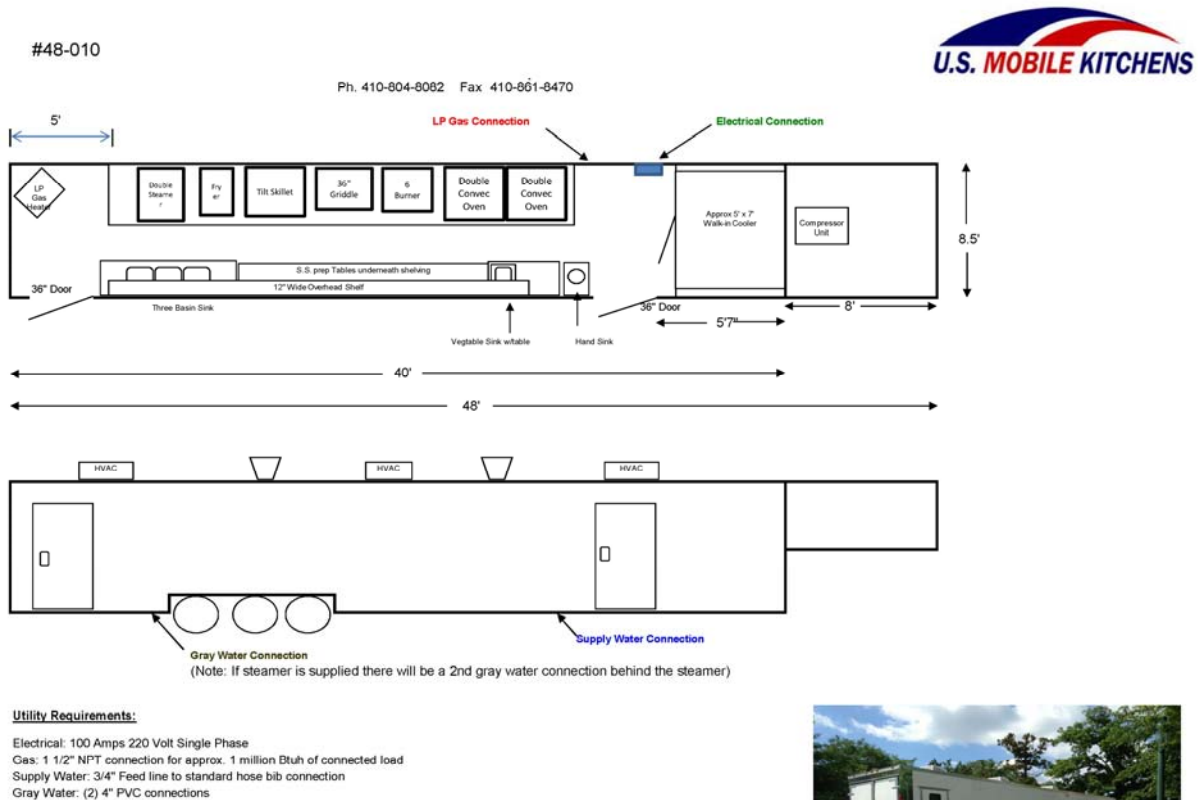
1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, and protect mobile kitchen in accordance with Supplier's written instructions.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Provide rented mobile kitchen as indicated for minimum of five (5) months, with additional month(s) as necessary to complete the kitchen flooring replacement:
 - .1 U.S. Mobile Kitchen, model #48-010
Contact: Heather Dellapenta, West Coast Territory Manager
(303) 961-0864
 - .2 Equivalent alternate may only be proposed during Tender period, for Departmental Representative approval.
 - .3 Mobile Kitchen's electrical use must be limited to 100 amp, 220 volt.
- .2 Mobile kitchen to include equipment as indicated and as per list provided by Departmental Representative.



www.usmobilekitchens.com

- .3 Propane fuel and tank compatible with mobile kitchen.
- .4 Prefabricated modular aluminum access ramps and stairs with railings. Layout as per drawings.
 - .1 All exposed surfaces shall be smooth and free of sharp or jagged edges.
 - .2 All fasteners shall be corrosion resistant.
 - .3 Ramps, landings, and stair shall support load requirements as per current National Building Code.
 - .4 All exterior ramp sections shall be designed for a 1:12 slope when assembled, and interior ramp sections shall be maximum of 1:20 slope.
 - .5 Include guardrail and handrail for exterior ramp, stair, and landing.
 - .6 The walking surface shall be continuous, without gaps, and shall be aluminum extruded slip resistant surface. Perforated or expanded metal panels are not acceptable.
 - .7 Guards and handrails shall be designed to provide load resistance requirements as per current National Building Code.
 - .8 Guards and handrails shall meet the current National Building Code exit requirements.

Part 3 EXECUTION

3.1 INSPECTION

- .1 Verify that conditions of substrate are acceptable for mobile kitchen parking and ramp & stair setup in accordance with Supplier's written instructions.
- .2 Visually inspect substrate in presence of Departmental Representative and footing design engineer.
- .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .4 Proceed with delivery and connection only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Complete electrical, propane, potable water, and sewer connections to mobile kitchen.
- .2 Install ramp, stair, guardrail and handrails; layout as per Drawings.

3.3 FIELD QUALITY CONTROL

- .1 Arrange for Supplier's Field Services:
 - .1 Obtain written report from Supplier, verifying compliance of handling, connecting services, protecting and cleaning of product and submit report to Departmental Representative.
 - .2 Ensure Supplier's representative is present during initial kitchen equipment calibration and testing.
 - .3 Demonstrate equipment operations to Departmental Representative.

3.4 CLEANING

- .1 Initial Cleaning: clean in accordance with written instructions from Supplier
- .2 Final Cleaning: upon disconnecting the services
 - .1 Remove and dispose in kitchen equipment.
 - .2 Clean in accordance with written instructions from Supplier.

3.5 PROTECTION

- .1 Protect kitchen and equipment inside from damage during setup.
- .2 Repair damage to adjacent facility and surfaces caused by mobile kitchen setup.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 This Section specifies general conditions for Divisions 21, 22, 23 and 25 and is to be read, interpreted, and coordinated with all other sections.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
- .2 Drawings and General Provisions of the Contract, including General and Supplementary Conditions, Division 00 and Division 01 Specification Sections apply to work specified in this section.
- .3 Section 25 05 00 – Common Works Results for Integrated Automation.

1.3 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise. Apply the greater requirement called for between the National and British Columbia codes.
- .2 National Codes:
 - .1 National Building Code of Canada 2015 (NBC).
 - .2 National Energy Code of Canada for Buildings 2015.
 - .3 National Fire Code of Canada 2015.
 - .4 National Plumbing Code of Canada 2015.
- .3 British Columbia Codes:
 - .1 British Columbia Building Code 2018 (BCBC).
 - .2 British Columbia Fire Code 2018.
 - .3 British Columbia Plumbing Code 2018.
 - .4 Technical Safety BC regulations and regulatory notices.
- .4 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE):
 - .1 ASHRAE 62.1-01, Ventilation for Acceptable Indoor Air Quality.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .6 Electrical Equipment Manufacturers' Association Council (EEMAC):
- .7 Technical Criteria for Correctional Institutions, April 2015.

1.4 Definitions

- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.

- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Departmental Representative.
- .8 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS", and "DDC" generally mean same.
- .9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .10 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.
- .11 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .12 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .13 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
- .14 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Departmental Representative.

1.5 General Scope

- .1 The scope of Section 22 Plumbing, Section 23 HVAC, and Section 25 Control is for building services within the project structure and 1m from the building.
- .2 Provide complete, fully tested, and operational systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.

- .3 Contract documents and drawings of this Division are diagrammatic and approximately, to scale unless detailed otherwise. They establish scope, material, and installation quality but are not detailed installation instructions.
- .4 Follow manufacturers' recommended installation instructions, details, and procedures for equipment, supplemented by requirements of the Contract Documents.
- .5 Install equipment generally in locations and routes indicated. Run piping and ductwork close to building structure, parallel to building lines, maximize headroom and maintain minimum interference with other services and free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.
- .6 For work within existing facilities, confirm locations and elevations of existing piping and equipment prior to commencement of new work.
- .7 Install equipment to provide service access, maintain service clearances and for ease of maintenance.
- .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Departmental Representative. Uncrate equipment, move in place and install complete; start up and test.
- .9 Install control dampers and other devices on piping and ductwork, furnished by Division 25.

1.6 Coordination of Work

- .1 Cooperate and coordinate with other trades on the project.
- .2 Make reference to electrical, mechanical, structural, and architectural drawings when setting out work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on site before fabricating or installing any materials or equipment.
- .3 Where dimensional details are required, work with the applicable architectural and structural drawings.
- .4 Full size and detailed drawings shall take precedence over scale measurements from drawings. Specifications shall take precedence over drawings.
- .5 Any areas indicated as space for future materials or equipment shall be left clear.

1.7 Permits and Fees

- .1 All work shall comply with provincial, municipal, bylaws and authorities having jurisdiction.
- .2 Obtain all permits and pay all fees applicable to the scope of work.
- .3 Contractor shall arrange for inspections of the work by the authorities having jurisdiction and shall provide certificates indicating Final Approval.

1.8 Tender Price Breakdown

- .1 Submit a tender price breakdown within thirty (30) days of tender closing and before first progress claim, in a format agreed to with the Departmental Representative.
- .2 As a minimum, include the following in the tender price breakdown:
 - .1 Mechanical: Equipment, materials, labour
 - .2 Plumbing: Equipment, materials, labour

.3 Controls: Equipment, materials, labour

1.9 Submittals

- .1 Submittals shall be in accordance with Division 01 - Submittal Procedures, Division 01 – Closeout Procedures, Division 01 – Closeout Submittals and the following:
- .2 No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent.
- .3 Contractor shall provide and submit to the Departmental Representative Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional Schedule S-B and Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.
- .4 Requirements for Contractor Retained Engineers
 - .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
 - .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
 - .3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:
 - .1 Coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
 - .2 The Contractor must comply with the insurance requirements specified herein. The Contractor must maintain the required insurance coverage for the duration of the Contract. Compliance with the insurance requirements does not release the Contractor from or reduce its liability under the Contract.
 - .3 The Contractor is responsible for deciding if additional insurance coverage is necessary to fulfill its obligation under the Contract and to ensure compliance with any applicable law. Any additional insurance coverage is at the Contractor's expense, and for its own benefit and protection.
 - .4 The Contractor must forward to the Contracting Authority within ten (10) days after the date of award of the Contract, a Certificate of Insurance evidencing the insurance coverage and confirming that the insurance policy complying with the requirements is in force. For Canadian-based Contractors, coverage must be placed with an Insurer licensed to carry out business in Canada, however, for Foreign-based Contractors, coverage must be placed with an Insurer with an A.M. Best Rating no less than "A-". The Contractor must, if requested by the Contracting Authority, forward to Canada a certified true copy of all applicable insurance policies.
 - .4 Retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above.

- .5 Evidence of the required liability insurance in such form as may be required is to be issued to Departmental Representative and Municipal Authorities as required prior to commencement of aforementioned consultant's services.
- .8 Submit shop drawings for all products identified in the relevant specification sections of Divisions 21, 22, 23 and 25. Provide drawings as electronic files (file format: .dwg, .dxf, pdf, or comparable). When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include a complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data
- .9 Submit the following shop drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia.
 - .1 Fastening details for Seismic restraints.
 - .2 Mounting details for spring isolation of equipment.
- .10 Shop drawings and product data shall be 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 for compliance to applicable codes.
- .11 Shop drawings to indicate:
 - .1 Material Specification including CSA or ULC reference numbers.
 - .2 Installation details to suit the applications on this project.
 - .3 Operating and maintenance requirements.
- .12 Material Safety Data Sheets (MSDS):
 - .1 Submit Material Safety Data Sheets (MSDS) in accordance with Division 01 - Submittal Procedures for the following products. Indicate VOC emissions, prior to installation or use:
 - .1 Adhesives.
 - .2 Caulking compounds.
 - .3 Sealants.
 - .4 Insulating materials.
- .13 Closeout Submittals:
 - .1 Provide mechanical operation and maintenance data in compliance with Division 01 - Closeout Submittals and the following:
 - .1 The Contractor shall furnish and pay for three (3) complete sets of operating and maintenance manuals for the complete mechanical installation plus two (2) copies of the digital version of the manuals on USB type flash drive.

- .2 Supply indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 Front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;
 - .2 Introduction sheet listing, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 Equipment manufacturer's authorized contact person name, telephone number and company website;
 - .4 Table of Contents sheet, and corresponding index tab sheets;
 - .5 Copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
- .3 Operation and maintenance manual approved by, and final copies deposited with the Departmental Representative a minimum of 7-days before final inspection.
- .4 Operation data to include but not limited to:
 - .1 Pressure test reports, and certificates issued by governing authorities
 - .2 Control schematics for systems including environmental controls.
 - .3 Wiring and connection diagrams.
 - .4 A description of the systems and associated controls.
 - .5 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .6 Operational instructions for systems and associated components.
 - .7 A description of actions to be taken in the event of equipment failure.
 - .8 Valves schedule and flow diagrams.
 - .9 Colour coding chart.
- .5 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.
 - .3 Recommended maintenance practices and precautions.
 - .4 Complete parts lists with numbers.

- .6 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets indicating point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results and final commissioning report.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting, and balancing.
- .7 Digital Version of Manuals
 - .1 The digital version of the manuals and the hard copy version shall be prepared by the same company.
 - .2 Utilize latest version of Adobe Acrobat, Portable Document Format (pdf).
 - .3 The digital manual shall be enhanced with the following features: Bookmarks, Internet Links, and Internal Documents Links and Optical Character Recognition (OCR).
 - .4 All shop drawings shall be scanned to a minimum 216mm x 279mm size. If the original page is 279mm x 432mm, the digital copy shall also be 279mm x 432mm.
 - .5 Provide a minimum 300 DPI for all scanned pages.
 - .6 All scanned material may be searched for text with minimum 60% Optical Character Recognition (OCR).
 - .7 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.
 - .8 Digital manual shall be organized in the same manner as the hard copy manual. Bookmark all major tabs and sub-sections and each set of shop drawings. Link the Table of Contents to the referenced section. Insert Internet Links to the Mechanical Equipment Manufacturers/Suppliers/Contractors official websites
- .8 Approvals:
 - .1 Submit 1 copy 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.
- .9 Warranties
 - .1 Include copy of all equipment warranty and extended warranty certificates into the Operation and Maintenance Manual.
- .10 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need as it becomes apparent during demonstrations and instructions.
 - .2 Results of Departmental Representative's Orientation (demonstrations).

- .3 List of spare parts turned over to Departmental Representative's forces.
- .2 Site records:
 - .1 Contractor shall maintain 1 set of white prints at contractors cost to mark changes as work progresses and as changes occur.
 - .2 Use different colour waterproof ink for each service. Do not use pencil or black ink.
 - .3 Transfer information weekly to show work as actually installed.
 - .4 Make available for reference purposes and inspection.
 - .5 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Departmental Representative for review. Make necessary revisions to drawings as per Departmental Representative's comments, to satisfaction of Departmental Representative.
- .3 Record drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for Mechanical, finalize production of record drawings.
 - .2 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Departmental Representative as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Departmental Representative
 - .3 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).
 - .4 Submit to Departmental Representative for approval and make corrections as directed.
 - .5 Perform testing, adjusting and balancing for HVAC using record drawings.
 - .6 Submit completed reproducible record drawings with Operating and Maintenance Manuals.
 - .7 Cost to transfer record information onto reproducible media & Auto-CAD are this contractor's responsibility. Departmental Representative will release drawings to contractor after signing a copyright form.
 - .8 Should the Contractor choose to utilise this Departmental Representative for transferring as built information, allow \$400 / sheet for all drawings in the construction set. This will cover costs for drafting time & printing costs.
 - .9 Submit copies of record drawings for inclusion in final testing and balancing report
 - .10 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Departmental Representative.

1.10 Spare Parts Submittals

- .1 Furnish spare parts in accordance with Division 01 - Closeout Submittals and as follows:
 - .1 One set of V-belts as applicable for each piece of machinery.
 - .2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Additional spare parts shall also be included as outlined in their appropriate sections.
- .3 Provide one set of special tools if required to service equipment as recommended by manufacturers.

1.11 Quality of Work

- .1 All work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Departmental Representative.
- .2 Work, which does not conform to standards accepted by the Departmental Representative and the trade, may be rejected by the Departmental Representative. The Contractor shall redo rejected work to the accepted standard at no cost to the Departmental Representative.

1.12 Metric Conversion

- .1 All units in this division are expressed in SI units.
- .2 Submit all shop drawings and maintenance manuals in SI units.
- .3 On all submittals (shop drawings etc.), use the same SI units as stated in the specification.
- .4 Equivalent Nominal Diameters of Pipes - Metric and Imperial:
 - .1 Where pipes are specified with metric dimensions and Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment, and piping.
 - .2 When CSA approved SI Metric pipes are provided, the Contractor shall provide at no extra cost adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

| Equivalent Nominal Diameter Of Pipes | | | | | |
|---|--------------|-----|--------------|-----|--------------|
| mm | inches (NPS) | mm | inches (NPS) | mm | inches (NPS) |
| 3 | 1/8 | 40 | 1-1/2 | 200 | 8 |
| 6 | 1/4 | 50 | 2 | 250 | 10 |
| 10 | 3/8 | 65 | 2-1/2 | 300 | 12 |
| 15 | 1/2 | 75 | 3 | 375 | 15 |
| 20 | 3/4 | 100 | 4 | 450 | 18 |
| 25 | 1 | 125 | 5 | 500 | 20 |
| 30 | 1-1/4 | 150 | 6 | 600 | 24 |

- .5 Metric Duct Sizes:
 - .1 The Metric duct sizes are expressed as 25 mm = 1 inch.

1.13 Drawings and Specifications

- .1 Drawings and specifications are complementary to each other, and what is called for by one shall be binding as if called for by both.
- .2 Should any discrepancy appear between drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of the plans, and specifications, obtain written clarification from the Departmental Representative during the tender period. Without a written clarification, the better quality and/or greater quantity of work or materials shall be estimated, performed and furnished within the tendered price.
- .3 Examine all contract documents, including all drawings and specifications, and work of other trades to ensure that work is satisfactorily carried out without changes to building.

1.14 Cutting, Patching and Coring

- .1 Provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.
- .2 Drill for expansion bolts, hanger rods, brackets, and supports.
- .3 Perform x-rays and obtain written approval from the Departmental Representative before cutting or burning structural members.
- .4 Provide openings and holes required in precast members for mechanical work. Cast holes 100 mm or larger in diameter. Field cut smaller than 100 mm.
- .5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.
- .6 Removal of any existing pipe, conduit, or ductwork within a slab core hole or slab opening through floors and roofs must be removed completely, including any associated sleeving, in a safe manner. Provisions are to be made during the removal process to protect any occupants and/or fabric of the space below. The Departmental Representative is to be advised of all existing mechanical service penetration locations, such that site visits and field reviews can be fully co-ordinated and undertaken before and after the opening is closed in and filled.
- .7 Filling of any existing slab core or opening is to be with an engineered design of concrete fill complete with doweling for adhesion and/or fire stopping system as appropriate.

1.15 Excavation and Backfill

- .1 Provide all excavating to facilitate installation of the mechanical work, including shoring, pumping, 150 mm compacted sand bedding under and first 300 mm of compacted sand over piping and ducting.
- .2 Refer to drawing details as applicable.

1.16 Installation of Equipment

- .1 Pipe all equipment drains to building drains except systems containing glycol.
- .2 Unions and flanges shall be provided in piping or ductwork to permit easy removal of equipment.
- .3 Maintain permanent access to equipment for maintenance.
- .4 Where practical, locate cleanouts in areas inaccessible to inmates such as janitor closets, pipe chases, mechanical rooms, etc. Any cleanouts in inmate areas shall

be secured with tamper-proof screws. Refer to Technical Criteria for Correctional Institutions.

- .5 In inmate housing units, below-grade or concealed drain lines from water closets shall be a minimum of 150 mm in diameter. Refer to Technical Criteria for Correctional Institutions.
- .6 Floor drains in areas occupied by inmates shall have grates secured with vandal-proof screws. Refer to Technical Criteria for Correctional Institutions.
- .7 To reduce the possibility of inmates hiding or disposing of contraband, grate openings in inmate areas shall consist of multiple holes approximately 10 mm in diameter. Refer to Technical Criteria for Correctional Institutions.
- .8 The plumbing security type access box shall have 1.9 mm type 304 stainless steel cover secured with vandal-resistant screws. Refer to Technical Criteria for Correctional Institutions.

1.17 Connections to Existing Services

- .1 Maintain liaison with the Departmental Representative and provide a mutually acceptable schedule to interrupt, reroute or connect to existing building services with the minimum of interruption of those services.
- .2 Major services shall not be interrupted before all preparatory work is completed and all required materials are on site. Provide a minimum of 48 hours' notice for all service shutdowns. Allow for major service interruptions outside of normal operating hours of the facility.
- .3 Interruptions and shutdowns of existing services shall be by the building/plant maintenance staff. Advise building/plant maintenance staff of the duration of service interruption or shut down.

1.18 Selective Demolition

- .1 Reference Standards
 - .1 Unless otherwise specified, carry out demolition work in accordance to CSA S350-M1980 Code of Practice for Safety in Demolition of Structures.
- .2 Remove from site all equipment, ducting or piping which is no longer required because of work under this Contract.
- .3 Existing Conditions
 - .1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.
- .4 Protection
 - .1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety of such work. Be liable for any such movement or settlement and any damage or injury caused.
 - .2 Cease operations and notify the Departmental Representative immediately for special protective and disposal instructions when any asbestos materials are uncovered during the work in this Section.
 - .3 Prevent debris from blocking surface drainage inlets and all types of drainage piping systems which remain in operation

- .5 Salvageable Materials
 - .1 Except as otherwise stated, salvageable materials from area of demolition shall become the property of the Departmental Representative at his discretion. All material not taken over by the Departmental Representative or removed from the building under this contract shall be removed from this site and disposed of as required by any applicable disposal regulations.
 - .2 Turnover to and deliver to the Departmental Representative's storage area all items which have been determined to have salvage value and has been removed due to the Work.

1.19 Equipment and Materials

- .1 Materials and equipment installed shall be new, CSA approved and of quality specified.
- .2 Each major component of equipment shall bear manufacturer's name, address, catalog and serial number in a conspicuous place.
- .3 Where two or more products of the same type are required, products shall be of the same manufacturer.
- .4 Notify the Departmental Representative in writing ten (10) days prior to the tender close, any materials or equipment specified which is not currently available or will not be available for use as called for herein. Failing this, the contract will assume that the most expensive alternate has been included in the tender price.
- .5 All equipment supplied to the project will meet efficiencies as defined in ASHRAE Standard 90.1 and NECB (current versions)

1.20 Cleaning

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Departmental Representative. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work. Refer to Section 01 74 11 Cleaning.
- .2 Clean equipment and devices installed as part of this project

1.21 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Division 01 - Common Product Requirements, the manufacturer's written instructions and the following:
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials and equipment in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area.
 - .2 Store and protect equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping, equipment and duct systems.

- .5 Protect equipment and open-end duct with polyethylene covers and maintain equipment on crates until installation.
- .6 Operate, drain and flush out unsealed bearings and refill with fresh oil before final acceptance.
- .7 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.
- .8 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .9 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.
- .10 Develop a Construction Waste Management Plan or Waste Reduction Work plan as related to Work of this Section in accordance with Division 01 – Construction Demolition Waste Management and Disposal.
- .11 Packaging Waste Management
 - .1 Remove for reuse and return pallets, crates, padding, packaging materials etc. as specified in the Construction Waste Management Plan or Waste Reduction Work plan in accordance with Division 01 - Construction Demolition Waste Management and Disposal.

1.22 Fire Stopping and Smoke Seals

- .1 Provide fire stopping and smoke seals as required in accordance with Division 07 – Fire Stopping.

1.23 Access Doors

- .1 General
 - .1 Provide access doors for maintenance or adjustment of all parts of the mechanical system. This shall apply but not be limited to valves, dampers, cleanouts and controls.
 - .2 Where equipment is concealed by a ceiling, the location of equipment shall be indicated by coloured markings. Refer to Section 23 05 53 Identification for Mechanical Piping and Equipment.
 - .3 Where equipment is concealed by a continuous structural or architectural surface, supply access doors of design to suit and match the surface in which they will be installed.
 - .4 Provide stainless steel doors in walls of washrooms, kitchen, utility rooms and laundry rooms.
 - .5 Provide Drywall type access doors in all drywall spaces requiring access to equipment.
 - .6 All fasteners on access panels shall be tamper proof, contractor shall provide three (3) sets of keys.
 - .7 Locate all access doors outside of secure areas where possible. Where not possible, review the locations of panels with the Departmental Representative prior to installation. All access panels within secure areas are to be of penal quality, lockable, vandal-proof and ligature resistant.

- .8 Provide 300 mm x 300 mm minimum size for inspection and hand access.
- .9 600 mm x 600 mm minimum size, larger if indicated on drawings, where entry is required and access is difficult.
- .10 Size to suit masonry modules when located in a masonry wall.
- .11 When located in a finished floor with tile, stonework, terrazzo, etc., a recessed bearing type access door is required. The door surface shall have a recess to take the particular surface material and pattern if this is available at the time the units are ordered.
- .12 Security Access Doors:
 - .1 Access doors for security areas shall be 1.70 mm thick double skinned internally reinforced at 150 mm on centre, 4.76 mm thick, insulated in pressed sink wiped cold rolled steel metal frame (similar to door frame) complete with necessary preparation to receive security lock escutcheon and hinges.
- .2 Submittals:
 - .1 Submit shop drawings for all access doors anticipated on this project.

1.24 Single Point Electrical Connection

- .1 If the equipment is indicated on the schedules or within the motor list (both included in the mechanical drawings) as a single point connection, the equipment shall be provided with all integral HOA type starters, internal wiring to all motors, starters, lighting, service outlets etc. such that a single electrical connection can be utilized to power all components within the unit. The unit shall also incorporate the required step-down transformers and wiring to connect all of these internal components including controls wiring. Coordinate with the controls subcontractor for the supply, installation, and wiring of control components.

1.25 Motor Starters and Accessories

- .1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.
- .2 Unless otherwise specified, starters for 1-phase motors are to be 115 volt; thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.
- .3 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.
- .4 Starters for 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.
- .5 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:
 - .1 Enclosures exposed to the elements – Type 3R, constructed of stainless steel;
 - .2 Enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;
 - .3 Enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;

- .4 Enclosures except as noted above – Type 1;
- .5 Enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.
- .6 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off

1.26 Miscellaneous Metals

- .1 Provide all necessary miscellaneous to hang or support materials, equipment and provide access for work under this contract.
- .2 All miscellaneous metals shall be prime painted.
- .3 Miscellaneous metals shall include but not limited to:
 - .1 Hangers for equipment, piping and ductwork.
 - .2 Support for equipment.

1.27 Scaffolding, Hoisting and Rigging

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Departmental Representative.
- .2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Departmental Representative.

1.28 Pipe Sleeves

- .1 Pipe sleeves shall be provided for piping passing through walls and floors. Minimum schedule 40 steel pipes or factory fabricated, flanged, high-density polyethylene sleeves with reinforced nail bosses. Sleeves shall extend 25 mm on either side of the wall.
- .2 Schedule 40 steel pipes shall be used as floor pipe sleeves in wet areas with a 50 mm up-stand.
- .3 Review and coordinate sleeve diameters with fire stop installation details as applicable.
- .4 Pipe sleeves are not required where pipes pass through cored concrete walls or floors.

1.29 Water Proofing Materials

- .1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

1.30 Escutcheons and Plates

- .1 Provide escutcheons and plates on all piping and ductwork passing through finished walls, floors and ceilings.
- .2 Escutcheons shall be one piece, stainless or chrome plated steel.

1.31 Progress Claim Breakdown

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Departmental Representative in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Departmental Representative's approval and review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.32 Notice for Required Field Reviews

- .1 Whenever there is a requirement for Departmental Representative to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Departmental Representative.
- .2 If Departmental Representative is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until Departmental Representative advises that it may be concealed.
- .4 When Departmental Representative is requested to perform a field review and work is not ready to be reviewed, reimburse Departmental Representative for time and travel expenses

1.33 Changes in the Work

- .1 Whenever Departmental Representative proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Departmental Representative for review, a quotation being proposed cost for executing change or revision.
- .2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 Make requests for changes or revisions to work to Departmental Representative in writing and, if Departmental Representative agrees, will issue Notice of Change.
- .4 Do not execute any change or revision until written authorization for the change or revision has been obtained from Departmental Representative.

1.34 Temporary or Trial Usage

- .1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract shall not represent acceptance.
- .2 Repair or replace permanent equipment used temporarily.
- .3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.35 Instruction to Departmental Representative

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train Departmental Representative's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Departmental Representative's choice), of Departmental Representative's designated personnel, on operation and maintenance procedures of system.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
 - .1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting – diagnostic instructions, test and inspection procedures;
 - .3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
 - .4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
 - .5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Departmental Representative's designated personnel, submit to Departmental Representative for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Departmental Representative's comments in final copy.
- .6 Obtain in writing from Departmental Representative a list of Departmental Representative's representatives to receive instructions. Submit to Departmental Representative prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
 - .1 Date instructions were given to Departmental Representative's staff;
 - .2 Duration of instruction;
 - .3 Names of persons instructed;
 - .4 Other parties present (manufacturer's representative, etc.).
- .7 Obtain signatures of Departmental Representative's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings

1.36 Guarantee / Warranty

- .1 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of Substantial Performance. The Contractor shall, at his own expense, repair and replace any work, which fails or becomes defective during the term of the guarantee/warranty, providing such work is not due to improper usage. The period of guarantee specified shall not in any way supplant any other guarantees of a longer period but shall be binding on work not otherwise covered.
- .2 Use of permanent systems for temporary heat shall not modify terms of the manufacturers' warranty or the guarantee.
- .3 If the equipment is used during construction, the warranty or guarantee period shall not be shortened or altered.

1.37 Substantial and Total Performance

- .1 Prior to requesting an inspection for Substantial Performance, provide a complete list of items, which are deficient.
- .2 A certificate of Substantial Performance will not be granted unless the following items are completed and available to the Departmental Representative:
 - .1 Final Plumbing Inspection Certificate from the Authority having Jurisdiction.
 - .2 Schedule S-C for seismic engineering.
 - .3 Commissioning checklists are completed and submitted as per Division 01.
 - .4 Vibration isolation supplier's inspection report
 - .5 Potable water piping's flushing and chlorination test certificate
 - .6 Major equipment – suppliers start-up test sheets and letters certifying start up. (packaged equipment)
 - .7 Draft Operating/Maintenance Manuals have been submitted for review.
 - .8 All mechanical systems have been commissioned and are capable of operation with alarm controls functional and automatic controls in operation.
 - .9 Air system has been balanced with draft report submitted to the Departmental Representative.
 - .10 Mechanical identification is complete.
 - .11 Warranty forms have been mailed to the manufacturer. Provide copy of the original warranty for equipment, which has a warranty period longer than one year.
 - .12 Operating and Maintenance demonstrations have been provided to the Departmental Representative.
 - .13 Written inspection report by manufacturer's representative has been submitted for noise and vibration control devices and flexible connections.
 - .14 Record drawings have been submitted.
 - .15 Fan plenums have been cleaned, and temporary filters have been replaced with permanent filters.
 - .16 All previously identified deficiencies have been corrected and accepted.

- .3 Prior to a Total Performance Inspection, provide declaration in writing that deficiencies noted at time of substantial performance inspection have been corrected and the following items completed prior to the total performance inspection:
 - .1 Submit final air balance report.
 - .2 Submit final operating and maintenance manuals.
 - .3 Complete final calibration.
- .4 The Departmental Representative shall provide one (1) visitation for the purpose of total performance inspection. Subsequent visitations if required shall be at the expense of the Contractor.
- .5 The Contractor shall provide qualified personnel in appropriate numbers to operate the facility until substantial performance is declared.

1.38 Alternate Materials and Equipment

- .1 The price submitted for this contract shall be based on the use of materials and equipment as specified.
- .2 Requests for alternate equivalent materials or equipment must be submitted to the Departmental Representative no later than seven (7) working days prior to the Mechanical trades' closing tender date. Submit all applicable technical data, including performance curves and physical details for review. Approval of requests shall only be given by addendum.
- .3 Approved equivalents and/or alternatives to specified products shall be equal to the specified product in every respect, operate as intended, and meet the space, capacity, and noise requirements outlined.
- .4 The Contractor shall be fully responsible for any additional labour and materials required by any trades or other Contractors to accommodate the use of other than specified materials or equipment. The Contractor shall bear any and all costs for design/system modifications to accommodate the "alternate" equipment. Extras will not be approved to cover such work.

2. PRODUCTS

2.1 Existing Services

- .1 Disconnect and cap all mechanical services in accordance with requirements of the authority having jurisdiction.
- .2 Building Mechanical Services: Maintain activity of all building services during demolition/removal of existing services required of this contract.
- .3 Maintain all trap seals and cap open-end pipe to ensure no sewer gas enters the building during renovations or demolition work. Maintain all existing sewer piping in a wet condition daily.

2.2 Demolition

- .1 Completely demolish the items scheduled and remove all materials from the premises unless otherwise requested by the Departmental Representative.

- .2 Carry out demolition in a manner to cause as little inconvenience to the occupied building area as building area as possible. Co-ordinate this activity with the Departmental Representative.
- .3 Carry out demolition in an orderly and careful manner.
- .4 All coring, patching and removal of existing equipment, pipes, and ductwork, which may affect the operation of occupied areas of the building, shall be carried out outside of regular office hours or as scheduled with the Departmental Representative.

2.3 Asbestos

- .1 The intent is for a Haz-Mat Contractor to remove all asbestos containing material prior to the proposed project work taking place. Notify the Departmental Representative if asbestos containing material is suspected to remain on site.
- .2 When new work is required to be connected to existing plumbing, piping, ductwork or equipment, which contains asbestos insulation or products the following, shall apply:
 - .1 Keep disruption to existing piping and equipment to a minimum
 - .2 Protect the site and all Contractors from the work
 - .3 Remove the asbestos at piping and equipment for new connections and carry out work in accordance with Work Safe BC requirements for asbestos removal.

2.4 Core Drilling

- .1 Clearly identify all proposed piping penetrations through existing slabs, walls etc. and advise the General Contractor. Obtain x-rays of the locations to ensure penetration will avoid any existing post tension cables or reinforced steel. Advise the Departmental Representative of any conflicts as a result of the x-rays and obtain the Departmental Representative approval before any coring take place.

2.5 Fire Stopping and Smoke Seals

- .1 Provide fire-stopping materials as applicable as per Division 07.

2.6 Access Doors

- .1 Drywall Surface: Extruded aluminum frame with gypsum board inlay and structural corner elements. Hinge to be concealed 2-point hinge, non-corroding with screwdriver operated cam latch.
- .2 Masonry Surface: Universal design, steel door (1.6 mm) and steel frame (1.2 mm), door flush to frame, rounded safety corners, continuous concealed hinge, screwdriver operated cam latch, prime coat grey painted finish.
- .3 Tile Surface: Universal design, stainless steel door (1.6 mm) and stainless steel frame (1.2 mm), door flush to frame, rounded safety corners, continuous concealed hinge, screwdriver operated cam latch, #4 satin stainless steel finish.
- .4 Plaster Walls and Ceiling: steel door 2 mm and steel frame 2 mm, door flush to frame edge, expansion casing bead and 75 mm wide galvanized lath surround recessed 18 mm to receive plaster, continuous concealed hinge, screwdriver operated cam latch, prime coat grey painted finish.

- .5 Acoustic Plaster: Steel door (1.6 mm) and steel frame (2 mm), door recessed 12 mm lined with self-furring lath, 75 mm wide galvanized lath surround recessed 18 mm to receive plaster flush to frame edge, concealed pivoting rod type hinge, screwdriver operated cam latch, prime coat grey painted finish.
- .6 Acoustical Tile Ceilings: Steel door (1.6 mm) and steel frame (2 mm), door recessed 25 mm to receive acoustic tile, concealed pivoting rod type hinge, screwdriver operated cam latch, prime coat grey painted finish.
- .7 Ductwork: Ultra low leakage type, flat oval design, galvanized steel frame (0.7 mm), double skin galvanized steel door (0.7 mm) with 25mm insulation fully enclosed in panel, bulb type seal integrally fastened to door, lever cam locks. Provide stainless steel in lieu of galvanized steel in stainless steel ductwork.

2.7 Electrical Motors

- .1 All Motors, 1 H.P. motors and larger, shall be energy efficient design and have a minimum and nominal full load efficiency, which will meet or exceed the values listed in accordance CAN/CSA C390-1. The minimum efficiency shall be guaranteed.
- .2 Belt Drives: Provide belt drives to the following requirements:
 - .1 Provide steel, cast iron or aluminum sheaves for motors less than 3/4 H.P.
 - .2 Provide steel or cast iron sheaves keyed to shafts, for motors 3/4 H.P. and larger.
 - .3 For motors less than 10 H.P. provide standard adjustable pitch drive sheaves having +/-10% range. Use mid-position of range for specified RPM.
 - .4 Match drive and driven sheaves.
 - .5 V-belts shall conform to the American Belt Manufacturers standards. Multiple belts shall be matched sets.
 - .6 Not less than a 2-belt configuration is required for each drive for motors 3/4 H.P. and larger.
 - .7 Minimum drive rating shall be 150% of nameplate rating of motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
 - .8 Motor slide rail adjustment baseplate with double draw bolt, shall allow for centre line adjustment.
 - .9 Tension belts to manufacturers recommendations before start up and after 100 hours of operation using calibrated belt tensioning gauge.
 - .10 Provide one spare set of belts for each piece of equipment with each belt separately identified for the equipment item to be served.
- .3 Shaft Couplings: Shaft couplings shall be of the pin or jaw neoprene insert type, gear type, or flexing steel insert type and shall allow coupling inserts to be easily removed without disassembly of the equipment.
- .4 Guards:
 - .1 Provide removable protective guards on all exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.
 - .2 Guards for drives shall have:
 - .1 1 mm expanded metal screen welded to 25 mm steel angle frame.

- .2 1.5 mm thick galvanized sheet metal tops and bottoms.
- .3 Removable sides for servicing.
- .4 38 mm dia. holes on both shaft centres for insertion of tachometer.
- .5 Sectionalize if necessary so one man can handle removal.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Fabricate and install belt guards for V-belt drives to permit movement of motors for adjusting belt tension and for belt slap.
- .5 Provide removable "U" shaped guards for flexible couplings with 2.5 mm thick galvanized frame and 1.2 mm thick expanded mesh face.
- .6 Provide guards on all unprotected fan inlets and outlets. Guards to be provided by fan manufacturer.
- .7 Prime coat guards and finish paint to match equipment.
- .8 Secure guards to equipment allowing for ease of removal.

3. EXECUTION

3.1 Painting Repairs and Restoration

- .1 Do painting in accordance with Division 09 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.
- .4 Clean exposed bare metal surfaces supplied under Divisions 21, 22, 23 and 25. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.
- .5 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer.

3.2 System Cleaning

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

3.3 Field Quality Control

- .1 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturers' verifying compliance of the work, in handling, installing, applying, protecting, cleaning and start-up of a product.
 - .2 Submit Manufacturer's Field Reports as described in PART 1 - Submittals.
 - .3 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.4 Demonstration

- .1 Departmental Representative may 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 the 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 Where specified elsewhere in Division 21, 22, 23 or 25 manufacturers to provide demonstrations and instructions.
- .4 Use operation and maintenance manual, record drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration requirements shall be as specified in the appropriate sections.
- .6 Contractor will record these demonstrations on digital video for future reference.

3.5 Fire Stopping and Smoke Seals

- .1 Refer to Division 07.

3.6 Access Doors

- .1 Installation:
 - .1 Provide all access doors required to access work installed by Divisions 21, 22, 23 and 25. Be responsible for coordinating locations, cutting opening and installing panels. Any secondary supports, blocking etc. will be by the ceiling or wall contractor.
 - .2 Access doors in mechanical equipment to be provided by this Division.
 - .3 Access panel requirements and locations shall be fully coordinated with all involved contractors prior to the installation of any mechanical systems or equipment.
- .2 Location:
 - .1 Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.
- .3 Provide 3 sets of each type of access door key to the Departmental Representative at substantial completion. Obtain a signed receipt indicating date, quantity of keys and person receiving keys. Submit receipt to the Departmental Representative.

3.7 Electrical Motors

- .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.
- .2 Installation:
 - .1 Unless otherwise noted starters and protection devices will be included under Division 26 - Electrical.
 - .2 Co-ordinate with Division 26 Contractor to ensure proper connection, correct thermal overload protection and correct motor controls.
 - .3 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.
 - .4 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.

- .5 Fasten securely in place.
- .6 Make removable for servicing, easily returned into, and positively in position.
- .3 Setting and Alignment:
 - .1 Employ a journeyman millwright to align all V-belt drives and/or shaft coupling drives. The millwright shall check that centrifugal fan wheels are properly centred on fan shafts.
 - .2 Align shaft couplings, using a dial indicator, to within +/-0.051 mm after grouting is complete and the piping system is operational.
 - .3 Align V-belt drives using a straight edge.
 - .4 Submit a certificate from the millwright employed, certifying that all shaft couplings and V-belt drives have been aligned and centrifugal fan wheels centred prior to initial start-up and checked again after final system balance adjustment.

3.8 Protection

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

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Sanitary and storm cleanouts for interior and exterior applications to within 1m from the building.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and shall be read, interpreted, and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical

1.3 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
 - .1 Applicable Building Code - Refer to Section 21 05 01
 - .2 Technical Criteria for Correctional Institutions, April 2015.

1.4 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:
 - .1 Shop drawings:
 - .1 Cleanouts
 - .2 Valve boxes
 - .2 Closeout submittals: submit all reviewed shop drawings for incorporation into manual specified in Section 21 05 01 – Common Work Results for Mechanical

1.5 General Requirements

- .1 Provide cleanouts on all sanitary and storm drainage piping at all changes in direction, at the ends of all horizontal runs, at the base of every stack, where drains leave the building; where shown on the drawings and in compliance with the local plumbing code, bylaws and ordinances.
- .2 Cleanout spacing on horizontal drainage piping shall be as a maximum:
 - .1 7.5 m apart in piping less than 3 NPS
 - .2 15 m apart in piping 3 NPS and 4 NPS
- .3 Provide caulked or threaded type cleanouts extended to finished floor wall surface.
- .4 Provide bolted cover plate clean-outs on vertical rainwater leaders only. Ensure ample clearance at clean-out for rodding of drainage system.
- .5 All cleanouts shall be full pipe size for pipes 4 NPS and smaller.
- .6 Cleanouts shall be 4 NPS for pipes 4 NPS and larger.
- .7 Where practical, locate cleanouts in areas inaccessible to inmates such as janitor closets, pipe chases, mechanical rooms, etc. Any cleanouts in inmate areas shall

be secured with tamper-proof screws. Refer to Technical Criteria for Correctional Institutions.

- .8 In inmate housing units, below-grade or concealed drain lines from water closets shall be a minimum of 150 mm in diameter. Refer to Technical Criteria for Correctional Institutions.

2. PRODUCTS

2.1 Flashing

- .1 Lead Flashing:
 - .1 Waterproofing: 24.4 kg/sq m sheet lead
 - .2 Soundproofing: 4.9 kg/sq m sheet lead.
- .2 CPE Flashing:
 - .1 1 mm thick chlorinated polyethylene (CPE).

2.2 Floor - Unfinished Area

- .1 Provide the following clean out in unfinished areas such as concrete floors in equipment rooms and flush type C.O. in outside areas.
 - .1 Cast iron floor level cleanout assembly with extra heavy duty, round, adjustable, scoriated, secured cast iron top and no-hub outlet. Suitable for heavy traffic.

2.3 Floor - Finished Area

- .1 Provide the following cleanout for general areas of a building:
 - .1 Cast iron cleanout with extra heavy duty round, adjustable, scoriated, secured nickel bronze top, and no-hub outlet
- .2 Provide the following cleanout for foot traffic areas with sheet goods flooring:
 - .1 Cast iron floor level cleanout assembly with a square adjustable nickel bronze top with 6mm tile recess, surface membrane clamp and no-hub outlet.
- .3 Provide the following for a cleanout in a carpeted floor area subject to foot traffic:
 - .1 Cast iron floor level cleanout assembly with round, adjustable, scoriated, nickel bronze top, and carpet clamping frame.
- .4 Provide the following cleanout in a terrazzo or other poured floor with foot and medium load wheeled traffic:
 - .1 Cast iron floor level cleanout assembly with round adjustable nickel bronze top with 12mm terrazzo recess and center lifting device, and no-hub outlet

2.4 Wall – Finished Area

- .1 Provide the following full calibre caulk ferrule cleanout for a hub opening in drainage piping in a finished wall:
 - .1 Cast iron full calibre caulk ferrule with cast bronze taper thread plug and stainless steel round cover and screw.
- .2 Provide the following cleanout in a concealed drainage line in a finished wall:

- .1 Cast iron cleanout tee and cast iron countersunk plug with stainless steel round cover and screw.

2.5 Cleanout – Copper Pipe

- .1 Cast brass with raised shoulder on plug and gasket.

2.6 Cleanouts – Cast Iron Pipe

- .1 Steel plug type.

3. EXECUTION

3.1 General

- .1 Cleanouts shall be extended to a finished wall or floor unless exposed in a basement area or similar. Cleanout piping may require to be extended beyond the room as required for cleanout installation.
- .2 All cleanouts passing through walls or floors with a waterproofing membrane shall have a clamping collar, which shall be clamped to the membrane.
- .3 All barriers for cleanout plugs shall be securely anchored so that they do not rotate when plug is being removed.
- .4 Install cleanouts on vertical risers a minimum of 200mm above finished floor.
- .5 Coordinate location of interior cleanouts with millwork and other obstructions such that clearance for access and rodding is maintained.
- .6 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

3.2 Flashing

- .1 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m² lead or equivalent.

3.3 Floor – Unfinished Areas

- .1 All outside cleanouts in paved areas shall be extended to grade in cast iron. They shall be sufficiently anchored in a 300 mm x 300 mm x 100 mm thick concrete block of concrete to prevent rotation of the pipe. Concrete work shall be provided and installed by Division 03.

3.4 Floor - Finished Areas

- .1 Where cleanouts occur in carpeted areas, they shall be extended to the finished walls unless the Departmental Representative gives special permission for them to terminate in the carpeted floor.
- .2 In potentially wet areas such as washrooms, cleanouts shall be extended to the walls wherever possible. Where conditions do not permit wall cleanouts, the cleanout cover shall be waterproof type with nickel bronze frame and cover and integral waterproofing clamping collar.
- .3 No cleanouts shall terminate at the ceiling of a room, sanitary and storm shall be extended to the floor above. Cleanouts shall not terminate in the floor of any sterile rooms.

3.5 Access Doors

- .1 Access doors shall be in compliance with Section 21 05 01 Common Work Results for Mechanical – Access Doors and the following:
 - .1 Access doors shall have a minimum clear opening of 200 mm x 200 mm for cleanouts 2 NPS and smaller 300 mm x 300 mm for cleanouts 3 NPS and larger.
 - .2 Painted walls: Provide prime coated covers as specified in Section 21 05 01 Common Work Results for Mechanical – Access Doors.
 - .3 Feature walls: Avoid covers on feature walls; i.e.: wood panels. If unavoidable, the covers shall be for painted walls but with finish material secured to the cover to the satisfaction of the Departmental Representative and finished flush with wall.
 - .4 Access doors in fire rated walls shall be fire rated to match the wall rating.

END OF SECTION

1. GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 Fire stopping of mechanical services penetrating fire separations.
- .2 Related Sections:
 - .1 This section of the Specification forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts of the Contract Documents including Section 07 84 00 Fire Stopping. If the requirements for fire stopping of mechanical services penetrations of this section differ from the requirements of Section 07 84 00, the most stringent requirements shall apply.

1.2 Intent

- .1 This Section includes through penetration fire stopping and smoke seal systems for penetrations through the following fire resistance rated assemblies, including both empty openings and openings containing penetrating items:
 - .1 Floors
 - .2 Walls and partitions
 - .3 Smoke barriers
 - .4 Construction enclosing compartmentalized areas
- .2 The 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 the Project.
 - .2 Materials having only a ULC label will not be acceptable for use on the Project, unless supporting documentation is provided indicating its use in a listed assembly.

1.3 Scope:

- .1 Provide fire stopping for all mechanical work in Divisions 21, 22, 23 and 25.
- .2 For renovation, projects, in addition to the necessary new penetrations, provide the fire stopping for all existing mechanical assemblies where fire stopping is damaged, discontinued or absent.

1.4 References

- .1 Applicable Building Code - Refer to Section 21 05 01.
- .2 Applicable Fire Code - Refer to Section 21 05 01.
- .3 ASTM E84-18a – Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 ASTM E119-18a – Standard Test Methods for Fire Tests of Building Construction and Materials.

- .5 ASTM E814-13a (2017) – Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .6 ASTM E1966-15 – Standard Test Method for Fire-Resistive Joint Systems.
- .7 ASTM E 2174 – 18, “Standard Practice for On-Site Inspection of Installed Firestops
- .8 CAN/ULC-S101-14 - Fire Endurance Tests of Building Construction and Materials.
- .9 CAN/ULC-S102-10 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .10 CAN/ULC-S115-11 (R2016) – Standard Method of Fire Tests of Firestop Systems.
- .11 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- .12 NFPA 101-2012 – Life Safety Code.
- .13 NFPA 251 – Standard Methods of Tests of Fire Resistance of Building Construction and Materials.
- .14 UL 263 – Standard for Fire Tests of Building Construction and Materials (ASTM E119, NFPA 251).
- .15 UL 1709 – Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel.
- .16 UL 1479 – Standard for Fire Tests of Penetration Firestops. (ASTM E814).
- .17 UL 2079 – Standard for Tests for Fire Resistance of Building Joint Systems.
- .18 ULC (Underwriters Laboratories of Canada) - List of Equipment and Materials for:
 - .1 Building Materials.
 - .2 Fire Resistance.
 - .3 Firestop Systems and Components.
- .19 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN4-S115-M under their designation of ULC-S115-M and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.
- .20 Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-M are given a cUL listing and are published by UL in their “Products Certified for Canada (cUL) Directory.

1.5 Definitions

- .1 Fire stopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.6 System Description

- .1 Fire stopping systems installed to resist spread of fire and passage of smoke and other gases at penetrations through fire resistance rated wall, floor assemblies, materials, and components.

1.7 Performance Requirements

- .1 Materials, accessories, and application procedures listed by ULC cUL, or tested in accordance with CAN/ULC-S115 to comply with building code requirements.
- .1 Fire stopping Materials: CAN/ULC-S101 ASTM E119 ASTM E814 to achieve a fire rating as noted on Drawings.
- .2 Surface Burning: CAN/ULC-S102 ASTM E84 with a flame spread/smoke developed rating of 25/50.

1.8 Administrative Requirements

- .1 Coordination: Coordinate with other work having a direct bearing on work of this section.
- .2 Pre-installation Meetings: Convene one (1) week before starting work of this section.

1.9 Submittals for Review

- .1 Submit shop drawings for all firestop systems anticipated on this project in accordance with Section 01 33 00 Submittal Procedures.
- .2 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.
- .3 Shop drawings shall be complete with a systems directory for system details.
- .4 Submit material safety data sheets provided with product delivered to job-site.
- .5 System Design Listings: Submit system design listings, including illustrations from a qualified testing and inspection agency that is applicable for each firestop configuration.

1.10 Quality Assurance

- .1 Products of This Section: Manufactured to ISO 9000 and 14000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience and FAIC Manufacturer Member in good standing.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience, approved by the manufacturer and as follows:
 - .1 Installer shall be certified, licensed, or otherwise qualified by the fire stopping manufacturer as having the necessary training to install the manufacturer's products to specified requirements. On request, the certified installer shall provide documented proof of certification from the firestop system manufacturer. A manufacturer's willingness to sell its firestop products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
 - .2 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

- .4 Retain and pay for the service of a Professional Engineer registered in the Province of British Columbia to inspect each and every mechanical fire stopping installation, and as required by the Authority having jurisdiction, and provide a report on all installations. The fire stopping engineer shall provide letters of assurance to the Departmental Representative, in accordance with the British Columbia Building Code.
- .5 A manufacturer's direct representative (not distributor or agent) shall be on-site during the initial installation of firestop systems to train appropriate contractor personnel in correct selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- .6 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- .7 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council and the Authorities having jurisdiction and be sealed by a Professional Engineer registered in the Province of British Columbia.

1.11 Regulatory Requirements

- .1 Conform to applicable code for fire resistance ratings and surface burning characteristics.
- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.12 Delivery, Storage and Protection

- .1 Deliver fire stopping products in original, unopened containers with labels intact and legible, identifying product and manufacturer.
- .2 Store and handle fire stopping materials to manufacturer's instructions.

2. PRODUCTS

2.1 Fire Stopping – General

- .1 Use the same product for all like applications.
- .2 Use the same manufacturer throughout the project and compatible materials for restoration work.
- .3 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke, and gases in compliance with requirements of CAN 4-S115-M and not exceeding intended opening sizes.
- .4 Fire stopping components compatible with each other, substrates forming openings and items penetrating the fire stopping under conditions of service and application.
- .5 Provide components for each fire stopping system that are needed to install fill material. Use only components specified by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .6 Where 'cast-in-place' fire stopping materials are used, provide fire stopping devices prior to concrete placement.

- .7 Firestop System Rating:
- .1 For penetrations through a fire wall or horizontal fire separation provide a firestop system with a 'FT' rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
 - .2 For combustible pipes, tubing, ducts, chimneys, optical fibre cables, electrical wires and cables, totally enclosed non-combustible raceways, electrical outlet boxes and similar building services that penetrate through a fire separation provide a firestop system with an 'F' Rating as determined by ULC or cUL as indicated below:.

| Separation Fire Resistance Rating | Fire Stopping Required ULC or cUL 'F' Rating |
|-----------------------------------|--|
| 30 minutes | 20 minutes |
| 45 minutes | 45 minutes |
| 1 hour | 45 minutes |
| 1.5 hours | 1 hour |
| 2 hours | 1.5 hours |
| 3 hours | 2 hours |

- .3 For joints provide a firestop system with an Assembly Rating as determined by CAN4-S115-M, ULC-S115-M or UL 2079 which is equal to the fire resistance rating of the construction being penetrated.

2.2 Manufacturers

- .1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following acceptable manufacturers:
 - .1 Refer to Section 23 05 01 Acceptable Manufacturers.
 - .2 JV-Industries Sleeves and Firestop Devices c/w Tremco Firestop materials.
 - .3 Emseal Emshield WFR2.
 - .4 Other manufacturers listed in the above noted reference Standards.

2.3 Accessories

- .1 Fibre Insulation: Alumina-silica refractory fibre insulation in blanket or bulk form with service temperature limit of 1315 degrees C, melting point of more than 1760 degrees C, specific gravity 2.56, thickness to suit application.
- .2 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .3 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .4 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.
- .5 Sealants for vertical joints: non-sagging.

2.4 Materials

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Pre-Installed firestop devices for use with non-combustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls:
 - .1 Hilti Cast-In Place Firestop Device (CP 680-P)
 - .1 Add Aerator Adaptor when used in conjunction with aerator system.
 - .2 Hilti Tub Box Kit (CP 681) for use with tub installations.
 - .3 Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - .4 Hilti Speed Sleeve (CP 653) for use with cable penetrations.
 - .5 Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - .6 Hilti Firestop Block (CFS-BL)
 - .7 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .3 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit, and electrical metallic tubing (EMT):
 - .1 3M Fire Stop Sealant 2000.
 - .2 3M Fire Barrier CP25 WB.
 - .3 Hilti CP 606 Flexible Firestop Sealant.
 - .4 Hilti CP 601s Elastomeric Firestop Sealant.
 - .5 Hilti FS-One Max Intumescent Firestop Sealant.
 - .6 Hilti FS 604 Self Levelling Firestop Sealant.
 - .7 Hilti CP-620 Fire Foam.
 - .8 Tremco Tremstop Fyre-Sil Sealant.
 - .9 Tremco Fyre-Sil SL.
 - .10 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .4 Sealants or caulking materials for use with sheet metal ducts:
 - .1 Hilti CP 601s Elastomeric Firestop Sealant.
 - .2 Hilti CP 606 Flexible Firestop Sealant.
 - .3 Hilti FS-One Max Intumescent Firestop Sealant.
 - .4 Hilti FS 604 Self Leveling Firestop Sealant.
 - .5 Tremco Fyre-Sil SL Sealant.
 - .6 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

- .5 Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps:
 - .1 3M Firestop Sealant 2000.
 - .2 Hilti CFS-SP WB Firestop Joint Spray.
 - .3 Hilti CP 601s Elastomeric Firestop Sealant.
 - .4 Hilti CP 606 Flexible Firestop Sealant.
 - .5 Hilti FS 604 Self Leveling Firestop Sealant.
 - .6 Tremco TREMstop Acrylic.
 - .7 Tremco Dymonic FC.
 - .8 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .6 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed flexible cable or cable bundles and plastic pipe:
 - .1 3M Fire Barrier CP25 WB.
 - .2 Hilti FS-One Max Intumescent Firestop Sealant.
 - .3 Tremco TREMstop IA.
 - .4 Tremco TREMstop WS.
 - .5 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .7 Intumescent sealants, caulking, or putty materials for use with low voltage cabling, communication cabling, and IT cabling:
 - .1 Hilti CP 653 Speed Sleeve.
 - .2 Hilti CP 680 Cast-in-Place Firestop Device.
 - .3 Hilti FS 657 Fire Block.
 - .4 Tremco TREMstop IA.
 - .5 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .8 Non-curing, re-penetrable intumescent sealants, caulking, or putty materials for use where future penetrations of low voltage cabling, communication cabling, or IT cabling may occur:
 - .1 Hilti CP 653 Speed Sleeve.
 - .2 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .9 Wall opening protective materials for use with cUL/ULC listed metallic and specified non-metallic outlet boxes:
 - .1 Hilti CP 617 Firestop Putty Pad.
 - .2 Tremco TREMstop MP.
 - .3 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

- .10 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa differential:
 - .1 3M Fire Barrier PPD Plastic Pipe Device.
 - .2 Hilti CP 648E/648S Wrap Strips
 - .3 Hilti CP 643N Firestop Collar.
 - .4 Hilti CP-644 Firestop Collar.
 - .5 Tremco TREMstop WS.
 - .6 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .11 Materials for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways:
 - .1 3M Firestop Foam 2001.
 - .2 3M Fire Barrier CS-195 Composite Sheet.
 - .3 Hilti CP-637 Firestop Mortar.
 - .4 Hilti CP 675T Firestop Board.
 - .5 Hilti CFS-BL Firestop Block.
 - .6 Hilti CP 620 Fire Foam.
 - .7 Tremco TREMstop PS.
 - .8 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .12 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways:
 - .1 Hilti CFS-BL Firestop Block.
 - .2 Hilti CP 675T Firestop Board.
 - .3 Tremco TREMstop PS.
 - .4 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .13 Sealants or caulking materials used for openings between structurally separate sections of wall and floors:
 - .1 3M Fire Barrier CP 25 WB.
 - .2 Hilti CFS-SP WB Firestop Joint Spray.
 - .3 Hilti CP 601s Elastomeric Firestop Sealant.
 - .4 Hilti CP 606 Flexible Firestop Sealant.
 - .5 Hilti FS 604 Self Leveling Firestop Sealant.
 - .6 Tremco TREMstop Fyre-Sil.
 - .7 Tremco Dymonic FC.
 - .8 Emseal Emshield WRF2.

- .9 Acceptable substitution product listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .14 Materials for locations of high re-penetration of low voltage wiring:
 - .1 Hilti CP635 Speed Sleeve.
- .15 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected:
 - .1 Hilti FS 657 Fire Block (for walls and floors)
 - .2 Hilti CP 658T Firestop Plug (for walls and floors)
 - .3 Hilti CP 680 Cast-In Place Firestop Device (for floors only)

3. EXECUTION

3.1 General

- .1 The Departmental Representative shall conduct mandatory destructive reviews for each type of installation. Destructive testing shall be at the discretion of the Departmental Representative and Authority having jurisdiction
- .2 Allow for destructive testing of 5% of fire stopping applications. Should installations not conform to manufacturer's listed assembly, an additional 25% of installations may 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 project.

3.2 Preparation

- .1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - .1 Verify penetrations are properly sized and in suitable condition for application of materials.
 - .2 Ensure surfaces to which firestop materials will be applied are free of dirt, grease, oil, rust, laitance, release agents, water repellants, and any other substances that may affect proper adhesion.
 - .3 Ensure all service lines are in place, tested and acceptable to the authority having jurisdiction, prior to application of fire stopping and smoke seal.
 - .4 Provide masking and temporary covering to prevent soiling of adjacent surfaces by fire stopping materials.
 - .5 Comply with manufacturer's recommendations for temperature and humidity conditions before, during, and after installation of fire stopping.
 - .6 Do not proceed until satisfactory conditions have been corrected.

3.3 Coordination

- .1 Installation is not to proceed until shop drawings have been reviewed.
- .2 Obtain fire resistance ratings and classifications for all wall and floor assemblies from the Architectural contract documents.

- .3 Coordinate location and proper selection of cast-in-place firestop devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- .4 Provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.
- .5 Fire stopping of floor and roof slab penetrations must precede steel stud track installation.
- .6 Fire stopping must precede fireproofing installation.
- .7 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.
- .8 Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- .9 Fire stopping must precede mechanical pipe insulation. Vapour barriers must be continued along with FPI – ASJ jacketing.

3.4 Installation

- .1 Regulatory Requirements: Install fire stopping and smoke seal material and components in accordance with ULC or cUL Certification and manufacturer's instructions.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
 - .1 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 by providing an air and water resistant seal.
 - .2 Consult with related trades before installation of ULC or cUL firestop systems that might hamper the performance of fire dampers in ductwork.
 - .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
 - .4 Tool or trowel exposed surfaces to a neat finish.
 - .5 Remove excess compound promptly as work progresses and upon completion.
 - .6 Protect materials from damage on surfaces subjected to traffic.
 - .7 Where possible, use metal sleeves for floor penetrations to prevent/mitigate the consequences of leakage or flooding.

3.5 Field Quality Control

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .3 Keep areas of work accessible until inspection by applicable code authorities.
- .4 Inspection of through-penetration fire stopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- .5 Use primers whenever recommended by manufacturer.

- .6 Perform patching and repairing of fire stopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- .7 Tag all penetrations and every 3 meters of joint seal with printed tags
 - .1 Tags shall indicate:
 - .1 Fire stop products used.
 - .2 Indicate the fire stop system # used, ULC or cUL.
 - .3 Date installed.
 - .4 Re-penetrated by & Date.
 - .5 F or FT rating.
 - .6 Installed by: (name and phone number of subcontractor).
 - .7 Person to contact and phone number in case of modification or new penetration of fire stop system.
 - .2 Tags shall state:
 - .1 CAUTION! FIRESTOP - DO NOT REMOVE, PUNCTURE OR DISCONTINUE UNLESS PREPARED TO RE-SEAL IMMEDIATELY WITH SPECIFIED PRODUCT

3.6 Clean Up

- .1 Remove temporary dams after initial set of fire stopping and smoke seal materials.
- .2 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .3 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.
- .4 Dispose of waste materials in conformance with Construction Waste Management Plan.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Thermal insulation and jacketing for plumbing piping and plumbing piping accessories.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
- .2 Applicable Building Code - Refer to Section 21 05 01- Common Work Results for Mechanical.
- .3 Applicable energy code or standard – Refer to Section 21 05 01 – Common Work Results for Mechanical.
- .4 Thermal Insulation Association of Canada (TIAC) – National Insulation Standards.
- .5 British Columbia Insulation Contractors Association (BCICA) – Quality Standard for Mechanical Insulation Manual.
- .6 CAN/ULC S102-M88 – Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .7 ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
- .8 ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

1.4 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:
 - .1 Certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Manufacturer's installation instructions.

1.5 General Requirements

- .1 The Installation firm shall be a current member of one of the following:
 - .1 Thermal Insulation Association of Canada (TIAC).
 - .2 British Columbia Insulation Contractors Association (BCICA).
- .2 Only Journeyman insulation applicators, with 3 years minimum successful experience in this size and type of project, shall perform the work.
- .3 Definitions:
 - .1 "CONCEALED" insulated mechanical services in trenches, chases, furred spaces, shafts and hung ceilings (services in tunnels are not considered to be concealed.)

- .2 "EXPOSED" will mean not concealed.
- .3 "K" value means Thermal Conductivity.
- .4 UL GREENGUARD: Provides independent third-party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's) and other specific product-related pollutants. Certification is based upon criteria used by Environmental Protection Agency (EPA), Occupational Safety and Health Organization (OSHA) and World Health Organization (WHO).
- .5 ASJ: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper.
- .6 SSL: Self-Sealing Lap.
- .7 FSK: Foil Scrim Kraft; jacketing.
- .8 PSK: Poly Scrim Kraft; jacketing.
- .9 PVC: PolyVinyl Chloride.
- .4 Provide thermal insulation on all new plumbing piping, valves and fittings as follows:
 - .1 Domestic cold water.
 - .2 Domestic hot water and recirculation (where applicable).
 - .3 All piping provided with heat tracing cable for freeze protection, and domestic hot water temperature maintenance.
 - .4 Provide foil faced flexible insulation on components requiring adjustment or servicing including meter sets, pressure reducing valves, valve bodies, strainers etc.
 - .5 Sanitary vent stacks for the last 3m prior to penetrating the roof or penetrating into a cold attic or similar space.
- .5 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact Departmental Representative.
- .6 Make good all existing insulation disturbed or removed to facilitate alterations and additions to existing piping

2. PRODUCTS

2.1 General

- .1 Products shall not contain asbestos, lead, mercury, mercury compounds or Polybrominated diphenyl ethers (PBDE).
- .2 Mineral fibre specified includes glass wool and rock wool.
- .3 Thermal conductivity ("k" factor) not to exceed specified values when tested in accordance with ASTM C547.
- .4 Insulation and jacketing materials shall not exceed 25 flame spread, 50 smoke developed rating when tested in accordance with CAN/ULC S102-M88 and NFPA 90A.
- .5 Insulation for PP-R piping shall be sized to fit the outer dimensions of the metric pipe sized piping system in lieu of standard NPS.

- .6 Glass mineral wool products shall have a recycled content of a minimum of 50 percent recycled glass content.
- .7 Low Emitting Materials: For all thermal and acoustical applications of glass mineral wool insulation, insulation shall be UL GREENGUARD Certified.

2.2 Preformed Pipe Covering

- .1 Piping Thermal Insulation:
 - .1 Piping service temperature 0°C to 315°C.
 - .2 Preformed insulation, formed glass mineral wool pipe insulation with all service jacket vapour retarder (ASJ). ASJ shall be re-enforced with glass fibre, factory applied with pressure sensitive lap closure.
 - .3 ASJ vapour transmission rate 0.02 perms maximum.
 - .4 "K" value at 24°C = 0.033 W/m.°C.

2.3 Blanket Insulation

- .1 Piping Thermal Insulation:
 - .1 Piping service temperature 0°C to 315°C.
 - .2 Flexible, glass mineral wool blanket insulation, all service aluminum foil vapour retarder (FSK). FSK shall be reinforced with glass fibre and factory applied.
 - .3 "K" value at 24°C = 0.035 W/m.°C.

2.4 Fastenings, Adhesives and Coatings

- .1 Insulation Fastenings: min. 1.6 mm thick galvanized wire, 0.6 mm thick aluminium wire, 0.6 mm thick type 304 stainless steel wire or 1.6 mm thick copper wire as commercially available.
- .2 Jacket Fastenings:
 - .1 Thermocanvas and All Service Jacket:
 - .1 Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.
 - .2 Metal Jackets:
 - .1 Sheet metal screws, pop rivets, stainless steel bands.
 - .3 PVC Jacket and Fitting Covers:
 - .1 PVC self-adhesive tape, plastic pop rivets, bonding cement.
- .3 Adhesives:
 - .1 Fabric adhesive to insulation pipe covering, water based, ultra-white, washable, anti-microbial.
- .4 Coatings:
 - .1 Vapour barrier coating on reinforcing membrane or on insulating cement:

2.5 Finish Jackets

- .1 Jackets:

- .1 Thermocanvas Jacket: fire rated, 170g fire retardant canvas jacket for covering mechanical insulation indoors, 25/50 fire class, plain wave cotton, no dyes.
 - .2 All Service Jacket: high puncture and tear resistance with 0.03 mm minimum thick foil. Water vapour permeance of 0.02 perms maximum. Self-adhesive material, flame spread/smoke development rating not to exceed 25/50.
 - .3 PVC Finishing Jacket: white, UV resistant, for indoor or outdoor applications, 25/50 fire class, minimum 0.50 mm thick.
 - .4 Aluminum Jacket: 0.51 mm thick stucco or smooth aluminum jacketing with longitudinal slip joints and 50mm end laps with factory applied protective liner on interior surface.
- .2 Preformed Fitting Covers:
- .1 PVC Fitting Covers pre-moulded one piece covers, white, UV resistant, for indoor or outdoor applications, 25/50 fire class, minimum 0.50 mm thick.
 - .2 Aluminum Fitting Covers: Die shaped components with factory applied protective liner on interior surface, 0.51 mm thick.

3. EXECUTION

3.1 General

- .1 Install in accordance with Thermal Insulation Association of Canada (TIAC) National Standards.
- .2 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .3 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified prior to insulation installation.
- .4 Use two layers of preformed insulation with staggered joints when the required nominal wall thickness exceeds 75 mm.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .6 Install hangers, supports outside vapour retarder jacket.
- .7 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- .8 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.
- .9 Insulate piping, fittings and valves. Do not insulate unions, flanges (except on flanged valves), roll groove couplings, strainers, flexible connections and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.
- .10 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.
- .11 Roof Drains and Vents: Adhere flexible blanket insulation with adhesive applied to all laps. Provide annealed tie wire at 400mm centres for securing insulation. Butt insulation and seal joints and breaks with 50mm wide foil adhered over joint.

- .12 Do not insulate exposed run-outs local to a plumbing fixture, chrome plated piping, valves, fittings. Do not insulate run-outs to individual units and equipment not exceeding 3600 mm long.
- .13 Where insulation is not specified:
 - .1 Hot Piping: Coat exposed hot pumps, pipe and fittings with Therma-Lite liquid insulation product to prevent skin burns
 - .2 Cold Piping: Coat exposed cold pumps, pipes, and fittings, connecting surfaces of thermometers, pressure gauges, flow switches, controllers, etc. with a No Sweat paint product to prevent condensation.

3.2 Polypropylene Piping

- .1 PP-R pipe and fittings are an insulated pipe system rated for flame and smoke development performance. The product must be wrapped with an insulation with ASJ of a minimum thickness 12mm that is listed and labelled to comply with CAN/ULC 102 flame spread and smoke developed ratings equal or less than 25 and 50 respectively.
- .2 All joints and couplings in the PP-R pipe must be completely covered by insulation. Joints in the insulation must be taped with a self-sealing insulation tape certified for use with a listed and labelled pipe insulation compliant with CAN/ULC S102 flame spread and smoke developed ratings equal or less than 25 and 50 respectively. The tape must be installed in accordance with the manufacturer's instructions.
- .3 Comply with application thickness table for insulation thickness or 12mm thick whichever is the greater.

3.3 Installation Cold Application - (5°C to 15°C) 1501-C

- .1 Piping: Apply pipe insulation with integral vapor retarder jacket to piping and hold in place by securing the jacket flap. Seal all flaps and butt strips with vapor retarder adhesive. Pipe insulation with integral self-sealing vapor retarder jacket will not require additional fastening.
- .2 Screwed or welded fittings: Insulate fittings with section of the pipe insulation mitered to fit tightly. All seams shall be sealed using vapor retarder tape.
- .3 Valves, Strainers: Insulate valve bodies, bonnets and strainers with fitted pipe insulation or mitered blocks all to thickness of adjacent pipe insulation, then seal all seams of vapor retarder with vapor retarder tape.
- .4 Flanged and grooved fittings: Insulate with oversized pipe insulation or mitered blocks to the thickness of the adjacent pipe insulation, then seal all seams of vapor retarder jacket with vapor retarder tape.

3.4 Installation Hot Application - Intermediate Temperature (15°C - 315°C) 1501-H

- .1 Piping: Pipe covering without integral jacket shall be held in place with insulation fastening at not less than 300 mm centres. Pipe insulation with integral jacket shall be held in place by stapling the flap on 75 mm centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.
- .2 Screwed or welded fittings: Insulate fittings with sections of the pipe insulation mitered to fit tightly, or with tightly placed flexible insulation covered with reinforcing membrane stapled in place. Alternately insulate fittings with tightly placed flexible insulation and apply PVC fitting covers.

| | | | | Minimum Thickness of Piping Insulation (mm) | | | | |
|---------------------------------------|-------|-------------|----|---|----|----|----|----|
| | | | | | | | | |
| Unconditioned space or outside | All | 0.046-0.049 | 38 | 40 | 65 | 65 | 75 | 90 |
| Hot Water Systems | 61-93 | 0.035-0.040 | 38 | 25 | 25 | 25 | 40 | 40 |
| | 41-60 | 0.035-0.040 | 38 | 25 | 25 | 25 | 40 | 40 |
| Cold Water Systems | 5-16 | 0.030-0.039 | 24 | 25 | 25 | 25 | 25 | 25 |
| | <5 | 0.030-0.039 | 24 | 25 | 25 | 40 | 40 | 40 |

Note: Where the thermal conductivity of a proposed insulation is greater than the range specified above, the thickness will be increased by the ratio of U2/U1.

U2 = proposed insulation "k" value at the table mean rating temperature.

U1 = upper range limit "k" value from the table above.

Note: Where thermal conductivity of proposed insulation is less than the range specified above, the thickness may be decreased by the ratio of U2/U1.

U2 = proposed insulation "k" value at the table mean rating temperature.

U1 = lower range limit "k" value from the table above.

3.8 Piping Finish Schedule

.1 Conform to the following:

| Duty | Type | TIAC Code |
|-----------------------------------|---------------|-----------|
| Indoors, concealed | Factory | CPF/2 |
| Indoors, exposed in utility areas | Canvas Jacket | CPF/1 |
| Indoors, exposed elsewhere | PVC Jacket | CPF/4 |
| Outdoors | Metal Jacket | CPF/3 |

3.9 Scope of Work

.1 Insulate all new domestic water pipes downstream from point of tie-in to existing pipes. Refer to drawings.

END OF SECTION

1. GENERAL

1.1 Summary

- .1 This section includes materials and installation for domestic cold, domestic hot and domestic hot water recirculation systems including all piping, fittings, valves and equipment inside the building to 915 mm outside the building.

1.2 Related Sections

- .1 This section of the specification forms part of the Contract Documents and shall be read interpreted and coordinated with all other parts of the Contract Documents.
- .2 Section 21 05 01 Common Work Results for Mechanical.
- .3 Section 23 05 29 Hangers and Supports for Mechanical Piping and Equipment.
- .4 Section 23 05 48 Vibration and Seismic Control for Mechanical.
- .5 Section 23 05 53 Identification for Mechanical Piping and Equipment.
- .6 Section 23 05 93 Testing, Adjusting and Balancing for HVAC.

1.3 References

- .1 Applicable Building and Plumbing Code - Refer to Section 21 05 01.
- .2 Canadian Standards Association (CSA Group).
 - .1 CSA-B64 Series 11 (R2016), Backflow Preventers and Vacuum Breakers.
 - .2 CSA B64.10.1 - Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.
 - .3 CSA-B356-10 (R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .3 Plumbing and Drainage Institute (PDI).
 - .1 PDI-WH201 (Revised 2010), Water Hammer Arrestors Standard.
- .4 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5 – Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric /Inch Standard.
 - .2 ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.
 - .3 ASME B16.15 - Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .4 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - .5 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .5 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A351/A 351M – Castings, Austenitic for Pressure Containing Parts
 - .2 ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- .6 American Water Works Association (AWWA).
 - .1 AWWA C606 – Standard for Grooved and Shouldered Joints.

- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .2 MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .3 MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
- .8 Plumbing and Drainage Institute (PDI).
 - .1 PDI-WH201 (Revised 2010), Water Hammer Arrestors Standard.
- .9 National Sanitation Foundation (NSF):
 - .1 NSF/ANSI 61 Drinking Water System Components – Health Effects.
- .10 Underwriters' Laboratories of Canada Inc:
 - .1 CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S115 Standard Method of Fire Tests of Firestop Systems.
 - .3 CAN/ULC-S102.2 Standard for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.4 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

1.5 Quality Assurance

- .1 All materials shall comply with manufacturer's specifications and referenced documents.
- .2 All roll grooved joint couplings, fittings, valves and specialties shall be manufactured by the same manufacturer including roll grooving tools used.
- .3 The installer of the piping system shall be qualified, licensed within the jurisdiction and familiar with the installation of the type of pipe or tube being installed.
- .4 To comply with the manufacturer's warranty requirements, confirm with the manufacturer the style or model number of couplings, dielectric connections, stainless steel bolted branch outlets, expansion compensators, valves, flange adaptors and accessories to suit pipe material and diameters.

1.6 Submittals

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets for fixtures and equipment.
 - .2 Indicate dimensions, performance, construction details and materials for specified items.

- .3 Shop Drawings:
 - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, dimensions, construction and assembly details and accessories for the following:
 - .1 Valves
 - .2 Domestic Water Pipe, Fittings and Insulation
 - .3 Mechanical and Press Fit Type Couplings and Gaskets
 - .4 Vacuum Breakers
 - .5 Back Flow Preventers and Relief Valve Monitors
 - .6 Water Hammer Arrestors
 - .7 Relief Valves
 - .8 Check Valves
 - .9 Air Vents
 - .10 Hose Bibbs
 - .11 Trap Seal Primers
 - .12 Water Filters
 - .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 Closeout submittals: submit maintenance and engineering data for incorporation into maintenance manuals.

1.7 Municipal Service Fees

- .1 Arrange and pay for all Municipal connection fees for dedicated domestic water connection(s) to the Municipal water supply system under this Section of work.
- .2 Combined fire suppression and potable water connection(s) shall be the responsibility of Section 21 13 00 Fire Suppression Sprinkler Systems.

1.8 Cross Connection Control

- .1 Double check valve assemblies and reduced pressure principle backflow prevention devices shall have approval from the Foundation for Cross Connection Control, University of Southern California.
- .2 Vacuum breakers shall conform to the requirements of C.S.A. B64.5.
- .3 Following installation, a test report completed by a certified tester shall be submitted to the Departmental Representative, indicating satisfactory operation of each device.
- .4 Tests are to be conducted in the period 30 to 60 days prior to date of Substantial Completion.
- .5 Provide one repair kit for every cross connection control device installed.

1.9 Pipe, Fittings and Couplings

- .1 Provide for all pipe, fittings, couplings, valves, nipples, drains and all accessory pipe work for a complete installation within the base tender price.
- .2 No extra cost will be considered based on failure of the contractor to allow for pipe, fittings and pipe work as required during construction to provide offsets to avoid structural components, and to coordinate with other piping services, ductwork, cable trays, conduits or other obstacles whether indicated on the drawings or not.

1.10 Seismic Protection

- .1 Comply with Section 23 05 48 – Vibration and Seismic Control for Mechanical.

1.11 Substantial & Total Performance

- .1 Comply with Section 21 05 01 Common Work Results for Mechanical – Substantial and Total Performance.

2. PRODUCTS

2.1 Pipe Hangers and Supports

- .1 Comply with Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.
- .2 Vertical piping shall be supported at its base and at the floor level of alternate storeys, unless otherwise recommended by pipe manufacturer, by rests that can support the weight of the pipe that is between it and the rest above it. Maximum spacing of vertical supports shall be 7.5 m or less if recommended by pipe manufacturer and to comply with seismic requirements.

2.2 Miscellaneous Metal Related to Domestic Water Systems

- .1 All miscellaneous metal related to the facility water distribution systems including all metal back up plates, stands, brackets and supports for all roof, floor or wall supported equipment and piping systems is part of this Section of the Work.
- .2 Provide two coats of heavy red oxide primer to all steel components after fabrication, and touch up on site after installation.

2.3 Piping General

- .1 Installation shall be in accordance with the manufacturer's installation instructions.

2.4 Buried Pipe and Fittings Inside the Building

- .1 75 mm and smaller.
 - .1 Type 'K' seamless soft annealed copper tubing to ASTM B88 or copper pipe to ASTM B42. Provide in long lengths and with no buried joints. All piping shall be encased in a polyethylene piping system.
- .2 100 mm and larger.
 - .1 Ductile Iron Pipe and Fittings:
 - .1 Cement lined ductile iron pipe and fittings, mechanical joints, pressure class 350 (Class 50 or 52) for 100mm through 300mm and conforming to:

- .1 AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
- .2 AWWA C110/A21.10 – Ductile Iron and Gray Iron Fittings.
- .3 AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 AWWA C104/A21.4 - Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.
- .2 Rigid radius cut grooves for use with cut grooved end mechanical joint couplings. Gaskets used shall be as recommended by the mechanical joint coupling manufacturer.
- .3 Interior: Asphalt seal coating on the inside cement mortar lining. For use in potable water systems.
- .4 Exterior: Bituminous coating.
- .2 All fittings shall be provided with integral tie lugs. Weld on lugs are not acceptable.
- .3 Tie rods, bolts and nuts shall conform to the requirements of ASTM specifications for steel bridges and buildings, serial designation A-7. All bolts shall have American Standard course screw threads with a Class 2 free fit. Rolled threads are unacceptable.

2.5 Above Ground Water Pipe Inside the Building

.1 Copper Piping Systems

- .1 Pipe and fittings:
 - .1 Cold and hot water:
 - .1 Type 'L' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42.
 - .2 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42.
 - .2 Cast brass or wrought copper solder joint pressure fittings with 95/5 Sn/Sb or Silvabrite 100 solder joints.
 - .3 Push to Connect Fittings:
 - .1 Suitable for use with copper tubing and certified to NSF/ASNI 61, NSF/ASNI 14 and ASSE 1061 for use with potable water.
 - .2 Lead free DZR brass body, EPDM O-ring, stainless steel grab ring.
 - .3 Maximum working pressure of 1,379 kPa and maximum temperature of 93° C.
 - .4 Roll groove fittings for 2 NPS and larger, copper-tube dimensioned grooved ends. (Flaring tube or fitting ends to accommodate alternate sized couplings is not permitted.) Complying with CSA B242, ASME B16.18 or ASME B16.22.
 - .5 Grooved couplings: Suitable for use with copper tube to ASTM B-88. Epoxy coated ductile iron to ASTM A536, designed with angle bolt pads to provide rigid joint at copper tubing sizes, EPDM-HP flush seal type gasket suitable for use with grooved copper tubing. Gasket shall be NSF 61 compliant for use with potable water and shall be suitable for temperature to 120°C.

- .6 Pressure joint fittings for 1 NPS and smaller, cast copper joint with 301 stainless steel internal components and EPDM seals, complying with ASME B16.18. Suitable for operating pressure to 1380 kPa.

.2 Ductile Iron Water Pipe Inside the Building

- .1 Special Class, ductile iron pipe, cement mortar lined, ULC Listed, conforming to:
 - .1 Minimum thickness class 54
 - .2 AWWA C150 - Thickness Design of Ductile-Iron Pipe
 - .3 AWWA C151/A21 - Ductile-Iron Pipe, Centrifugally Cast.
 - .4 AWWA C104-13 Cement Mortar Lining for Ductile Iron Pipe.
- .2 Rigid radius cut grooves for use with cut grooved end mechanical joint couplings.
- .3 Interior: Asphalt seal coating on the inside cement mortar lining. For use in potable water systems.
- .4 Exterior: alkyd phenolic primer and protective enamel finish.
- .5 Ductile iron fittings conforming to:
 - .1 CSA B-05 Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 AWWA C-606 Grooved and Shouldered Joints.
 - .3 Rated 2400 kPa working pressure.
- .6 Ductile iron pressure couplings for direct connection to grooved end IPS / steel pipe sizes, transition couplings shall be used. Coupling housing shall be cast with offsetting angle-pattern bolt pads for joint rigidity.
- .7 Grade 'M' Flush Seal gaskets conforming to ANSI/NSF 61 for use on potable water systems and specifically designed for use with ductile iron pipe surfaces.
- .8 Stainless steel track head bolts and stainless steel nuts.

.3 Stainless Steel Piping Systems

- .1 Pipe:
 - .1 Only 304/304L or 316/316L stainless steel pipe shall be used.
 - .2 Stainless steel pipe shall conform to:
 - .1 ASTM A312 / A312M and ASME B36.19M, Type 304/304L or 316/316L, Schedule 10, or 40. Roll grooved as appropriate to the pipe material, wall thickness, pressure, size and method of joining. Use roll sets specifically designed for grooving the applicable stainless steel pipe.
 - .2 Pipe ends shall be roll grooved in accordance with AWWA C606 and shall be free from indentations, projections, burrs, roll marks, etc. where the gaskets are seated. Roll grooves shall be well defined with fully formed vertical flanks.
- .2 Stainless steel pipe sizes:
 - .1 50mm and smaller: Schedule 10 suitable for use with press type fittings.

- .2 65mm to 150mm: Roll grooved Schedule 10 suitable for use with galvanized rigid style mechanical couplings.
- .3 200mm to 300mm: Roll grooved Schedule 10 suitable for use with galvanized rigid style mechanical couplings.
- .4 100mm and larger: Roll grooved Schedule 40 suitable for use with rigid galvanized mechanical couplings.
- .3 Stainless steel fittings:
 - .1 Grooved end fittings:
 - .1 65mm and larger: roll grooved. Fittings shall be manufactured of stainless steel conforming to ASTM A-403, WPW, WPW/S9, or CR/S9, or shall be fabricated from stainless steel pipe conforming to ASTM A312, with factory roll grooved ends. Fittings shall be type 304/304L or 316/316L stainless steel.
 - .2 Press type fittings:
 - .1 50mm and under: Suitable for use with Schedule 10 stainless steel pipe. Stainless steel press type fittings shall conform to the material and sizing requirements of ASTM A312 or ASTM A554. O-rings shall be EPDM.
 - .2 NSF 61 certified.
- .4 Mechanical couplings for stainless steel pipe:
 - .1 Couplings for use with stainless steel pipe shall be as recommended by the manufacturer so as to comply with the manufacturer's warranty requirements.
 - .2 Suitable for stainless steel pipe dimensions.
 - .3 Couplings shall have a minimum pressure rating of 2068 kPa.
 - .4 Manufactured in two segments of cast ductile iron conforming to ASTM A-536.
 - .5 Mechanical coupling bolts shall be zinc plated to ASTM B-633 heat treated carbon steel track head conforming to ASTM A-449 and A-183 with minimum tensile strength of 758,450 kPa.
 - .6 Gaskets:
 - .1 Flush seal gaskets shall be pressure responsive design, molded of Grade "E" EPDM.
 - .7 Couplings shall be protected against galvanic corrosion.
 - .8 Couplings for use in corrosive environments:
 - .1 Housing type 316 stainless steel conforming to ASTM A351, A753 and A744, Grade CF8M.
 - .2 Gaskets: Grade "E" EPDM
 - .3 Bolts: ASTM F593, Group 2 type 316 stainless steel.
 - .4 Nuts: ASTM F594, Group 2 type 316 stainless steel.
- .5 Flanges for stainless steel pipe:
 - .1 Stainless steel pipe flanges shall conform to ASME B16.5, "Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard and

- .1 ASTM A 182/A A 182M, "Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service" or
- .2 ANSI/AWWA C228, "Stainless Steel Pipe Flanges for Water Service – Sizes 2 In. Through 72 In. (50mm Through 1,800mm)."
- .2 Stainless steel pipe flange material shall match the grade of the pipe material used.
- .6 Stainless steel tube:
 - .1 Stainless steel tube shall conform to:
 - .1 ASTM A 269, "Seamless and Welded Austenitic Stainless Steel Tubing for General Services".
 - .2 ASME B16.9, "Factory Made Wrought Buttwelding Fittings".
 - .2 Only 304/304L or 316/316L stainless steel tube shall be used.
- .7 Joints for stainless steel pipe:
 - .1 Grooved couplings: rigid type, designed to clamp the bottom of the groove to provide an essentially rigid joint.
 - .2 Stainless steel welded joints:
 - .1 Welding shall conform to ASME B31.9 – Building Services Piping and in accord with good engineering practice.
 - .2 Butt weld pipe fittings shall have an equal or thicker section than the pipe wall specified.
 - .3 Dielectric connections between dissimilar metals: dielectric fittings to ASTM F492 complete with thermoplastic liner. Dielectric couplings shall be compatible with and suitable for pressure rating of piping systems. For pipes 50mm and under provide isolating unions. For pipes 65mm and over provide isolating flanges.
 - .4 Stainless steel bolted branch outlets may be used in applicable sizes for header piping 75mm through 200mm. The outlet shall consist of stainless steel housings, stainless steel bolts and nuts, and a pressure responsive elastomer gasket.
- .8 Valves for stainless steel piping:
 - .1 Gate valves
 - .1 Class 150 304 or 316 stainless steel body conforming to ASTM A351 Class 150.
 - .2 Outside screw and yoke, flanged ends.
 - .3 End flange dimensions to ANSI B16.5.
 - .2 Globe valves
 - .1 Class 150 304 or 316 stainless steel conforming to ASTM A351 Class 150.
 - .2 Stainless steel bolted bonnet, stem and disc.
 - .3 Flanged ends.

- .3 Check valves
 - .1 Stainless steel body conforming to ASTM A 351 Grade C8FM, stainless steel disc, shaft and spring, NFS 61 certified and 2068 kPa rated. Resilient seat spring return.
 - .2 Suitable for horizontal or vertical (up flow) installations.
 - .3 Grooved system end preparation.
 - .4 EPDM seat.
- .4 Ball valves
 - .1 50mm and under, press fit type:
 - .1 Designed to work with Schedule 10 stainless steel pipe.
 - .2 Three piece body design suitable for 2068 kPa and furnished with press ready ends.
 - .3 Full port with stainless steel body, ball and cap.
 - .4 PTFE ball seat, body seal thrust washer and packing.
 - .5 EPDM O-ring seals.
 - .6 Equipped with lever handle.
 - .2 65mm and larger roll grooved end:
 - .1 Roll grooved end ball valves shall be rated for 4,137 kPa consisting of type 316 stainless steel body, ball and stem.
 - .2 Full port type in conformance with MSS SP-110 requirements.
 - .3 Equipped with lever handle.
- .5 Butterfly valves
 - .1 Grooved end butterfly valves for stainless steel application: 2" (DN75) through 8" (DN200) sizes:
 - .1 300-psig CWP, fully stainless steel body conforming to ASTM A351, Grade CF8M.
 - .2 Disc shall be fully stainless steel conforming to ASTM A351, Grade CF8M, with 17-4PH stainless steel stem. (Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.)
 - .3 Valve shall include fiberglass and 316 stainless steel bearings with TFE lining, with Grade E (EPDM) pressure responsive seat.
 - .4 10-position lever handle or gear operator as required.

2.6 Valves

- .1 Valves shall conform to NSF 61/372.
- .2 Gate: (for shut-off and isolation)
 - .1 50 mm and smaller, bronze body, solid wedge disc, bronze or stainless steel trim, non-rising stem, 860 kPa rating.

- .2 65 mm and larger, flanged ends, cast iron body, solid wedge disc, bronze or stainless steel trim, rising stem, outside screw and yoke.
- .3 Ball: (in lieu of gate valves or as specified)
 - .1 50 mm and smaller, brass two piece body, blow-out proof stem, PTFE seats, brass chrome plate ball, lever handle operator, 1035 kPa rating.
- .4 Butterfly: (in lieu of gate valves or as specified)
 - .1 65 mm and larger, 1,380 kPa rating, wafer style or threaded lug style cast iron body, EPDM seat liner, bronze disc, 403 stainless steel stem, 10 position lever lock handle operator on 150 mm diameter and smaller, handwheel worm gear operator on 200 mm diameter and larger, for installation between Class 125 / 150 flanges.
- .5 Globe: (for throttling, bypass and make-up applications)
 - .1 50 mm and smaller, bronze body, bronze or stainless steel trim, 860 kPa rating.
 - .2 265 mm and larger, flanged ends, cast iron body, bronze or cast iron bevel-type disc, bronze or stainless steel trim, rising stem, outside screw and yoke.
- .6 Check: (for horizontal installation)
 - .1 50 mm and smaller, threaded joint type, bronze body, bronze or stainless steel swing disc holder with Teflon disc, 860 kPa rating.
 - .2 65 mm and larger, flanged ends, cast iron body, bronze or cast iron swing disc, bronze or stainless steel trim, 860 kPa rating.
 - .3 65 mm and larger grooved Victaulic Style 717 PPS coated.
- .7 Balance: (for domestic hot water recirculation)
 - .1 30 mm and smaller, globe lockshield, for maximum system temperature, bronze body and trim, Teflon; polytetrafluoroethylene (PTFE), disc, female by male union connection, 690 kPa rating. Valve shall conform to NSF 61/372.
 - .2 40 mm and larger, plug type, wrench adjustable stop, for maximum system temperature, semi-steel body, resilient plug seals, EPT or RS 55, max. 120°C operating temperature, 860 kPa, threaded end connections for up to 50 mm, flanged end connections on 65 mm and larger. Valve shall conform to NSF 61/372.
- .8 Pressure reducing:
 - .1 Direct acting water pressure reducing valves for domestic water supply systems shall conform to CSA-B356 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
 - .2 25 mm and smaller: Bronze body, SS integral strainer, renewable SS seat, high temperature rated diaphragm suitable for hot and cold water. Rated at maximum inlet pressure of 2100 kPa.
 - .3 30 mm and larger: Pilot operated, cast iron body, modified globe design, threaded ends to 50 mm, flanged ends 65 mm and larger. Maximum inlet pressure 2100 kPa. Bronze trim. Pilot control system: bronze with SS trim, hydraulically operated, diaphragm actuated.

- .4 40mm through 500mm: Factory assembled valve with grooved ends and a maximum pressure rating of 1,723 kPa. Globe or angle style with double chamfered diaphragm, full bore "Y" pattern type with semi-straight (no right angles) flow through the valve for minimum head loss. Valve body and covers shall be ductile iron to ASTM A536 with an NSF 61 approved electro statically applied fusion bonded epoxy coating. The valve seat, operating shaft, all internal screws, bolts and nuts shall be SAE 303 stainless steel. Seat shall be removable. 302 stainless steel valve spring. ASTM B62 bronze bearings, NBR disc seal and nylon fabric bonded rubber diaphragm with all O-rings EPDM. 316 stainless steel pilot control accessories, tubing and fittings.
 - .1 Valve shall operate independent of valve differential pressure utilizing a 2-way control principle.
 - .2 The pressure relief pilot control shall be a direct acting, adjustable, spring loaded, normally closed diaphragm valve designed to permit flow when controlled pressure is greater than the spring setting.
 - .3 The pilot control shall have a second sensing port which can be utilized to install a pressure gauge.
 - .4 A full range of spring settings shall be available in ranges of 21 to 2,965 kPa with a standard range of 103 to 1,586 kPa.
 - .5 The diaphragm assembly shall be contained within the main actuator and shall be the only moving part.
 - .6 The valve manufacturer shall provide a computerized cavitation chart which shall show flow rate, differential pressure, percentage of valve opening, Cv/Kv factor, system velocity and if there will be cavitation damage.

- .9 Drain Valves and Hose Bibbs:
 - .1 Hose Bibbs: Lockshield globe type with bronze body and trim suitable for maximum system operating pressure.
 - .2 Drain Valves: Ball type with brass body, cap & chain and chrome plated brass ball.

- .10 Thermostatic Mixing Valves:
 - .1 Point of use lavatory tempering valve:
 - .1 Adjustable temperature selection, tamper proof, lead free brass body, internal checks with screens, rough bronze finish and complying with CSA B125.
 - .2 Maximum pressure 861 kPa.
 - .3 Inlet range hot: 49 - 82°C, cold: 4 -27°C, temperature adjustment 27 - 49°C.
 - .4 Minimum flow 1 Lpm single duty, 2 Lpm up to 2 lavatories.
 - .5 3/8 NPS compression for single lavatory application.
 - .6 1/2 NPS screwed for two (2) lavatory application.

2.7 Vacuum Breakers

- .1 Pressure type:
 - .1 CSA approved, mechanically independent spring loaded poppet type check valve with a downstream spring loaded air inlet valve, with upstream and downstream isolation valves and test cocks.
- .2 Atmospheric type:
 - .1 CSA approved, bronze body, chrome plate finish where exposed.
- .3 All vacuum breakers shall be sized in accordance with the following table:

| Pipe Size mm | Pressure Type Size mm | Atmospheric Type Size |
|-----------------|--------------------------|-----------------------|
| 12 - 25 | 12 | Full Pipe Size |
| 30 - 40 | 19 | Full Pipe Size |
| 50 - 75 | 25 | Full Pipe Size |

2.8 Backflow Prevention Stations

- .1 Double Check Valve Assembly (DCVA):
 - .1 2 NPS and smaller, lead free cast copper silicone alloy body, twin positive seat check modules, captured springs, replaceable check module seats and discs, service through a single bronze or stainless steel access cover. Complete with two isolation valves, 4 top mount test cocks and a bronze strainer. Suitable for horizontal or vertical installations.
 - .1 Temperature range 0.5°C - 82°C
 - .2 Maximum working pressure: 1206 kPa
 - .3 Factory assembled to CSA B64.5 and AWWA C510
 - .2 2½ NPS and larger, FDA approved epoxy coated cast iron body, lead free design, twin positive seat check modules, captured springs, replaceable stainless steel check module seats and discs, service through a bolted access cover. Complete with two OS&Y isolation valves, 4 test cocks and a strainer.
 - .1 Temperature range 0.5°C - 43°C.
 - .2 Maximum working pressure: 1206 kPa.
 - .3 Factory assembled to CSA B64.5 and AWWA C510.
- .2 Reduced Pressure Backflow Assembly (RPBA):
 - .1 2 NPS and smaller, lead free cast copper silicone alloy body, pressure differential relief valve, between 2 positive seat check valves, air inlet, water outlet, replaceable check module seats and discs. Complete with two isolation valves, 3 top mount ball valve test cocks, a strainer and repair/maintenance kit. Suitable for horizontal or vertical installations.
 - .1 Temperature range 0.5°C - 60°C.
 - .2 Maximum working pressure: 1206 kPa.
 - .3 Factory assembled to CSA B64.4, B64.10 and AWWA C511.

- .2 2½ NPS and larger, FDA approved epoxy coated cast iron body, lead free design, pressure differential relief valve, between 2 positive seat check valves and captured springs, replaceable stainless steel seats, stainless steel internals, service through a bolted access cover. Complete with two OS&Y isolation valves, test cocks, a strainer and repair/maintenance kit.
 - .1 Temperature range 0.5°C - 43°C.
 - .2 Maximum working pressure: 1206 kPa.
 - .3 Factory assembled to CSA B64.4, B64.10 and AWWA C511.
- .3 Reduced pressure principal backflow prevention devices shall be complete with built in relief valve monitor.
- .4 Solenoid operated control valve (24 vac) to close in response to an electrical signal to the solenoid pilot assembly. Valve shall be in compliance with ANSI/AWWA C530 and NSF/61 requirements. Valve shall be single seated, line pressure-operated, diaphragm-actuated, pilot controlled globe valve. The valve shall seal by means of a corrosion resistant seat and resilient, rectangular seat disc. These and other parts shall be replaceable in the field without removing the valve from the line. Valve and pilot control shall contain no packing glands or stuffing boxes. All internal and external ferrous surfaces shall be coated with a high quality fusion epoxy coating.
- .5 Electric solenoid timer to shut down 24 vac solenoid control valve upon opening of relief on reduced pressure principle backflow preventer. CSA certified fiberglass housing, 120 vac relay power 24 vac, external top mounted power and alarm lights, wall and valve stainless steel mounting brackets, timer factory set at 10 seconds and test switch.

2.9 Strainers

- .1 Sized on a 4 to 1 ratio of basket open area to connecting pipe cross-sectional area, 'Y' pattern, 304 stainless steel screen.
- .2 6 mm to 50 mm, threaded ends, bronze body, 1034 kPa rating.
- .3 65 mm and larger, flanged ends, cast iron body, 860 kPa rating.
- .4 65 mm and larger, grooved ends, ductile iron body, 2065 kPa rating.

2.10 Water Hammer Arrestors

- .1 Bellows or piston manufactured style with stainless steel casing and welded stainless steel nesting bellows if of the bellows style. Site fabricated air chambers are unacceptable.

2.11 Temperature and Pressure Relief Valves

- .1 Design: A.S.M.E. rated for the energy input to the system and the pressure rating of the equipment.

2.12 Pipe Joints

- .1 Solders and fluxes having a lead content and self cleaning acid type fluxes shall not be used.
- .2 All copper to steel or iron and flanged adaptors shall be brass, not copper.
- .3 All unions or similar interconnections between dissimilar metals shall be dielectric couplings.

2.13 Air Vents

- .1 Design: Automatic float type, 1035 kPa (150 psi) max. operating pressure.

2.14 Hydrants and/or Hose Bibbs

- .1 Hose Bibb Type 'C': (standard type):
 - .1 Faucet with hose end spout in chrome plate finish.
 - .2 "T" type handle in chrome plate finish.

2.15 Trap Seal Primers

- .1 Provide flow actuated type priming device piped to nearest fixture so that device will introduce regulated amount of water into trap whenever fixture is used.
- .2 Provide pressure actuated type priming device piped where the nearest fixture is remote to the floor drain requiring trap priming.
- .3 Electronic Trap Priming Assembly:
 - .1 Pre-assembled unit in a 16 gauge steel wall mounted cabinet with screw driver access door latch, mounting anchors, lead free bronze ball valve, lead free atmospheric vacuum breaker, pre-set 24 hour adjustable timer, manual override switch, 120 volt solenoid valve, calibrated manifold for equal water distribution to multiple floor drains.
 - .2 3/wire single point connection.
 - .3 20mm inlet connection.
 - .4 Discharge manifold shall be complete with outlet ports.
 - .5 Provide shut off valve and water hammer arrestor on inlet supply.

2.16 Water Meter

- .1 All water meters shall be new. Used or reconditioned meters are not acceptable.
- .2 Water meters are to be native BACnet Compatabile and connected to base building BMS system.
- .3 Meter shall come complete with moulded insulation with vapour barrier or contractor is to supply removable insulation jacket.
- .4 All meters shall meet the following requirements:
 - .1 Meet appropriate AWWA requirements.
 - .2 Be capable of 95% accuracy at low flows less than or equal to 0.031 L/s.
 - .3 Meters 50mm and larger shall have bolt flanged ends.
- .5 The water meter, water meter installation and location shall comply with the standards and requirements of the Authority Having Jurisdiction.
- .6 For inside meter installations, provide a remote meter reader to suit municipal requirements. Provide conduit from the water meter location to the remote reader location required by Authority Having Jurisdiction. Remote reader shall be equipped with a radio transmitter end point.

- .1 Meters shall have encoder type remote registration conforming to the latest version of AWWA C707.
- .2 The register shall provide at least eight digit registration at the meter with the ability to simultaneously encode in digital format at least eight significant digits of the meter reading for transmission through the remote reader. A meter identification number shall also be provided with each reading. Registration shall be to the nearest cubic metre.
- .7 Test ports shall be provided for all meter assemblies 50mm and larger. In the absence of a test port on the meter case, a test tee shall be installed with a 50mm diameter threaded lateral and plug at a distance of three (3) pipe diameters downstream of the meter.

2.17 Self Cleaning Water Filters

- .1 Suitable for cold water application up to a maximum water temperature of 30° C. and a maximum water pressure of 1,034 kPa.
- .2 Filter mesh size 0.1mm, flanged connections to ASME B16.1.
- .3 Self cleaning back-washable with automatic time and pressure differential actuation.
- .4 Automatic backwash generated by a time actuated relay with adjustable range from 1 to 1,440 hours and a pressure differential control setting adjustable from 0.0 kPa to 179.3 kPa.
- .5 Backwash process shall not result in any interruption of water supply or filtration process.
- .6 Electronic control enclosure with display for system diagnostics with LED display for operation, alarm fault buzzer and manual over-ride button.
- .7 120/60 VAC plug-in transformer. Maximum load current 1A. Maximum switching voltage 24V.
- .8 Two (2) potential-free output dry contact remote transmissions for building automation system.

3. EXECUTION

3.1 Water Service Connections

- .1 Coordinate with Division 33 Utilities Contractor or the municipality for the installation and location of the water connection.
- .2 Provide all required material, pipe size adapters, offsets, tie rods, thrust blocks etc. to make connection to the provided service for a complete installation.

3.2 Building Water Entry

- .1 Where the water service enters the building terminate at the edge of the building and excavation with a Smith Blair standard sleeve coupling having stainless steel nuts and bolts. Bridge the excavation with ductile iron pipe.
- .2 Provide concrete thrust blocks at all changes of direction of underground piping, including underslab piping. Provide thrust blocks at fittings where an essentially horizontal water main turns up through a slab into the building.
- .3 Provide stainless steel tie rods with stainless steel associated nuts, bolts and washers from the below slab piping and connect to the first pipe flange within the building.

- .4 Provide sleeves where pipes penetrate foundation walls or building slabs or other concrete members. Sleeves for fire lines or combined potable water and fire lines shall be minimum 2 pipe diameters larger than the pipe. Seal penetrations water tight using non-hardening mastic where there is no hydraulic pressure or mechanical seal such as Link Seal where hydraulic pressure may occur.
- .5 Coordinate with Division 21 Fire Suppression for a supervised valve or supervisory switch on any isolating valves serving fire lines or combined potable water and fire lines.

3.3 Examination

- .1 The installing contractor shall examine the pipe/tube and fittings for defects or cracks. There shall be no defects of the pipe/tube and fittings. Any damaged pipe/tube and fittings shall be rejected.

3.4 General Piping Installation

- .1 Provide expansion joints or flexible couplings at building expansion joints, building earthquake joints, building firewalls and other locations as required. Refer to Section 23 05 16 – Expansion Fittings and Loops for Mechanical Piping.
- .2 Unless otherwise noted, pipe hangers and supports shall be as required by Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.
- .3 Provide allowance for thermal expansion and contraction of piping passing through a wall, floor ceiling or partition.
- .4 Piping shall be installed such that it is not in contact with building members.
- .5 Stainless steel press connections shall be made in accordance with the manufacturer's installation instructions
- .6 Piping shall be installed such that it is not in contact with building members.
- .7 All off site prefabrication of piping shall be at the contractor's own risk.
- .8 Install piping to maximize headroom in all areas, including exposed installations. Coordinate space requirements with other installation Contractors.
- .9 Combustible pipe shall not be installed.
- .10 Installation shall be in accordance with the applicable building and plumbing codes and local authority having jurisdiction.
- .11 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.
- .12 Tie rods complete with their associated nuts, bolts and washers shall be stainless steel.
- .13 Install piping free of sags, bends and kinks.
- .14 Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.
- .15 Threaded joints shall have teflon tape applied to the male threads only. Tighten joint with a wrench and backup wrench as required.
- .16 Assemble piping using fittings manufactured to noted standards. Installation shall also be to the manufacturer's recommendations.
- .17 Connect to fixtures and equipment shall be in accordance with manufacturer's written instructions unless otherwise indicated.

- .18 Grooved joint shall be installed in accordance with the manufacturer's written recommendations. Grooved ends shall be clean and free from indentations, projections, or roll marks. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor's representative is not considered qualified to conduct the training.)
- .19 Provide dielectric connections between dissimilar metals. Dielectric fittings complete with thermoplastic liner and complying ASTM F492.
- .20 Where a hanger or support for pipe or tube is of a dissimilar metal it shall be suitably separated and electrically insulated from the pipe or tube.
- .21 Joints in copper tubes installed underground shall be made with either flared or compression fittings or be brazed using a brazing alloy within the American Welding Society's AWS-BCuP range. Compression fittings shall not be used underground under a building.
- .22 For press type and push to connect fittings, the insertion depth and installation methods shall comply with the fitting manufacturer's recommendations. For press to connect fittings, provide to Departmental Representative one disconnect clip for each size of fitting installed.

3.5 Concealed Supply Piping

- .1 Concealed water supply piping to plumbing fixtures, trim items, equipment, hose bibbs, etc. shall be installed using cast brass 90 degree drop ear elbow or drop ear tees as the piping design dictates.
- .2 Blocking shall be provided within the concealed space and the elbows and tees shall be secured to the blocking using brass screws to provide a rigid installation.

3.6 Stainless Steel Pipe

- .1 Preparation:
 - .1 Stainless steel shall be cut with a wheeled pipe cutter or approved stainless steel pipe cutting tool. The pipe shall be cut square to permit proper joining of the fittings.
 - .2 Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.
 - .3 The pipe end shall be wiped clean and dry. The burrs on the pipe shall be reamed with a deburring or reaming tool.
- .2 Installation:
 - .1 Stainless steel press connections shall be made in accordance with the manufacturer's installation instructions.
 - .2 Provide protection against abrasion where stainless steel pipe is in contact with other building members by wrapping with an approved tape, pipe insulation or otherwise suitable method of isolation.
 - .3 Provide allowance for thermal expansion and contraction of stainless steel pipe passing through a wall, floor, ceiling or partition.
 - .4 Vertical stainless steel pipe shall be supported at each floor or at 3 metre intervals.

- .5 Where a hanger or support for stainless steel pipe or tube is of a material other than stainless steel, it shall be suitably separated and electrically insulated from the pipe or tube.
- .3 Hangers and Supports:
 - .1 Spacing of hangers and supports for stainless steel pipe:
 - .1 Size smaller than 1": Maximum spacing of 2.5 metres
 - .2 Size 1" and larger: Maximum spacing of 3 metres
 - .2 Spacing of hangers and supports for stainless steel tube:
 - .1 Size smaller than 1": Maximum spacing of 2.5 metres
 - .2 Size 1" and larger: Maximum spacing of 3 metres

3.7 Valve Installation

- .1 Where possible, disassemble solder end joint valves before soldering. Where disassembly and reassembly of the valves is impossible, the contractor shall give special regard to solder jointing in order not to damage, melt or deform any valve parts.
- .2 Shut Off Valves:
 - .1 Install shut-off or isolation valves whether shown on the drawings or not at the following locations:
 - .1 At the point where the water service first enters the building.
 - .2 At the base of each new building riser.
 - .3 At each new main branch supply point; provide a valve on each outlet leg from the tee or cross.
 - .4 At each single plumbing fixture (i.e. normally this requirement is satisfied by the provision of the angle valve specified with the specific fixture).
 - .5 At each single piece of equipment.
 - .6 At all points as indicated on the drawings.
 - .7 At all points where the plumbing code requires same.
 - .8 Close to the main on each new branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.
 - .9 On the inlet to each new plumbing equipment item, on each supply to each new plumbing fixture not having stops on supplies, and elsewhere as indicated.
- .3 Install swing check valves as indicated.
- .4 Install shut off valves in each new hot-water circulating loop.
- .5 Mixing Valves:
 - .1 In addition to check valves common to the mixing valves, provide, in an accessible location, a positive swing check valve and strainer on each of the hot and cold water supplies upstream of the mixing valve. Provide an access panel to the check valves and strainers where required.

- .6 Balancing Valves:
 - .1 Install circuit balancing valves in hot water recirculating branch mains and branch connections to return mains whether indicated on drawings or not.
 - .2 Combination valves are not acceptable. Provide separate valve for isolation.
- .7 Pressure Reducing Valves:
 - .1 Pressure reducing valve stations, as a minimum shall consist of the following:
 - .1 A high flow or main pressure reducing valve; which shall be one pipe size smaller than the incoming or outflowing building service, and shall be provided with a strainer, a reducer, shut off valve and union on the inlet side and a union, reducer and a shut off valve on the outlet side.
 - .2 A low flow pressure reducing valve; which shall be 25 mm in size, and shall be provided with a strainer, shut off valve and union on the inlet side and a union, shut off valve on the outlet side.
 - .3 A pressure gauge and gauge cock on each side of the pressure reducing valve.
 - .4 Where a pressure reducing valve with integral low flow bypass is used the piping, fittings and accessories shall be arranged as described for the high flow or main pressure reducing valve above.
 - .2 Set main pressure reducing valve at maximum 415 kPa outlet pressure. Adjust outlet pressure setting if required.
 - .3 Set small flow pressure reducing valve at 35 kPa higher outlet pressure than main pressure reducing valve.
- .8 Drain Valves:
 - .1 Install drain valves 20 mm minimum, or line size where the piping is smaller than 20 mm.
 - .2 Install a hose-end adaptor, cap and chain on the discharge side of each drain valve or pipe to drain where indicated.
 - .3 Install drain valves at the base of each new riser, at low points of horizontal runs, and where required to drain the water distribution piping system.
- .9 Thermostatic Mixing Valves
 - .1 Point of use lavatory tempering valve:
 - .1 Provide a tempering valve to all lavatories with domestic water service in excess of 48°C and all lavatories served by automatic faucets.
 - .2 Tempering valve shall be concealed but accessible for service and adjustment.
 - .3 Tempering valve shall be adjusted to provide domestic hot water from 43°C to 48°C.

3.8 Backflow Prevention Station Installation

- .1 Install at each fixture or item of equipment to CSA B64 on plumbing lines where contamination of the water system can occur.
- .2 Pipe lines shall be thoroughly flushed before installing the backflow preventer.

- .3 Valves shall come complete with moulded insulation with vapour barrier or contractor is to supply removable insulation jacket.
- .4 Valve shall be easily accessible for testing and service. Do not install in a concealed location.
- .5 Pipe differential relief outlet through air gap to drain.
- .6 Built in relief valve monitors shall be connected to the BMS system.
- .7 Backflow prevention stations and the installation of backflow prevention stations shall be in complete accordance with the requirements of CSA B64.10 and the applicable Building and Plumbing Codes.
- .8 Complete testing of all reduced pressure principle backflow prevention devices shall be carried out under this section of the work prior to final acceptance of plumbing systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.
- .9 Each backflow preventer shall be protected from the effects of water hammer by the installation of one or more water hammer arrestors.
- .10 Provide one repair kit for every cross connection device installed.

3.9 Strainer Installation

- .1 Install strainer blow-off connections.
- .2 strainer shall come complete with moulded insulation with vapour barrier or contractor is to supply removable insulation jacket.
- .3
- .4 Blow-off connections shall be full drain connection size and shall include:
 - .1 Up to 50 mm - nipple and cap (hot services).
 - .2 65 mm and larger - nipple, globe valve and nipple (hot services).
 - .3 All sizes (cold services) - plug the blow-off connection only.

3.10 Flanges and Unions

- .1 Provide on all connections to pumps, reducing valves, control valves, fixtures, and equipment.
- .2 Connections up to and including 50 mm size shall be all bronze union, 1,035 kPa rating with ground seat; larger connections shall be flanged.

3.11 Pressure Gauges

- .1 Install pressure gauge at all pump suction and discharge points and at each pressure reducing station inlet and outlet.

3.12 Water Hammer Arrestors

- .1 Size in accordance with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.
- .2 Install on branch lines to flush valves, solenoid valves, self-closing faucets, quick closing valves and on kitchen and laundry equipment incorporating solenoid valves.

3.13 Pipe Joints

- .1 Install dielectric type couplings where copper piping and accessories connect to plumbing equipment such as steel storage tanks, pressure reducing stations.
- .2 Where the water service enters the building terminate at the edge of the building and excavation with a Smith Blair standard sleeve coupling having stainless steel nuts and bolts. Bridge the excavation with ductile iron pipe.
- .3 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.
- .4 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.
- .5 Provide flanges or unions on all connections to new reducing valves, control valves, fixtures, and equipment.
- .6 Connections up to and including 2 NPS shall be all bronze union, 1,035 kPa rating with ground seat; larger connections shall be flanged.

3.14 Air Vents

- .1 Install at all high points in domestic hot water recirculation system.
- .2 Install on tees and not on horizontal piping or radiused elbows.
- .3 Install 15 mm (1/2") minimum isolating gate valve ahead of each air vent.
- .4 Pipe all air vent discharge connections separately to nearest building drain using 6 mm (1/4") hard drawn copper.

3.15 Hydrants and/or Hose Bibbs

- .1 Provide operating keys to the Departmental representative for all hose bibbs that do not possess an attached handle.
- .2 Provide an isolating shut-off valve upstream of all hose bibbs.
- .3 Exterior ground type hose bibb boxes shall be set flush and anchored in a 460 mm square x 200 mm thick concrete collar all set at 25 mm above surrounding grade.
- .4 Connect drain ports on floor mount type hose bibbs indirectly to drainage system where such drainage ports are located within the confines of the building.
- .5 Seal around the perimeter of hose bibbs with silicone caulk in a neat manner, for a waterproofing seal. Where a water proof membrane is present, provide a hose bibb with a membrane clamp.

3.16 Trap Seal Primers Valves

- .1 Provide floor drain trap primers in watercloset rooms and other areas connected to the sanitary sewer in accordance with the plumbing code and as designated on the drawings.
- .2 Locate at locations that are readily accessible by the building maintenance staff.

3.17 Self Cleaning Water Filters

- .1 Provide all necessary support and restraints for water filters.
- .2 Run backwash flush connection to nearest drain using an indirect connection at termination point.

3.18 Water Meters

- .1 Install water meters, including valving, to the requirements of the Authority Having Jurisdiction.
- .2 Water meters shall be installed horizontally with the register casing oriented upward. The meter assembly shall be supported by appropriate steel pipe stands.
- .3 Provide isolation valves on the inlet to and outlet from the water meter.
- .4 Provide a strainer on the water meter inlet between the shut off valve and meter inlet.
- .5 Provide a locked valved bypass around the water meter connected to the water system upstream of the inlet valve and downstream of the outlet valve.
- .6 Location of and above grade mounting height of remote readers shall be as required by the Authority Having Jurisdiction and shall be easily accessible for reading. All wiring and conduit to remote reader shall be by this section of the work. The wire from the meter to the remote reader shall be installed in accordance with the manufacturer's recommended length. Buried conduit shall be a minimum of 600mm below finished grade. Penetration of exterior building wall associated with the remote reader conduit and wiring shall be sealed to prevent moisture intrusion.
- .7 The meter assembly shall be flushed and air eliminated from the system. The meter installation shall be checked for leaks at completion of installation and any leaks shall be corrected.
- .8 Provide a test report from an independent test agency to verify that the meter and reader have been installed and set to read within the acceptable limit of accuracy as set out in AWWA standards.

3.19 Testing and Inspection

- .1 Conform to the requirements of Section 21 05 01 Common Work Results for Mechanical
- .2 Use only potable water for testing of potable water systems.
- .3 Test pressure shall be the greater of 1.5 times maximum system operating pressure or 860 kPa. for 8 hours.
- .4 Any leaks shall be corrected and the system retested.

3.20 Flushing and Cleaning of Water Lines

- .1 Where flushing and cleaning of the piping only is required: The piping system shall be flushed with potable water from the municipal system at a minimum velocity of 1 m/s until the water is free of turbidity and discolored water does not appear at any of the outlets.
- .2 For confirmation, bacteriological testing shall be performed by a reputable testing agency. Should bacteriological testing indicate contamination, flushing shall be repeated.
- .3 Submit to the Departmental Representative a certificate from the testing agency stating that the bacteriological testing and flushing of the systems has been successfully completed and the test samples comply with the requirements.

3.21 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 expansion compensators are installed properly.

3.22 Start-Up

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Flushing procedures have been completed.
 - .3 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring hot water storage tank up to design temperature slowly.
 - .4 Monitor piping systems for freedom of movement and pipe expansion.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

3.23 Performance Verification

- .1 Timing:
 - .1 After 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 Testing in accordance with Section 23 05 93 – Testing, Adjusting and Balancing for Mechanical.
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Sterilize systems for Legionella control.
 - .5 Verify performance of temperature controls.
 - .6 Verify compliance with safety and health requirements.
 - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor/s. Repeat for outlets and flush valves.
 - .8 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .3 Reports:
 - .1 In accordance with Section 23 08 00 – Commissioning of Mechanical Systems.
 - .2 Include pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Sanitary drain waste and vent piping, equipment and accessories between plumbing fixtures to 1m from the building.
- .2 Interior sanitary waste and vent piping shall be provided as depicted on the drawings to plumbing fixtures that will discharge sanitary waste and shall be connected to discharge to the
 - .1 existing sanitary waste piping as depicted on the drawings.

1.2 General Requirements

- .1 All buried sanitary drain and waste piping shall be a minimum of 3 NPS.
- .2 Buried sanitary drain and waste piping shall be one size larger than the above ground size up to 4 NPS
- .3 Like product and materials shall be of one manufacturer.
- .4 Non-functioning existing interior sanitary waste piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings. Abandoned piping shall be identified on record drawings and tagged as abandoned.

1.3 Municipal Service Fees

- .1 Arrange and pay for any Municipal connection fee for sanitary sewer connection to the Municipal sewer system under this Section of work.

1.4 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and shall be read, interpreted, and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical
- .3 Section 22 05 76 – Facility Drainage Piping Cleanouts

1.5 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
- .2 Applicable Building Code - Refer to Section 21 05 01.
- .3 ASTM B32: Standard Specification for Solder Metal.
- .4 ASTM B306: Copper DWV tube drainage type, drawn temper.
- .5 ASME B16.23 or ASME B16.29: Copper drainage fittings cast copper or wrought copper.
- .6 ASTM F 628: Acrylonitrile-butadiene-styrene (ABS) drainage, waste, and vent pipe – cellular core.
- .7 ASTM C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- .8 CAN/CSA-B70: Cast Iron Soil Pipe, Fittings, and Means of Joining.
- .9 CAN/CSA-B602: Mechanical Couplings for Cast Iron Drain, Waste, Vent Pipe, and Sewer Pipe.

- .10 CAN/CSA B181.1: Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings
- .11 CAN/CSA B181.2: PVC solid wall DWV pipe, schedule 40, drain, waste, and vent piping and pipe fittings.
- .12 CAN/ULC S102.2 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.6 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:
- .2 Shop drawings:
 - .1 Floor Drains
 - .2 Backwater Valves
 - .3 Double Wall Containment Pipe Leak Detection System
 - .4 Air Admittance Valves
 - .5 Grease Interceptors

1.7 Pipe, Fittings and Couplings

- .1 Provide for all pipe, fittings, couplings, nipples, drains and all accessory pipe work for a complete installation within the base tender price.
- .2 No extra cost will be considered based on failure of the contractor to allow for pipe, fittings and pipe work as required during construction to provide offsets to avoid structural components, and to coordinate with other piping services, ductwork, cable trays, conduits or other obstacles whether indicated on the drawings or not.

1.8 Freeze Protection

- .1 Provide heat tracing as indicated in the contract drawings and referenced in Section 23 05 33 – Heat Tracing for Mechanical Piping and Tanks.

1.9 Seismic Protection

- .1 Comply with Section 23 05 48 – Vibration and Seismic Control for Mechanical.

1.10 Substantial & Total Performance

- .1 Comply with Section 21 05 01 Common Work Results for Mechanical – Substantial and Total Performance.

2. PRODUCTS

2.1 Pipe Hangers and Supports

- .1 Comply with Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.

2.2 Cleanouts

- .1 Comply with Section 22 05 76 – Facility Drainage Piping Cleanouts

2.3 Above Ground Pipe and Fittings

- .1 Cast Iron drain, waste and vent pipe and fittings:
 - .1 3 NPS to 15 NPS
 - .2 Class 4000 cast iron mechanical joint pipe complying to CAN/CSA-B70.
 - .3 Stainless steel couplings with neoprene or butyl rubber compression gaskets complying to CAN/CSA-B602.
- .2 Copper Tube, (DWV)
 - .1 Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for the fixture drain or the portion of the vent pipe below the flood level rim of manually flushing and waterless urinals.
 - .2 The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
 - .3 The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME B16.29.
 - .4 The joints shall be lead free solder, using a water flushable flux, and conforming to ASTM B32.

2.4 Below Ground Piping and Fittings

- .1 Cast iron drain, waste and vent pipe and fittings:
 - .1 3 NPS to 15 NPS
 - .2 Class 4000 cast iron mechanical joint pipe complying to CAN/CSA-B70.
 - .3 Stainless steel couplings with neoprene or butyl rubber compression gaskets complying to CAN/CSA-B602.

2.5 Air Admittance Valves

- .1 Air admittance valves used as a vent shall be used only in compliance with the requirements of the applicable plumbing/building code.
- .2 To ASTM D 2665/D 2661 and NSF Standard 14.
- .3 One way valve designed to allow air to enter the drainage system when negative pressures develop in a piping system. The device shall close by gravity and seal the vent terminal at zero differential pressure at no flow conditions and under positive internal pressures.
- .4 Materials:
 - .1 Aluminum cover, polystyrene insulated cover cap, ABS vent body, synthetic rubber membrane, rubber connector.
- .5 Screening on the inside and outside to protect the sealing membrane from foreign objects.
- .6 Opens at -70 kPa and seals at 0 kPa and above.
- .7 Air admittance valves shall be rated for the size of pipe to which they are connected.
- .8 Air admittance valve wall box: High impact polystyrene for in wall installation, with snap on polystyrene faceplate grille to allow air movement, mounting brackets and able to accommodate 40mm or 50mm adapters.

2.6 Safes, Flashing and Vent Terminals

- .1 Metal Flashing: 26 gauge galvanized steel.
- .2 Metal Counter flashing: 22 gauge galvanized steel.
- .3 Thicknesses of flashing fabricated on-site for vent pipes shall conform to the requirements of the applicable plumbing code/building code.
- .4 Prefabricated flashing for vent pipes shall conform to CSA B272 – Prefabricated Self-Sealing Roof Vent Flashing.
- .5 Lead Flashing:
 - .1 Waterproofing: 25 kg/m² sheet lead
 - .2 Soundproofing: 5 kg/m² sheet lead.
- .6 Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- .7 Floor Drain and Floor Sink Flashing: 40 mil thick chlorinated polyethylene (CPE), equivalent to Chloraloy. 25 kg/m² sheet lead flashings.
- .8 Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.7 Floor Drains

- .1 Floor Drains General
 - .1 Unless otherwise noted:
 - .1 All floor drains shall be cast iron body with all non-plated parts coated for rust prevention.
 - .2 All floor drains shall have adjustable collars.
 - .3 All floor drains installed in areas with sheet good flooring shall be complete with a surface clamping clamp.
 - .4 Provide all floor drains with anchor flange and reversible membrane clamp with weep holes.
 - .5 Provide all floor drains with a trap primer connection.
 - .6 Provide a sediment bucket for all drains in mechanical rooms, janitorial and utility rooms and as specified below.
 - .7 Floor drains in areas occupied by inmates shall have grates secured with vandal-proofscrews. Refer to Technical Criteria for Correctional Institutions.
 - .8 To reduce the possibility of inmates hiding or disposing of contraband, grate openings in inmate areas shall consist of multiple holes approximately 10 mm in diameter. Refer to Technical Criteria for Correctional Institutions.
 - .2 Finished Area Drains
 - .1 Floor Drain “FD-1” (washroom, shower)
 - .1 Heavy duty polished nickel bronze round strainer, 125mm diameter
 - .2 Vandal proof secured top
 - .2 Floor Drain (surface membrane)

- .1 325mm diameter wide cast iron flanged head (latex flange) with clamp down light duty polished nickel bronze round strainer, 125mm diameter.
- .3 Food Services
 - .1 Floor Drain : (floor sink).
 - .1 300mm x 300mm x 200mm (12"x12"x8") deep cast iron floor sink, 225 mm (9") square slotted light duty grate(up to 900kg capacity), white acid resisting epoxy or porcelain enamel interior, aluminum interior anti-splash dome strainer and aluminum sediment bucket. Cast iron non-plated parts to be coated for rust prevention.

2.8 Grease Interceptors

- .1 General:
 - .1 Connect all drainage piping from fixtures and equipment that discharge waste water that contains or may be contaminated with fats, oils and grease to grease interceptors.
 - .2 Food grinders, potato peelers and similar equipment used in the preparation of food shall be connected to a solids interceptor prior to connection to a grease interceptor if the wastewater from this equipment contains or may be contaminated with fats, oils and greases.
 - .3 A garbage compactor used in connection with a food preparation facility located outside of the building shall be connected to a drain that is connected to a grease interceptor. Storm water shall be prevented from mixing with the wastewater that is discharged into the drain connected to the grease interceptor.
 - .4 The maximum flow capacity of all fixtures and equipment connected to a grease interceptor shall not exceed the maximum rated flow capacity of the interceptor.
 - .5 The size of a flow control fitting required to be used with a grease interceptor shall not exceed the rated flow capacity of the grease interceptor.
 - .6 Grease interceptors shall achieve the most restrictive rating standard for the maximum effluent concentration for the jurisdiction in which it is being installed as measured in accordance with the requirements of CSA B481.2, or as determined by the Authority Having Jurisdiction.
 - .7 Grease interceptors shall be complete with an accessible sampling port on the discharge piping located prior to the discharge piping connecting to any other part of the drainage system.
 - .8 The grease interceptors rated flow capacity shall be permanently labelled on the grease interceptor and be clearly visible.
 - .9 Enzymes to facilitate the passage of fats, oils and grease shall not be permitted.
- .2 Grease Interceptors:
 - .1 Grease Interceptor GI-1:
 - .1 Steel body, coated for acid resistance, double wall deep trap, integral clean-out, primary and secondary baffles, clean-out lid or plug, internal flow rate control, gasketed non-skid aluminum cover.
 - .2 For recessed installation:

- .1 Acid resistant coated fabricated steel extension piece as required to suit recessed installation.
 - .2 Acid resistant coated fabricated steel recessing receiver with adjustable support brackets.
 - .3 PDI rated at 25 lps (400 gpm) flow rate and 362 Kg (800 lbs) capacity.
 - .4 Interceptor shall be suitable for surface, semi-recessed, flush-deep installation as required. (Refer to drawings for location.)
 - .5 Complete with vented in-line flow control.
 - .6 Encased fiberglass sensor box containing an electronic grease level sensor a fiberglass display with green power light, yellow and red dual level lights, audio alarm and junction box. Power required 120 volt with GFCI.
- .2 Grease Interceptor GI-2:
- .1 Steel body, coated for acid resistance, double wall deep trap, integral clean-out, primary and secondary baffles, clean-out lid or plug, internal flow rate control, gasketed non-skid aluminum cover.
 - .2 For recessed installation:
 - .1 Acid resistant coated fabricated steel extension piece as required to suit recessed installation.
 - .2 Acid resistant coated fabricated steel recessing receiver with adjustable support brackets.
 - .3 PDI rated at 13 lps (200 gpm) flow rate.
 - .4 Interceptor shall be suitable for surface, semi-recessed, flush-deep installation as required. (Refer to drawings for location.)
 - .5 Complete with vented in-line flow control.
 - .6 Encased fiberglass sensor box containing an electronic grease level sensor a fiberglass display with green power light, yellow and red dual level lights, audio alarm and junction box. Power required 120 volt with GFCI.

3. EXECUTION

3.1 General

- .1 Comply with manufacturer's installation instructions and the following:
- .2 Route piping in orderly manner, maintain gradient, conserve building space and group piping whenever practical at common elevations.
- .3 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .4 Pressure waste piping from pumping stations and other equipment shall be pressure piping and fittings as specified for domestic water.
- .5 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab.

- .6 Class 4000 mechanical joint cast iron soil pipe, fittings and mechanical joint couplings shall be of one manufacturer.
- .7 Copper to cast iron joints shall be male brass adaptors to tapped fittings.
- .8 Nipples shall be cast iron or heavy brass.
- .9 Support horizontal pipe runs and brace at intervals and points as recommended by the manufacturer and the local authority having jurisdiction.
- .10 Support vertical pipe stacks and assemblies and brace as recommended by the manufacturer and the local authority having jurisdiction.
- .11 Visually inspect materials for defects prior to installation.
- .12 Reject defective material and remove from site.
- .13 Surfaces must be clean and free of foreign matter at points of joining.
- .14 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .15 Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
- .16 Install bell and spigot pipe with bell end upstream.
- .17 All floor mounted fixtures and floor flanges shall be secured on a firm base and fastened to the floor or flange of the fixture.
- .18 Joints in a floor flange or between a fixture and the drainage system shall be provided with a resilient watertight and gas tight seal.
- .19 Every screw, bolt, nut and washer used to connect a water closet to a floor flange and to anchor the floor flange to the floor or anchor the water closet to the floor shall be made of corrosion resistant materials.
- .20 Where a vent passing through a roof may be subject to frost closure, it shall be protected from frost closure by increasing its diameter by one pipe size (but not less than 75 mm immediately prior to penetrating the roof or by other acceptable frost closure protection methods.
- .21 Except for a wet vent, every vent pipe shall extend above the flood level rim of every fixture that it serves before running horizontal.

3.2 Pipe Hangers and Supports

- .1 Comply with Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.

3.3 Cleanouts

- .1 Comply with Section 22 05 76 – Facility Drainage Piping Cleanouts

3.4 Above and Below Ground Piping and Fittings

- .1 Cast Iron Pipe and Fittings:
 - .1 Connect with mechanical joint couplings.
 - .2 Be aware of manufacturers torque requirements for varying coupling types and torque couplings accordingly.
- .2 ABS / PVC Pipe and Fittings:

- .1 Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products, or other aggressive chemical agents not compatible with ABS or PVC compounds.
- .2 Do not install piping with glued joints at temperatures below those recommended by the solvent manufacture.
- .3 Do not install ABS piping upstream of any grease or oil interceptors.
- .3 Below Ground Pipe Support:
 - .1 Pipe Bedding:
 - .1 All buried piping inside the building below floors and slabs except for footing drains shall be supported on a bed of well compacted sand (95% Modified Proctor Density).
 - .2 Bedding shall extend from 150 mm below pipe and shall support the pipe barrel not the joints and/or couplings.
 - .3 Before backfilling, the complete line shall be tested and inspected and approved by the Authority Having Jurisdiction.
 - .2 For pipe support below a floating slab install piping using hangers fixed to the foundation or structural slab using hangers that are capable of keeping the pipe in proper alignment and can support the weight of the pipe, its contents and the backfill above the pipe. Refer to drawings for detail.
- .4 Refer to Division 31 specification for trenching and backfilling.

3.5 Back Water Valve

- .1 Back water valves shall be installed in locations as noted on the drawings.
- .2 Provide support for the backwater valve where suspended in a pit.
- .3 Pits for backwater valves shall be sized to accommodate backwater valve dimensions and all fittings.

3.6 Air Admittance Valves

- .1 Shall not be installed in supply or return air plenums or where they may be subject to freezing.
- .2 Install in accordance with the manufacturer's recommendations.
- .3 Valves shall be readily accessible and installed in a location that allows air to enter the valve.

3.7 Safes, Flashing and Vent Terminals

- .1 Provide flexible flashing and metal counter flashing where piping penetrates weather or waterproofed walls and floors.
- .2 CPE, Chloraloy 240 lining or lead material may be used under built-up floor sinks and showers; and at floor drains and cleanouts. Chloraloy shall be solvent welded to manufacturer's installation instructions. Lead shall not be used on roofs where the roofing material is applied by a torch-on method.

- .3 Flash floor drains in floors with topping over finished areas with lead or CPE membrane, a minimum of 300mm clear on sides with minimum 900mm x 900mm sheet size. Fasten flashing to drain clamp device.
- .4 Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.
- .5 Supply and install 25 kg/m² lead safes under built-up showers and mop sinks on any floor, which is not slab-on-grade. The safes shall extend across the floors and up walls and curb to a minimum height of 150 mm and shall be turned into the floor drain flange, unless specifically noted otherwise. Seams shall be welded (burned), not soldered. Any metal shall be commercially pure lead only. Treat both sides of the safe with two coats of asphalt.
- .6 Provide acoustical lead flashing around pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
- .7 Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.
- .8 Terminate all vent terminals a minimum of 25 mm above the water level at which roof drainage overflows through roof overflow scuppers or drains.
- .9 Distances of vent terminals from all building openings, fresh air intakes and property lines shall be in compliance with the applicable code and the Authority Having Jurisdiction requirements.
- .10 Vent flashing minimum 450 mm x 450 mm base dimension shall terminate flush with the top of 300 mm high vent pipe and the gap between the flashing and pipe shall be closed with a 25 kg/m² separate lead cap 75 mm high. The main flashing shall not be turned over the pipe.
- .11 In areas subject to vandalism, terminate vents with 180° return bends.
- .12 Installation and termination of vents from grease interceptors shall comply with the requirements of the applicable codes and the Authority Having Jurisdiction.

3.8 Floor Drains

- .1 Install floor drains set low to provide proper drainage.
- .2 Generally do not locate floor drains in the center of mechanical rooms. Locate floor drains in close proximity to the equipment and / or devices that will be discharging water to them, such that drain connections from the equipment and / or devices can be piped to the floor drains without creating a tripping hazard.
- .3 Water piping from trap primer to floor drain to be PEX tubing where cast into concrete and protected in a polyethylene sleeve where buried below slab. Provide Type L copper where exposed within the building.

3.9 Grease Interceptors

- .1 Grease interceptors shall be readily accessible for all inspection, cleaning, maintenance and sampling.
- .2 Pit Installation:

- .1 Provide 8 mm checker plate cover/s over it. Plates shall be sized not larger than 0.93 m² and complete with two (2) loose lifting rings per section recessed into cover. Provide 75 mm x 75 mm x 10 mm angle iron frame set in concrete and recessed to suit thickness of checker plate cover. Anchor frame with 6 mm x 75 mm anchor bolts at 900 mm O.C. Weld 25 mm x 8 mm stop along perimeter of angle frame. All metal components shall be prime coated prior to installation.
- .3 Slab Suspension:
 - .1 Provide extensions and supports as required to suspend interceptor from building floor slab to ensure a rigid installation.
 - .2 Where the interceptor penetrates a rated floor assembly, provide a rated enclosure around the interceptor body. Provide appropriate fire stopping at all pipe penetrations of the rated enclosure.
 - .3 Interceptor extension pieces shall suit inlet and outlet invert elevations. Top of interceptor shall be flush with finished floor.

3.10 Excavation & Backfilling

- .1 Refer to Division 31 for excavation, trenching and backfill requirements.
- .2 Provide excavation, trenching and backfill required for the installation of the mechanical work. Do not undertake any cutting, boring or excavating in or about the building, which may cause interference with the progress of the work or weaken the structure in any way, without the prior approval of the Consultant.
- .3 Trenching for buried services shall be deep enough to accommodate the required pipe grade, bedding material depth, pipe outside diameter and backfilling of trench with approved backfill material to 300mm above top of pipe. Trench width from outside walls of pipe to trench walls shall be as narrow as proper joining and backfilling will permit.
- .4 Backfilling in all trenches shall be with clean river sand (pea gravel where approved), carefully placed and tamped in uniform layers for the full width of the trench to a height of 300mm over the top of the pipe. All backfill material shall be free of stones, boulders, cinders and frozen material. Remainder of all trenches shall be filled by the General Contractor.
- .5 Where sanitary sewer pipes pass under a grade beam or footing the trench around the piping up to and in contact with the footing shall be provided with a 450 kg concrete grouting so as to seal the outside trenching from normal storm runoff and backflow of rain water through the trenching and into the crawl space and/or under the floor slab.
- .6 Where sanitary sewer, pipes pass through exterior walls below grade, the General Contractor shall install corbels on the exterior walls and run bridging from corbel to undisturbed soil for the support of the pipes. 25mm (1") thick waterproof mastic shall be applied around the pipes which pass through the wall.
- .7 Be responsible for repairing and making good, to match original condition, all existing concrete walls, pavement, walkways etc., where these have been damaged by this Division.

3.11 Testing and Adjustment

- .1 General:
 - .1 In accordance with Section 23 08 00 Commissioning of Mechanical Systems and the following:

- .2 Test for leaks and defects all new plumbing piping systems and parts of existing systems, which have been altered, extended or repaired. Submit to the Consultant a copy of a Pipe Pressure Test Log for each section of piping tested.
- .3 Leave uncovered and unconcealed all new, altered, extended, or replaced piping until it has been tested and reviewed. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
- .4 Repair all leaks and defects using new materials and retest all plumbing systems until satisfactory results are obtained.
- .2 Plumbing Piping Pressure Testing
 - .1 Tests on the sanitary waste drainage systems shall consist of a hydraulic pressure testing of 3000 mm for 8 hours.
 - .2 An air test in accordance with the Plumbing Code may be used during freezing conditions.
- .3 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Prime using trap primer. Adjust flow rate to suit site conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of basket strainers.
 - .5 Clean out baskets.
- .4 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .5 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 The supply and installation of plumbing trim for fixtures and equipment not supplied under Division 22 or 23 sections such as kitchen equipment.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical

1.3 Piping Connections to Equipment

- .1 Supply and install all piping components - pipe fittings, valves, strainers, vacuum breakers, backflow preventers, unions and insulation - as indicated, specified or as recommended by the equipment manufacturer.
- .2 Arrange the rough-in and piping connections to this equipment as recommended by the equipment manufacturer, to maintain ease of access for servicing and to minimize the possibility of anyone being burnt by hot surfaces.
- .3 Chrome plate all uninsulated piping and piping components exposed to view, unless otherwise indicated. Provide chrome plate escutcheons at all wall and floor penetrations.
- .4 In kitchens and all other wet areas, pipe penetrations through floors shall be complete with minimum schedule 40 steel pipe sleeves that extend to 50mm above finished floor level. Sleeve inside diameter shall allow for pipe outside diameter and required fire stopping.
- .5 Connect to all equipment requiring plumbing connections.
- .6 Plumbing piping to equipment shall be neatly racked together with heating pipes and shall be a minimum of 300 mm above the floor to facilitate cleaning where required.
- .7 For kitchen equipment connections, refer to kitchen consultant's, food facilities or plumbing drawings for details of equipment item numbers and rough-in locations.
- .8 Unless otherwise noted in the following item list provide and install all components under this section of the work for all equipment requiring plumbing connections that are supplied under this section of the work.
- .9 Item numbers in Part 2 correlate to item numbers of equipment not supplied by this section of the contract documents.
- .10 Listing order of the components noted in the Products section for each of the following items is the order in which the components shall be installed either to the specific item as in the case of service supply to that item or away from the specific item as in the case of drainage from the specific item.

- .11 Some components listed for one item of equipment may together utilize the components listed for another item of equipment. For example for two pieces of equipment where each is listed to be provided with a reduced pressure principle backflow prevention device both may be together provided cold water service through the same reduced pressure principle backflow prevention device. The listing of the provision of a reduced pressure principle backflow prevention device is in this example to ensure and clarify that cold water service to each item is protected by a reduced pressure principle backflow prevention device. Refer to the drawings for additional clarification of the intent.
- .12 Gas pressure regulator settings indicated are for elevations up to 610 metres [2,000'] above sea level. BTU input ratings shall be derated for the elevation above sea level if above 610 metres [2,000'].
- .13 Provide chrome plated cast brass P traps with cleanouts. ABS P traps and waste arms are not permitted.

1.4 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
 - .1 Applicable Building Code - Refer to Section 21 05 01.

1.5 Submittals

- .1 Comply with Division 1 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals.

2. PRODUCTS

2.1 Kitchen Equipment

- .1 Floor Drain Pan (Item No.)
 - .1 Connect 75 mm drain pan tail-piece through 75 mm P-trap to sanitary waste system.
- .2 Stainless Steel Floor Pan (Item No.)
 - .1 Connect 75 mm drain through P-trap in floor.
- .3 Dishwasher (Item No.)
 - .1 Connect 12 mm 60°C hot water through shut-off valve, water hammer arrestor, pressure type vacuum breaker and pressure reducing valve set at 138 kPa [20 psi].
 - .2 Connect 20 mm 82°C hot water rinse through shut-off valve, temperature gauge, pressure gauge, water hammer arrestor, pressure reducing valve set at 138 kPa pressure gauge, pressure type vacuum breaker and shut-off valve.
 - .3 Connect 50 mm drain directly through P-trap and waste arm to sanitary waste.
- .4 Hand Sink (Item No.)
 - .1 Connect 12 mm 60°C hot and cold water each through stops and risers.
 - .2 Install faucet supplied by kitchen equipment contractor.
 - .3 Connect 40 mm waste through P-trap and waste arm.

3. EXECUTION

3.1 (Not used)

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Materials and installation for:
 - .1 Flexible braided hose.
 - .2 Flexible pipe connectors.
 - .3 Expansion joints.
 - .4 Expansion compensators.
 - .5 Pipe alignment guides.
 - .6 Pipe anchors.
 - .7 Expansion loops.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical.
- .3 Section 22 11 16 – Domestic Water Piping.

1.3 References

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A53/A53M- [18], Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A105/A105M- [14], Standard Specification for Carbon Steel Forgings, for Piping Applications.
- .2 American Society of Mechanical Engineers:
 - .1 ASME B31.9 - Building Services Piping.
 - .2 ASME Section IX - Boiler and Pressure Vessel Code -Welding and Brazing Qualifications.

1.4 Design Requirements:

- .1 It is the Contractor's responsibility to retain the services of a qualified professional engineer to design the pipe expansion system for the actual installed layout of all piping systems covered by this specification section.
- .2 The Contractor is required to review the mechanical, structural, and architectural documents for the identification of any seismic joints for seismic separations within the building structure that affects the installation of any mechanical systems. At each of these locations, the contractor shall allow for the design, supply, and installation of applicable mechanical system flexible connections along with support of these systems on each side of the seismic joint or separation. This applies to all piping systems as well as ductwork systems.

- .3 Special attention should be given to straight pipe runs, pipe shaft installations and non-metallic pipe installations. As a minimum on hot piping, provide expansion compensation on every other floor of a non-metallic pipe riser in a shaft and every third floor for metallic pipe risers in a shaft.

1.5 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:
- .2 Submit data on all materials.
- .3 Shop Drawings:
 - .1 Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.
 - .2 Submit shop drawings sealed by a professional engineer.
- .4 Product Data:
 - .1 Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, and braid structure.
 - .2 Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- .5 Design Data:
 - .1 Indicate criteria and show calculations.
 - .2 Submit sizing methods calculations sealed by a professional engineer.
- .6 Manufacturer's Installation Instructions: Submit special procedures.
- .7 Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- .8 Welders' Certificate: Provide welders' certificate.
- .9 Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.
- .10 Operation and Maintenance Data:
 - .1 Submit adjustment instructions.

1.6 General Requirements

- .1 For non-metallic piping systems comply with manufacturer's installation instructions and recommendations for expansion compensation, anchoring and guides.
- .2 Provide structural work and equipment required for expansion and contraction of piping. Provide anchors, guides, and expansion joints as required to adequately protect the piping systems.
- .3 Provide expansion compensation for all closed piping systems including but not limited to: heating water, chilled water, steam and condensate, closed condenser water systems, and all other closed piping systems that operate at varying temperatures. Expansion compensation as described in this section may be eliminated from copper pipe open systems in installations other than vertical service shafts. Open systems include domestic cold, domestic hot, domestic hot recirculating systems.

- .4 Make provision for expansion and contraction of all pipe work. All piping shall be anchored and supported in such a manner that strain and/or weight does not come upon any apparatus and pipe branch connections. Expansion joints and compensators shall be installed and guided as per manufacturer's recommendations. All equipment shall be connected with unions or flanges to provide for easy removal. Where piping passes through walls or floor slabs, the sleeves shall be of sufficient size to accommodate the expansion and the pipe insulation, without binding or crushing the insulation or preventing the expansion of the piping.
- .5 All grooved joint couplings, fittings, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. All castings shall be date stamped for quality assurance and traceability.
- .6 Expansion Compensation Design Criteria:
 - .1 Installation Temperature: 10°C (50°F).
 - .2 Domestic Hot Water: 60°C (140°F).
 - .3 Safety factor: 30%.
- .7 In the absence of manufacturer's expansion data use the following criteria:

| Material | Expansion Coefficients |
|-------------------------------------|-------------------------|
| | $10^{-6} m/m\ ^\circ C$ |
| Carbon Steel | 11.7 |
| Copper | 16.8 |
| HDPE High Density Polyethylene | 120 |
| PE Polyethylene | 150 |
| CPVC Chlorinated Polyvinyl Chloride | 79 |
| PVC Polyvinyl Chloride | 50.4 |

1.7 Warranty

- .1 Furnish five year manufacturer warranty for leak free performance of packed expansion joints.

2. PRODUCTS

2.1 Flexible Metal Hose

- .1 Steel Piping:
 - .1 Inner Hose: Stainless Steel convoluted bellows.
 - .2 Exterior Sleeve: Double braided stainless steel.
 - .3 Suitable for system operating temperatures and pressures.
 - .4 Joints: As specified for pipe joints.
 - .5 Size: Use pipe-sized units.

- .6 Maximum offset: 20mm on each side of installed center line per linear 300mm of flexible connector length.
- .7 Application: Steel piping ½ NPS to 14 NPS.
- .2 Copper Piping:
 - .1 Inner Hose: Phosphor bronze convoluted bellows.
 - .2 Exterior Sleeve: Braided bronze.
 - .3 Suitable for system operating temperatures and pressures
 - .4 Joints: As specified for pipe joints.
 - .5 Size: Use pipe-sized units.
 - .6 Maximum offset: 20mm on each side of installed center line per linear 300mm of flexible connector length.
 - .7 Application: Copper piping ½ NPS to 4 NPS.

2.2 Flexible Pipe Connectors

- .1 Restrained Double Sphere Elastomer Type:
 - .1 Molded twin spherical type with integral cable or control rod restraints.
 - .2 Reinforced with an external ring between spheres.
 - .3 Safety factor for burst and flange pullout shall be a minimum of 3:1.
 - .4 Bridge bearing quality Neoprene or EPDM.
 - .5 Suitable for outdoor installation.
 - .6 Suitable for system operating temperatures and pressures.
 - .7 Joints: As specified for flanged pipe joints.
 - .8 Size: Use pipe-sized units.
 - .9 Cable or control rods require washer bushings to absorb a thrust of 6,800kPa.
 - .10 Control rods shall be used on all flexible pipe connectors when not anchored on both sides of the connector.
 - .11 Application: Chilled water and condenser systems only. Steel piping 2 NPS to 12 NPS.

2.3 Expansion Joints

- .1 Stainless Steel Bellows Type:
 - .1 Corrugated, packless.
 - .2 Stainless steel guide sleeves.
 - .3 Cover over external surfaces.
 - .4 Suitable for system operating temperatures and pressures.
 - .5 Maximum Compression: 45mm.
 - .6 Maximum Extension: 6mm.
 - .7 Joint: As specified for piping system.

- .8 Size: Use pipe sized units.
- .9 Accessories: limit stops.
- .10 Application: Axial or lateral movements. Steel piping 3 NPS and smaller.
- .2 External Ring Controlled Stainless Steel Bellows Type:
 - .1 Suitable for system operating temperatures and pressures.
 - .2 External cast iron control rings.
 - .3 Maximum Compression: 24mm.
 - .4 Maximum Extension: 9mm.
 - .5 Maximum Offset: 3mm.
 - .6 Joint: As specified for flanged pipe joints.
 - .7 Size: Use pipe sized units.
 - .8 Accessories: Internal flow liner, external guide rods, limit stops.
 - .9 Application: Axial or lateral movements. Steel piping 4 NPS and larger.
- .3 Copper Sleeve Type:
 - .1 Slip type.
 - .2 Allowance for repacking under full service.
 - .3 Suitable for system operating temperatures and pressures.
 - .4 Joint: As specified for piping system.
 - .5 Size: Use pipe sized units.
 - .6 Accessories: drip connections.
 - .7 Application: Axial movements. Copper or steel piping 2 NPS and larger.
- .4 Groove End Type:
 - .1 Slip type.
 - .2 Packless, gasketed, telescoping body and slip pipe section.
 - .3 Suitable for system operating temperatures and pressures.
 - .4 Size: Use pipe sized units.
 - .5 Consists of a series of grooved end pipe nipples joined in tandem with Victaulic Style 77 flexible couplings.
 - .6 Application: Axial movements. Steel piping 2 NPS and larger.

2.4 Expansion Compensators.

- .1 Copper Pipe Expansion Compensator - Low Pressure:
 - .1 Two-ply bronze or stainless steel convoluted bellows.
 - .2 Suitable for up to 121°C operating temperature and 414 kPa operating pressure.
 - .3 Maximum Compression: 12mm per each linear 300mm of compensator.
 - .4 Maximum Extension: 6mm per each linear 300mm of compensator.

- .5 Joint: As specified for piping system.
- .6 Size: Use pipe sized units.
- .7 Application: Axial movements. Copper or steel piping 2 NPS and under.
- .2 Steel Pipe Expansion Compensator:
 - .1 Bronze or stainless steel bellows in carbon steel casing.
 - .2 Anti-torque groove, internal pipe guides, internal liner.
 - .3 Suitable for system operating temperatures and pressures up to 1035 kPa
 - .4 Maximum Compression: 12mm per each linear 300mm of compensator.
 - .5 Maximum Extension: 6mm per each linear 300mm of compensator.
 - .6 Joint: As specified for piping system.
 - .7 Size: Use pipe sized units.
 - .8 Application: Axial movements. Steel piping 2 NPS and under.

2.5 Pipe Alignment Guides.

- .1 Heavy gauge pressed steel with precision drilled bolting.
- .2 Black enamel paint coated.
- .3 The interface with the copper tube shall be coated with a permanent dielectric material.
- .4 Accommodate specified insulation thickness.
- .5 Vapour barriers, jackets to remain uninterrupted.
- .6 Suitable for system operating temperatures.
- .7 Application: Copper or steel piping 1 NPS and larger.
- .8 Provide as per manufactures instructions.

2.6 Pipe Anchors.

- .1 Fabricate from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

2.7 Expansion Loops

- .1 Provide expansion loops as required.
- .2 The three legs of the expansion loop shall be equal unless indicated otherwise.
- .3 Cold springing of the expansion loop up to 50% of the expansion travel is allowable.

3. EXECUTION

3.1 General

- .1 Install to manufacturer's instructions.
- .2 Provide all piping systems with provision for expansion.

- .3 Only major expansion fittings and loops have been indicated on the drawings. Provide all required additional expansion fittings and loops to accommodate system expansion and contraction.
- .4 Provide flexible pipe connectors on all pipes connected to equipment supported by vibration isolation.
- .5 Provide flexible pipe connectors at right angles to displacement. Install one end of the compensator immediately adjacent to the isolated equipment and provide an anchor at the other end.
- .6 Provide expansion joints on all piping crossing building expansion joints, building seismic joints for seismic separations.
- .7 Provide a minimum of three pipe elbows in all branch pipe connections. Provide flexible metal hose connectors where space does not permit the installation of three elbows.
- .8 Install compensators in the horizontal plane unless indicated otherwise.
- .9 Rigidly anchor piping to the structural members. Provide pipe guides to direct movement along the pipe axis.
- .10 Ensure flexible metal hose and expansion compensators, specifically low pressure units, are not damaged during pressure testing.

3.2 Flexible Metal Hose

- .1 Provide a union at the hose on all screwed installations.
- .2 Protect the hose from torque damage during installation.

3.3 Expansion Joints

- .1 Provide 2 sets of alignment guides at each expansion joint. Spacing to manufacturer's recommendations.
- .2 Provide anchors on both sides of each expansion joint. Spacing to manufacturer's recommendations.
- .3 Locate expansion joints centrally between anchors.
- .4 Bellows Type:
 - .1 Provide a union at one end of each unit with threaded connections.
 - .2 Remove any slippage bolts and or spacers after installation.
- .5 Sleeve Type:
 - .1 Provide structure for base mounted units.
 - .2 Pack joints after installation.

3.4 Pipe Alignment Guides

- .1 Alignment guides are required to maintain the pipe/tube centerline axial to expansion joints and throughout the intermediate portion of the run to prevent buckling.
- .2 Expansion joints that do not include internal guides require an alignment guide to be located 4 diameters from the face of the expansion joint, and an additional guide 14 diameters from the first guide or as per manufacturer's instructions.

- .3 Expansion joints with internal guides require only one alignment guide to be located 10-14 diameters from the expansion joint or as per manufacturer's instructions.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Materials and installation for meters, thermometers, and pressure gauges in piping systems.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts
- .2 Section 21 05 01 – Common Work Results for Mechanical

1.3 References

- .1 The latest revisions of the following standards shall apply
- .2 American Society of Mechanical Engineers (ASME).
 - .1 ASME B40.100 Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200 Thermometers, Direct Reading, and Remote Reading.
- .3 Canadian Standards Association
 - .1 CAN/CSA-C22.2 No. 157 Intrinsically Safe and Non-incendive Equipment for Use in Hazardous (Classified) Locations.
 - .2 CSA C22.2 No. 213 Non-incendive Electrical Equipment for use in Class I, Div. 2 Hazardous Locations.

1.4 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:
- .2 Submit manufacturer's product data for following items:
 - .1 Flow Meters.
 - .2 Encoders, pulse heads and or data output modules
 - .3 Pressure gauges.
 - .4 Pressure gauge taps
 - .5 Thermometers.
 - .6 Wells.
 - .7 Test plugs
 - .8 Test thermometer

2. PRODUCTS

2.1 General

- .1 Select thermometers and pressure gauges so that their operating range falls in the middle half of the scale range.

2.2 Positive Displacement Flow Meters (Liquid)

- .1 AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron bottom cap, hermetically sealed register, remote reading to AWWA C706.
- .2 Meter: Brass body meter with magnetic drive register.
 - .1 Service: Cold water, 50°C (122°F).
 - .2 Nominal Flow: to suit application.
 - .3 Pressure Drop at Nominal Flow: 35 kPa (5 psi).
 - .4 Maximum Operating Pressure: 860 kPa (125 psi).
 - .5 Accuracy: 1½ percent.
 - .6 Maximum Counter Reading: 100 million litres.
 - .7 Size: As required – see drawings/piping schematic.
 - .8 Output signals shall be BACnet®, BACnet/IP, or via individual analog and pulse outputs.
- .3 Application: hydronic make-up water applications.

2.3 Pressure Gauges

- .1 Case & Ring: 115 mm (4½”), cast aluminum, black steel, or stainless steel case with stainless steel or chrome plated face ring.
- .2 Lens: Shatter-proof acrylic.
- .3 Dial: Aluminum with white finish and black markings, both IP and metric graduations.
- .4 Pointer: Adjustable type, aluminum with black finish.
- .5 Movement: Rotary type bushed movement, silicone dampened to prevent pointer oscillation.
- .6 Pressure Element Assembly: Phosphor bronze bourdon tube.
- .7 Connection: Brass, 6 mm (1/4”) NPT, bottom-outlet.
- .8 Accuracy: Plus or minus one percent of entire range (ASME B40.1 Grade A).
- .9 Scale: Dual units, Kilopascal, and psig.
- .10 Listing:
 - .1 Registered with Provincial Boiler and Pressure Vessel Safety Branches with CRN number.
 - .2 ULC listed for use on fire protection systems.
- .11 Accessories:
 - .1 Install a needle valve ahead of each gauge.
 - .2 Install a pressure snubber ahead of each gauge.
 - .3 Install an anti-syphon loop (suitable for steam pressure) ahead of each gage on steam systems.

2.4 Differential Pressure Gauges

- .1 Magnehelic: 90 mm (3½") diameter dial in case, diaphragm actuated, black figures on white background, front recalibration adjustment, (inclined type manometer and tubing, static pressure tips, and mounting assembly).

2.5 Pressure Gauge Taps

- .1 Needle Valve: Brass, 6mm (1/4") NPT for minimum 2068 kPa (300 psi).
- .2 Ball Valve: Brass 6mm (1/4") NPT for 1724 kPa (250 psi).
- .3 Pulsation Damper: Pressure snubber, brass with 6mm (1/4") NPT connections

2.6 Thermometers – Piping

- .1 Case: cast aluminum alloy with anodized, powder coat or baked enamel finish.
- .2 Lens: Clear glass or heat resistant acrylic window.
- .3 Scale:
 - .1 225 mm (9 inch) scale length.
 - .2 White background with temperature range in black
 - .3 Dual Celsius and Fahrenheit scale.
- .4 Tube: non-toxic organic filled (non-mercury).
- .5 Adjustable Fitting: 180° adjustment in vertical plane and 360° adjustment in horizontal plane.
- .6 Connection: 30mm (1 1/4") threaded brass coupling nut.
- .7 Stem: Aluminum, tapered to fit standard thermowells, packed with heat transfer paste to provide maximum temperature response.
- .8 Accuracy: plus or minus one percent of full scale.

2.7 Thermometer Wells

- .1 Material:
 - .1 Copper Pipe: Copper or bronze.
 - .2 Steel Pipe: Brass.
- .2 Size: 20 mm (3/4") NPT.
- .3 Brass separable sockets for thermometer stems with or without extensions, and with cap and chain. Provide extensions as required.
- .4 Registered with Provincial Boiler and Pressure Vessels Safety Branch with CRN number.

2.8 Test Plugs for Pressure / Temperature

- .1 6 mm (1/4") NPT solid brass test plug fitting and cap for receiving 3 mm (1/8") O.D. pressure or temperature probe.
- .2 Dual seal core, Nordel EPDM, suitable for temperature of 177°C (350°F) and rated for zero leakage from vacuum to 6895 kPa (1000 psi).
- .3 Provide one (1) master test kit containing:

- .1 One (1) gauge adaptor, 3 mm (1/8") O.D. probe.
- .2 Two (2) test pressure gauge of suitable range
- .3 Two (2) stem pocket testing thermometers of suitable range.

2.9 Test Thermometer

- .1 Hand over a test thermometer in protective case to the Departmental Representative during the Departmental Representative's Demonstration and Instruction Period. Provide the same make and type as the permanently installed thermometers suitable for use with pipe mounted wells. Range 0°C to 115°C. (30°F to 240°F).
- .2 Obtain two signed receipts from the Departmental Representative certifying that the test thermometer has been received. Hand one over to the Departmental Representative.

3. EXECUTION

3.1 Application

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Installation

- .1 Install thermometers and gauges 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 Install engraved lamacoid nameplates as specified in Section 23 05 53 – Identification for Mechanical Piping and Equipment, identifying medium.
- .4 Adjust gauges and thermometers to final angle, clean windows, and lenses, and calibrate to zero.

3.3 Positive Displacement Meters

- .1 Install positive displacement meters with isolating valve on inlet and outlet. Provide full line sized valved bypass with globe valve for liquid service meters.

3.4 Flow Meters

- .1 The flow meter shall be sized and programmed by the manufacturer for each specific application and installed according to manufacturer's recommendations.
- .2 Pay special attention to straight pipe length requirements. Provide flow conditioners when required to meet the manufacturer's minimum upstream straight pipe run requirement.
- .3 Co-ordinate required output signals with the Division 25 Contractor.
- .4 For installations in non-metallic pipe, install grounding rings or probes as required.
- .5 Provide lateral and horizontal supports as required to minimize vibration at the meter location.
- .6 Final connection to the BAS shall be completed by Division 25 as per specifications. All wiring will be done in accordance with Canadian National Electric Code standards and regulations, and in conjunction with the local Electrical Safety Association office.

3.5 Pressure Gauges

- .1 Install pressure gauges with pulsation dampers for liquid service. Provide gauge cock or needle valve to isolate each gauge. Extend nipples to allow clearance from insulation.
- .2 For steam service, provide pigtail siphon and needle valve.
- .3 Provide one compound pressure gauge per pump. Install taps on pump suction, pump discharge and before strainer. Pipe to gauge with needle valve on each tap.
- .4 Use extensions where pressure gauges are installed through insulation.
- .5 Provide positive pressure gauges as indicated on the drawings and in the following locations:
 - .1 Expansion tanks.
 - .2 Pressure tanks.
 - .3 Standpipe highest point.
 - .4 Standpipe and sprinkler water supply connection.
 - .5 Sprinkler system.
 - .6 Pressure reducing valves – both sides.
 - .7 Domestic water supply to building.
- .6 Provide compound pressure gauges as indicated on the drawings and in the following locations:
 - .1 Pumps.
 - .2 Steam service.
- .7 Provide air system static pressure gauges as indicated on the drawings and in the following locations:
 - .1 Medium and high pressure system.
 - .2 Supply fan discharge.

3.6 Differential Pressure Gauges

- .1 Provide filter differential pressure gauges as indicated on the drawings and at the following locations:
 - .1 Built-up filter banks.
 - .2 Unitary filter sections.
- .2 Provide air system static pressure taps as indicated on the drawings and at the following locations:
 - .1 Inlet and discharge of supply and return fans.
 - .2 Inlet and discharge of coils.
 - .3 Inlet and discharge of silencers.
 - .4 Inlet and discharge of mixing chambers.
 - .5 Inlet and discharge of humidifier section.
 - .6 Inlet and discharge of heat recovery sections.

3.7 Thermometers

- .1 Install in wells on piping. Provide heat conductive material inside well.
- .2 Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 65 mm (2½") for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- .3 Install thermometers in air duct systems on flanges.
- .4 Install thermometer sockets adjacent to control systems thermostat, transmitter, or sensor sockets.
- .5 Locate duct mounted thermometer minimum 3 metres (10 feet) downstream of mixing dampers, coils, or other devices causing air turbulence, whenever possible.
- .6 Coil and conceal excess capillary on remote element instruments.
- .7 Use extensions where thermometers are installed through insulation.
- .8 Provide stem type thermometers as indicated on the drawings and in the following locations:
 - .1 Headers to central equipment.
 - .2 Coil banks at inlet and outlet.
 - .3 Heat exchangers at inlet and outlet.
 - .4 Boilers at inlet and outlet.
 - .5 Chillers at inlet and outlet.
 - .6 Heat pumps at inlet and outlet.
 - .7 Cooling tower/fluid coolers at inlet and outlet.
 - .8 DHW tanks.
- .9 Provide dial type thermometers as indicated on the drawings and in the following locations:
 - .1 After coils in air systems.
 - .2 Each supply air zone.
 - .3 Outside air intake.
 - .4 Return air plenum.
 - .5 Mixed air plenum.

3.8 Thermometer Wells

- .1 Install wells for balancing purposes.
- .2 Install wells where indicated for use with test thermometers.
- .3 Provide thermometer wells as indicated on the drawings and in the following locations:
 - .1 All lines to three way control valves.
 - .2 Individual return lines from heating and cooling coils.

3.9 Pressure / Temperature Ports

- .1 Install pressure/temperature ports into threaded pipe nipples welded to wall of pipe. Locate fittings in accessible spaces.
- .2 Provide one pressure / temperature port test kit.
- .3 Coordinate locations with the balancing agent to ensure all ports are provided as required for testing and balancing services.
- .4 Install pressure / temperature ports in the following locations:
 - .1 Both sides of two-way control valves.
 - .2 All lines to three-way control valves.
 - .3 Heating and cooling coils: At common inlet and outlet of each coil.
 - .4 Heat exchanger: At inlet and outlet.
 - .5 Chiller: At inlet and outlet of chilled water and condenser water.
 - .6 Finned tube elements: At inlet and outlet.
 - .7 Radiant heaters: At inlet and outlet.
 - .8 In-slab radiant heating zones: At inlet and outlet to manifolds.
 - .9 Reheat coils: At inlet and outlet.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Materials and installation for hangers and supports for mechanical and plumbing piping, ducting and equipment.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical
- .3 Section 23 05 48 – Vibration and Seismic Control for Mechanical.

1.3 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
- .2 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1 – Power Piping.
- .3 ASTM International
 - .1 ASTM A125 – Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod, 60,000 PSI Tensile Strength.
 - .3 ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58 – Pipe Hangers and Supports - Materials, Design and Manufacture.
- .5 Underwriter's Laboratories of Canada (ULC)

1.4 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:
 - .1 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
 - .2 Certificates:
 - .1 Submit certificates from the manufacturer certifying that materials comply with specified performance characteristics and physical properties of the listed Related Standards.
 - .3 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.5 General Requirements

- .1 Plumbing piping: to the more stringent requirements of the BC Plumbing Code and the National Plumbing Code of Canada.
- .2 Construct pipe hangers and supports to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .3 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
- .4 Ensure that supports do not transmit excessive quantities of heat to building structure.
- .5 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .6 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .7 Provide hangers and supports to secure equipment in place, prevent vibration, protect against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.
- .8 Support from (top of) structural members. Where structural bearings do not exist or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.

2. PRODUCTS

2.1 General

- .1 Fabricate hangers and supports 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.
- .3 Power actuated fasteners and "drop-in" anchors shall not be used for tension load applications such as pipe and duct hangers.

2.2 Riser Clamps

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

2.3 Insulation Protection Shields

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield, galvanized sheet carbon steel. Length designed for maximum 3 m span.
 - .2 Non-metallic support coupling, sized to suit standard and millimeter pipe O.D. UL listed, meeting 25/50 flame and smoke spread ratings. Supplied with hanger and/or strut mount as a complete support assembly.

- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm and over.
 - .2 For piping to 60°C Non-metallic support coupling, sized to suit standard and millimeter pipe O.D. UL listed, meeting 25/50 flame and smoke spread ratings. Supplied with hanger and/or strut mount as a complete support assembly.

2.4 Equipment Supports

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Division 5. Submit calculations with shop drawings.

2.5 Equipment Anchor Bolts and Templates

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

2.6 Other Equipment Supports

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Division 5.
- .2 Submit structural calculations with shop drawings.

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 and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 Hanger Spacing

- .1 Within 300 mm of each elbow.

| Maximum Pipe Size NPS | Maximum Spacing Steel m | Maximum Spacing Copper m | Minimum Rod Dia mm |
|--------------------------|----------------------------|-----------------------------|-----------------------|
| up to 1/2 | 1.8 | 1.5 | 9 |
| 3/4, 1 | 2.4 | 1.8 | 9 |

3.4 Hanger Installation

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Install hangers to provide minimum 13 mm space between finished covering and adjacent work.
- .5 Support vertical piping at every other floor.
- .6 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
- .7 Support riser piping independently of connected horizontal piping.
- .8 Install plastic inserts between steel studs and piping.
- .9 Provide insulation protection saddles on all insulated piping.

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

1. GENERAL

1.1 Section Scope

- .1 The work in this section includes, but is not limited to the following:
 - .1 Seismic restraints for isolated equipment.
 - .2 Certification of seismic restraint designs and installation supervision.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
- .2 Applicable Building Code: Refer to Section 21 05 01 – Common Work Results for Mechanical.
- .3 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
 - .1 ASHRAE HVAC Applications Handbook (Seismic Design Chapter 54).
- .4 Federal Emergency Management Agency (FEMA):
 - .1 FEMA – Installing Seismic Restraints for Mechanical Equipment.
- .5 Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
 - .1 VISCMA – Installing Seismic Restraints for Mechanical Equipment.

1.4 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:
 - .1 Consultant Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional Schedule S-B and Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.
 - .2 Shop drawings: submit drawings for vibration control stamped and signed by a Professional Engineer.
 - .3 Shop drawings: submit drawings for seismic control stamped and signed by a Professional Engineer registered or licensed in Province of British Columbia.
 - .4 Provide separate shop drawings for each isolated system complete with performance and product data.

1.5 General Requirements

- .1 All mechanical piping as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
- .2 Provide seismic restraints for all required equipment, piping, and ductwork.
- .3 Responsibilities:
 - .1 The Contractor shall retain the services of a qualified professional seismic engineer (Seismic Engineer) registered in the Province of British Columbia. The Seismic Engineer shall design and review the installation of all seismic restraints as well as mechanical equipment and mechanical system supports. The restraints and supports shall be specifically designed to fasten to the structure indicated in the contract documents and installed in the field. The complete design for these systems shall comply with all applicable building code requirements.
 - .2 Seismic Engineer shall provide and submit to the Departmental Representative Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional Schedule S-B and Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.
 - .3 Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
 - .1 Determine vibration isolation and seismic restraint sizes and locations.
 - .2 Provide vibration isolation and seismic restraints as scheduled or specified.
 - .3 Provide calculations and materials if required for restraint of non-isolated equipment.
 - .4 Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
- .4 All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
- .5 It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.
- .6 All such systems must be installed in strict accordance with seismic codes, component manufacturer's, and building construction standards. Whenever a conflict occurs between the standards, the most stringent shall apply.
- .7 Seismic restraints shall be designed in accordance with seismic force levels as indicated in the Building Code for the specific region of the project.
- .8 All elastomeric components in isolation pads, mounts, and seismic snubbers shall be bridge bearing neoprene, meeting CSA Standard CAN3-S6 Section 11.10.
- .9 Provide an acceptable means of corrosion protection for all equipment, attachments, and accessories supplied under this section, suitable for the conditions in which this equipment, etc. will be installed.
- .10 Bolt all equipment to the structure. Do not bridge isolation elements.
- .11 Use ductile materials in all vibration isolation equipment.

.12 Isolators:

- .1 Provide neoprene isolators for deflections 6mm and under.
- .2 Provide either neoprene or steel spring isolators for deflections between 6mm and 12mm.
- .3 Provide steel spring isolators for deflections of 12mm and over.
- .4 Provide adjustable limit stops for spring isolation mounts on equipment with operating weights substantially different from the installed weights.
- .5 All spring isolators shall be "open spring" unless otherwise stated. Seismically rated housed spring isolators may be used in lieu provided that they meet this project's requirements for seismic restraint.
- .6 Isolators and bases which are factory supplied with equipment shall meet the requirements of this section. Where internal isolation is provided, the isolation requirements specified in the minimum static deflection table apply to all separate vibration sources in the unit. Where internal vibration isolation is not provided, the unit frame shall be rigid enough such that the isolators can be attached directly without additional stiffening.
- .7 Space isolators under equipment so that the minimum distance between adjacent corner isolators is at least equal to the height of the center of gravity of the equipment. Include height of center of gravity on shop drawings. Otherwise, provide suitable horizontal restraint isolators.
- .8 Select isolators in accordance with equipment weight distribution to allow for an average deflection meeting or exceeding the specified deflection requirements and so that no isolator has a deflection less than 80% of the static deflection specified. A minimum of 4 isolators are required for each piece of equipment, unless specified otherwise. Number and colour code each isolator to show location. Mark code number and colour on shop drawings, on each isolator and on each base to ensure proper placement. Clearly tag all springs to show undeflected height and static deflection.
- .9 Refer to the minimum static deflection table contained in this Section.

.13 Piping Hangers:

- .1 Provide resilient hangers on all piping, etc., rigidly connected to vibration isolated equipment. Provide the hangers for a distance of 3.0m for a 1 NPS pipe and 13.5m for a 10 NPS pipe. Isolate other pipe sizes for a proportionate distance (both interpolation and extrapolation may be required). Select the three closest hangers to the vibration source for the lesser of 25mm static deflection or the static deflection of the isolated equipment. Select the remaining isolators for the lesser of 25mm static deflection or one-half the static deflection of the isolated equipment.
- .2 Where resilient hangers cannot be provided for piping rigidly connected to vibration isolated equipment (such as a rigid fire-stop falling within the required isolation distance), provide flexible connectors. One end of each flexible connector shall be installed directly to a flange of the isolated equipment (between the equipment and isolation valves) unless otherwise indicated on the drawings.

1.6 Regulatory Requirements

- .1 Tested values must show that the seismic restraint hardware used in conjunction with the vibration isolation product is capable of withstanding the increased forces, as calculated for the specific project, using the formulae provided in the applicable building code.
- .2 Supply isolators and seismic restraints meeting the structural requirements of the building code, including Section 4.1.8.18 with respect to seismic snubbers, or provide equivalent requirements where integral seismic restraint is provided in isolators / bolting.
- .3 Include building code Section 6.2.1.6(2). Vibration isolator housings are considered a safety guard with respect to isolated equipment and any contained compressed springs. Include "Fail Safe" seismic restraint in all vibration isolation designed to hold mechanical equipment and springs in place.

2. PRODUCTS

2.1 General

- .1 Isolation, anchors, bolts, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in Code for the seismic zone in which building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.
- .2 Where impact forces may be significant, use ductile materials.
- .3 Seismic restraining devices factory supplied with equipment are to meet requirements of this Section.

2.2 Type 7N – Neoprene Hangers

- .1 Double deflection neoprene hangers shall consist of a rigid steel frame containing a neoprene element with an upper embedded steel washer and an integral bottom flange, which will protrude, and friction fit into the lower circular opening of the hanger frame. The lower hole in the hanger box shall be of a large enough diameter to permit the threaded hanger rod to swing through a minimum 30° arc from side to side before contacting the neoprene flange. Nominal static deflection under load shall be 5mm. No hanger shall be loaded to less than 50% of this deflection nor exceed the manufacturers maximum recommended loading.

2.3 Type 13 - Flexible Piping Connections

- .1 Flexible piping connectors are to be supplied with seismic restraint materials.
- .2 Where flexible connections are not specified with piping in other Sections they are to be as specified herein.
- .3 Expansion joints shall be peroxide cured EPDM throughout with Kevlar® tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable.
- .4 Sizes 19mm through 50mm may have one sphere, bolted threaded flange assemblies, and cable retention.
- .5 Safety factors shall be a minimum of 3/1. All expansion joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment.

- .6 The piping gap shall be equal to the length of the expansion joint under pressure. Control rods passing through 13mm thick Neoprene washer bushings large enough to take the thrust at 0.7 kg/mm² of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the expansion joint rating without them.
- .7 Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration acceleration and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.
- .8 All expansion joints shall be installed on the equipment side of the shut off valves.

2.4 Anchor Bolts

- .1 Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying to its allowable loads.

2.5 Seismic Cable Restraints

- .1 Galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
- .2 Cables must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.
- .3 Cables must not be allowed to bend across sharp edges.
- .4 Cable assemblies shall suit installation type:
 - .1 Ceiling and at the clevis bolt.
 - .2 Between the hanger rod nut and the clevis.
 - .3 Clamped to a beam.

3. EXECUTION

3.1 General

- .1 All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.
- .2 Brace in-line equipment independently of ducts and pipes.
- .3 Do not mix solid and cable bracing.
- .4 All runs to have a minimum of two transverse and one longitudinal brace. A run is defined as any change in direction except offsets.

3.2 Seismic Restraint Installation

- .1 The following Mechanical Components Restraint Guide is to be used as a general guide only to establish appropriate restraint methods, hardware, and attachments, however, due to differences in construction, size, weight, and configuration of different manufacturer's equipment and variety of ways and means that equipment and components can be installed, specific restraint methods are to be confirmed in the field. Seismic restraint materials and methods are to be reviewed and approved by Departmental Representative

3.3 Mechanical Component Restraint Guide

| Item | Type Of Restraint | Minimum No. of Restraints | Notes |
|--------|-------------------|---------------------------|----------------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Piping | SCR TSR | As required | As per Specification |
| | | | |

| LEGEND | |
|--------|---|
| SCR | Slack cable restraint (bolted to structure) |
| TSR | Threaded support rod (bolted or clamped to structure) |

3.4 Seismic Piping Restraints

- .1 Seismically restrain all new piping as follows:
 - .1 Piping located in all utility and mechanical equipment rooms that is 1 ¼ NPS and larger.
 - .2 All other piping 2 ½ NPS and larger.
- .2 Provide transverse piping restraints at 12m maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- .3 Provide longitudinal restraints shall be at 24m maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- .4 Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.

3.5 Seismic Cable Restraints

- .1 Cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.
- .2 Cable assemblies are installed taut on non-isolated systems.

- .3 Where cable restraints are installed on support rods with spring isolators, the spring isolation hangers must be specification type.

3.6 Vibration Isolator Installation - General

- .1 Vibration isolation products as outlined in section 2 above are to be applied based on 2 basic project specific situations. The requirements for each of these is outlined below:
 - .1 Acoustical classification AA - Office Towers, Multi Storey Condominiums
 - .2 Acoustical classification A - Commercial
- .2 This project has an acoustical classification of AA. See Vibration Isolation Application Schedule for vibration isolation application requirements.
- .3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.
- .4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.
- .5 Use the lowest RPM scheduled for two-speed equipment in determining isolator deflection.
- .6 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing (seismically rated) anchors.
- .7 Isolate piping larger than 25 mm dia. directly connected to motorized and/or vibration isolated equipment with 25 mm static deflection spring hangers at spacing intervals in accordance with following:
 - .1 For pipe less than or equal to 100 mm dia. – first 3 points of support;
- .8 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm.
- .9 Flexible pipe connectors (Type 13 isolator) shall be provided and installed per the Vibration Isolation Application Schedule.
- .10 Provide hot dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located outdoors or in areas of high moisture which may cause corrosion.
- .11 Provide a minimum clearance of 50mm to other structures, piping, equipment, etc., for all equipment mounted on vibration isolators.
- .12 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing drilled inserts.
- .13 After installation and adjustment of isolators, verify deflection under load to ensure loading is within specified range.
- .14 Where isolated piping connected to noise generating equipment is routed from the utility or mechanical room through plumbing chases or other openings, position isolated piping to avoid contact with the structure, framing, gypsum wallboard and other elements which may radiate noise. Submit proposed details to meet this requirement. On all AA projects, Type 10 acoustical seals shall be provided on piping entering or leaving utility and mechanical rooms.

- .15 Ensure that the installed seismic restraints do not adversely affect the proper functioning of any vibration isolation products required by this section.
- .16 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm dia. and smaller. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to Departmental Representative.

3.7 Type 8 - Neoprene Washer/Bushing

- .1 Isolate variable frequency drive controller using neoprene washer/bushing isolators or soft grommets such that structure borne noise transmission to occupied space is less than airborne noise transmission.

3.8 Type 13 - Flexible Piping Connectors

- .1 Supply flexible piping connectors for connections (including plumbing) to seismically restrained equipment. Hand connectors to appropriate piping trade at site for installation.

3.9 Minimum Static Deflection Schedule

| Equipment | Equipment Supported By: | |
|--|-------------------------|----------------|
| | Slab on Grade | Elevated Floor |
| Fans, Blowers & Packaged H & V Units: | | |
| Under 0.5 HP | 1mm | 1mm |
| 0.5 HP to 7.5 HP | 25mm | 25mm |

NOTES:

- .1 Table indicates required static deflection of isolators for all fans regardless of power rating and for all other motor driven equipment over 0.37kW.
- .2 Advise Departmental Representative of equipment not contained in this table and obtain clarification as to the isolation performance requirements.
- .3 Steel spring isolators shall be used for all deflections 12mm and over.
- .4 Neoprene isolators shall be used for deflections 6mm and under.

3.10 Vibration Isolation Application Schedule

| Equipment | AA | A |
|---------------------------------------|-----------------|-----------------|
| Piping | | |
| Attached to Isolated Equipment | 7SN - See 3.4.5 | 7SN - See 3.4.5 |
| Through Mechanical Room Walls 1½" | 10 | - |
| Hot Water Risers - No Expansion Loops | 11,12,13 | - |
| Fans Hung | | |
| >>1/2hp>>1200 rpm | 7N & 14 | 8 & 14 |

| Equipment | AA | A |
|------------|--------|---|
| Fractional | 8 & 14 | |

Note:

- .1 Table indicates type of isolation required and any other sections of note.

3.11 Field Quality Control

- .1 Seismic Engineer:
 - .1 The Seismic Engineer shall perform all field services as required to fulfil the Building Code obligation for the provision of the Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.
 - .2 Submit concise field reports to the Departmental Representative within 3 days of each site review.
 - .3 Make adjustments and corrections in accordance with written report.
- .2 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 Twice during the installation, at 25 % and 60 % completion stages.
 - .2 Upon completion of installation.
 - .3 Submit a concise manufacturer's report to the Departmental Representative within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.

END OF SECTION

1. GENERAL

1.1 Section Scope

- .1 Materials and installation for the identification of all mechanical piping, ducting, equipment, and controls.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
- .2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

- .1 The latest revisions of the following standards shall apply unless noted otherwise.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.60 – Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3 – Identification of Piping Systems.

1.4 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:
 - .1 Submit data on all materials.

1.5 General Requirements

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Identify each system and system component according to the nomenclature used on the drawings and specifications. Identification to be consistent throughout the project.
- .3 When identifying systems and components in existing buildings, the new items shall be numbered sequentially with existing systems. Where possible include the zone or building area serviced by each system.
- .4 Submit list of system and component labels to be Departmental Representative for review prior to engraving.

2. PRODUCTS

2.1 Piping Systems Governed by Codes

- .1 Any piping that is governed by CSA or any other applicable code as addressed in contract documents, is to comply with those applicable codes concerning identification.

2.2 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.

2.3 System Equipment Nameplates

- .1 Each piece of equipment shall be identified with its equipment schedule identification, e.g. supply fan SF-1, cooling coil CC-1, pump P-1.
 - .1 Coordinate equipment with drawings and with Departmental Representative's requirements
- .2 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .3 Construction:
 - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .4 Sizes:
 - .1 Conform to following table:

| Size No. | Size (mm) | No. of Lines | Height of Letters (mm) |
|----------|-----------|--------------|------------------------|
| 1 | 10 x 50 | 1 | 3 |
| 2 | 13 x 75 | 1 | 5 |
| 3 | 13 x 75 | 2 | 3 |
| 4 | 20 x 100 | 1 | 8 |
| 5 | 20 x 100 | 2 | 5 |
| 6 | 20 x 200 | 1 | 8 |
| 7 | 25 x 125 | 1 | 12 |
| 8 | 25 x 125 | 2 | 8 |
| 9 | 35 x 200 | 1 | 20 |

- .2 Use maximum of 25 letters/numbers per line.
- .5 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.

2.4 Piping Systems Identification

- .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 by Workplace Hazardous Materials Information System (WHMIS) regulations.

- .3 Letter Height:
 - .1 13 mm high - 1-1/4 NPS pipe & smaller.
 - .2 25 mm high - 1-1/2 NPS up to 2-1/2 NPS pipe.
 - .3 50 mm high - 3 NPS and larger pipe.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75mm: 100mm long x 50mm high.
 - .2 Outside diameter of pipe or insulation 75mm and greater: 150mm long x 50mm 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 20mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from the Departmental Representative.
 - .2 Colours for legends, arrows: to following table:

| Background Colour | Legend, Arrows |
|-------------------|----------------|
| Yellow | BLACK |
| Green | WHITE |
| Red | WHITE |
| Blue | WHITE |

- .3 Background colour marking and legends for piping systems:

| Contents | Background Colour Marking | Legend |
|----------------------------|---------------------------|---------------------|
| Domestic Hot Water Supply | Green | DOM. HW SUPPLY, DHW |
| Domestic Cold Water Supply | Green | DOM. CW SUPPLY, DCW |
| Storm Water | Green | STORM |
| Sanitary | Green | SAN |
| Condensate Drain | Green | COND |

| Contents | Background Colour Marking | Legend |
|------------------|---------------------------|--------|
| Irrigation Water | Per CSA B128.1 | |

2.5 Valves, Controllers Identification

- .1 Provide valve identification and secure with non-ferrous chain or "S" hooks suitable for the system temperature.
- .2 Identification tags shall be of brass, aluminum, metalphoto, lamicoide or fiberglass, stamped or engraved with 12mm high identifier markings.
- .3 Tag the following new valves as a minimum:
 - .1 Valves on main piping circuits.
 - .2 Valves on major branch lines.
 - .3 Valves on minor branch lines in horizontal or vertical service spaces and mechanical rooms.
 - .4 Drain valves and hose bibbs on systems containing glycol.
 - .5 Control valves.
- .4 Do not tag the following valves:
 - .1 Valves on control valve stations.
 - .2 Plumbing fixture stops or hose bibbs.
 - .3 System drain valves.
- .5 Provide a valve tag schedule. Include in the identification of each tagged item, valve type, service, function, normal position and location of tagged item.
- .6 Provide a flow diagram for each system, reference applicable charts and schedules.

2.6 Ductwork Systems Identification

- .1 50mm high stencilled letters and directional arrows 150mm long x 50mm high.
- .2 Colours: black, or co-ordinated with base colour to ensure strong contrast.

2.7 Ductwork Access Identification

- .1 Secure 50 mm high, self-adhesive stick on-letters, on duct access panels to identify their usage, according to the following:
 - .1 Cleaning and service access, colour black, tag "C.A"
 - .2 Controls including sensors, colour black, tag "C"
 - .3 Backdraft dampers, balance dampers and control dampers, colour black, tag "D"

2.8 Controls Components Identification

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section. Include: sensors, transmitters, BMS controlled damper actuators, end-devices, distributed control panels (DCP)'s, application specific controllers (ASC)'s and field panels.
- .2 Inscriptions to include function and (where appropriate) fail safe position.

2.9 Ceiling Access Identification

- .1 Provide 6 mm self adhesive coloured dots to access doors in solid ceilings. Identify the location of equipment concealed above as follows:
 - .1 **Yellow** - Concealed equipment and cleaning access.
 - .2 **Black** - Control equipment, including dampers and sensors.
 - .3 **Green** –domestic cold water, domestic hot water isolation valves.

3. EXECUTION

3.1 General

- .1 Provide identification only after painting has been completed.
- .2 Perform work in accordance with CAN/CGSB-24.3 Identification of Piping Systems except as specified otherwise.
- .3 Provide ULC and/or CSA registration plates as required by respective agency.

3.2 Nameplates

- .1 Location shall be in conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Provide standoffs for nameplates on hot and/or insulated surfaces.
- .3 Do not paint, insulate or cover nameplate data.

3.3 Location of Identification on Piping and Ductwork Systems

- .1 Provide on long straight runs in open areas in equipment rooms: at not more than 17m 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 Provide adjacent to each change in direction.
- .3 Provide at least once in each small room through which piping or ductwork passes.
- .4 Provide on both sides of visual obstruction or where run is difficult to follow.
- .5 Provide on both sides of separations such as walls, floors, partitions.
- .6 Provide where system is installed in pipe chases, ceiling spaces, confined spaces, at entry and exit points, and at access openings.
- .7 Provide at beginning and end points of each run and at each piece of equipment in run.
- .8 Provide at point immediately upstream of major manually operated or automatically controlled dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification shall be easily and accurately readable from usual operating areas and from access points. Position the identification approximately at right angles to the 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.

3.4 Valves, Controllers Identification

- .1 Provide identification on valves and operating controllers, except at plumbing fixtures or where in plain sight of equipment they serve.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass located in the main mechanical or utility room. Provide one copy in each operating and maintenance manual.
- .3 Number valves in each system consecutively.
 - .1 Identification coding is to start with a utility description followed by a maximum of three numerals:
 - .2 Domestic Water DW-1, DW-2, DW-3...

END OF SECTION

1. GENERAL

1.1 General

- .1 This Section specifies general conditions for Divisions 25 and is to be read, interpreted, and coordinated with all other sections of Division 25 and Section 21 05 01 – Common Work Results for Mechanical.

1.2 Related Requirements

- .1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
- .2 Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification Sections apply to work specified in this section.

1.3 References

- .1 Work, materials, and equipment shall comply with the most restrictive of local, provincial, and National authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
 - .2 British Columbia Codes:
 - .1 British Columbia Electrical Code
 - .2 British Columbia Safety Authority

1.4 General Scope

- .1 'Provide' shall mean 'supply and install'.
- .2 Provide complete, fully tested, and operational systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.
- .3 Contract documents and drawings of this Division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material, and installation quality but are not detailed installation instructions.
- .4 Follow manufacturers' recommended installation instructions, details, and procedures for equipment, supplemented by requirements of the Contract Documents.
- .5 Install equipment to provide: service access, maintain service clearances and for ease of maintenance.
- .6 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors.

1.5 Coordination of Work

- .1 Products furnished but not installed under this division
 - .1 Division 22 – Plumbing
 - .1 Domestic water sub metering

1.6 Submittals

- .1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

- .2 Provide submittals on all hardware, software, and installation. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent. Provide drawings as files on optical disk (file format: .dwg, .dxf, pdf, or comparable). When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include a complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data and the following:
 - .1 BAS Hardware:
 - .1 Manufacturer's description and technical data, performance curves, product specification sheets, and installation/maintenance instructions for:
 - .1 Control Panels
 - .2 Transducers/Transmitters
 - .3 Sensors (including accuracy data)
 - .4 Actuators
 - .5 Valves
 - .6 Relays/Switches
 - .7 Operator Interface Equipment
 - .8 Wiring
 - .9 Other relevant items
 - .2 Wiring diagrams and layouts for each control panel. Show all termination numbers.
 - .3 Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware.
 - .2 Quantities of items submitted shall be reviewed but are the responsibility of the Division 25 Contractor.
 - .3 Instrumentation and Data Point Summary Table. Contractor shall submit in table format with the following information for each instrument and data point. The table is to be reviewed and approved by the Departmental representative prior to hardware and software installation and programming.
 - .1 Point name
 - .2 Point description: provide building designation, system type, equipment type, engineering units, and functionality; include a description of its physical location
 - .3 Expected range (upper and lower limit)
 - .4 Instrumentation (as applicable): manufacturer, model number, range, and accuracy specification
 - .5 Type
 - .1 AI: analog input
 - .2 BI: binary input
 - .3 NAI: network analog input

- .4 NBI: network binary input
- .5 CP: Configuration Property
- .6 P: Programmed (e.g., soft or virtual point in control sequence such as a PID input or output)
- .7 C: Calculated value; a soft or virtual point. If calculated value, provide logic diagrams or code and any constants used in formula. If time-based integrated values are required, provide time periods: minutes, daily, weekly, monthly, and yearly. Also, indicate if it is a running average.
- .6 Input resolution
- .7 Graphic display resolution
- .8 Data trend interval
- .3 Schedules:
 - .1 Within one month of contract award, provide a schedule of the work indicating the following:
 - .1 Intended sequence of work items.
 - .2 Start dates of individual work items.
 - .3 Duration of individual work items.
 - .4 Planned delivery dates for major material and equipment and expected lead times.
 - .5 Milestones indicating possible restraints on work by other trades or situations.
 - .2 Provide monthly written status reports indicating work completed, revisions to expected delivery dates, etc. An updated project schedule shall be included.
- .4 Provide Record drawings and maintenance data in compliance with Division 01 - Closeout Submittals and the following:
 - .1 Submit project record documents upon completion of installation. Co-ordinate quantity to suit number of O&M manuals required. The documents shall be submitted for approval prior to final completion and shall include:
 - .2 Project Record Drawings. As-built versions of the submittal shop drawings provided as files on optical media and as 11" x 17" prints.
 - .3 Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 25 08 00 Commissioning of Integrated Automation "BAS Demonstration" and "BAS Acceptance".
 - .4 Certification of pressure test required for: Control Air Tubing.
 - .5 Operation and Maintenance (O & M) Manual.
 - .6 As-built versions of submittal product data.
 - .7 Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
 - .8 Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.

- .9 Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
 - .10 Graphic files, programs, and database on magnetic or optical media.
 - .11 List of recommended spare parts with part numbers and suppliers.
 - .12 Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
 - .13 Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - .14 Licenses, guarantees, and warranty documents for equipment and systems.
 - .15 Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- .5 Training Materials. Provide course outline and manual for each class at least six weeks before first class. The BAS designer will modify course outlines and manuals if necessary to meet departmental representative needs. The BAS designer will review and approve course outlines and manuals at least three weeks before first class.

1.7 Acceptable Control System Primary Manufacturers

- .1 Refer to Section 23 05 01 for acceptable manufacturers list.
- .2 Quality Assurance
 - .1 Installer and Manufacturer Qualifications
 - .1 Installer shall have an established working relationship with BAS Manufacturer of not less than three years.
 - .2 Installer shall have successfully completed BAS control system training. Upon request, Installer shall present certification of completed training including hours of instruction and course outlines.

1.8 Identification

- .1 All components of the Building Management System shall be identification tagged. Comply with Section 23 05 53 - Identification for Mechanical Piping and Equipment.

1.9 Warranty

- .1 Warrant work as follows:
 - .1 Warrant labor and materials for specified BAS free from defects for a period of 12 months after final acceptance. BAS failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to departmental representative. Respond during normal business hours within 24 hours of departmental representative warranty service request.
 - .2 Work shall have a single warranty date, even if departmental representative receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

- .3 Provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, departmental representative can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Departmental representative written authorization.
- .4 Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of BAS designer's acceptance.
- .2 Special warranty on instrumentation:
 - .1 All instrumentation shall be covered by manufacturer's transferable [one-year] "No Fault" warranty. If manufacturer warranty is not available, the BAS installer shall provide the same.

1.10 Substantial & Total Performance

- .1 Comply with Section 21 05 01 Common Work Results for Mechanical – Substantial and Total Performance.
- .2 A certificate of Substantial Performance will not be granted unless the controls systems have been commissioned and are capable of operation with alarm controls functional and automatic controls in operation. Commissioning checklists must be submitted prior to the request by the Contractor to have a substantial completion inspection.

1.11 Ownership of Proprietary Material

- .1 Project-specific software and documentation shall become CCS property. This includes, but is not limited to graphics, record drawings, database, application programming code, and documentation.

2. PRODUCTS

2.1 Not used

3. EXECUTION

3.1 Examination

- .1 The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Consultant for resolution before rough-in work is started.

3.2 Co-ordination

- .1 Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- .2 Coordinate final graphics floor plans, room names and numbering with Architectural drawings including any changes made during construction. These graphics should be provided to the Engineers and the departmental representative for sign off before the graphics are completed.

- .3 Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the BAS specified in this section. These controls shall be integrated into the system and coordinated by this Contractor as follows:
 - .1 Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
 - .2 The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.
 - .3 The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
 - .4 The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.3 General Workmanship

- .1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- .2 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- .3 Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).
- .4 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- .5 All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.
- .6 All work, materials, and equipment shall comply with the rules and regulations of applicable local, provincial, and federal codes and ordinances as identified in Part 1 of this specification.

3.4 Existing Equipment

- .1 Unless otherwise directed, the contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the contractor find existing equipment that requires maintenance, the Consultant is to be notified immediately.
- .2 All redundant wiring and equipment as a result of this project, that is not identified for either salvage or reuse, shall be removed and become the property of the contractor, unless otherwise noted.
- .3 The mechanical system must remain in operation based on the departmental representative requirements within the building (i.e. between the hours of 6 a.m. and 6 p.m., Monday through Friday). Any interruptions to the operation of existing building systems must be co-ordinated with the Owner and the design team in advance of any interruptions.
- .4 The scheduling of fans through existing or temporary time clocks or BAS shall be maintained throughout the BAS installation.

- .5 Modify existing starter control circuits, if necessary, to provide hand/off/auto control of each starter controlled. If new starters or starter control packages are required, these shall be included as part of this contract.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 This project scope includes:
 - .1 Remove and reconnect kitchen equipment service connections,
 - .2 Temporary relocation of kitchen equipment service locations,
 - .3 Temporary power connection to temporary kitchen trailer,
 - .4 Sleeving of branch wiring through concrete floor,
 - .5 Firestopping

1.2 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 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.
- .3 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.
- .4 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.
- .5 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.
- .6 Comply with the requirements of the General Contract and coordinate the installation with all other trades on site.
- .7 Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied and/or relocated by other trades.

1.3 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.

1.4 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 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.
- .3 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.

1.5 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and Operating Personnel in the operation, care and maintenance of systems, system equipment and components.

1.6 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.

1.7 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.

1.8 LOCATION OF OUTLETS

- .1 Locate outlets/connection points 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/connection points at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

1.9 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 Mounting heights shall generally match existing heights for similar components.
- .3 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .4 It is recommended that contractor take photos for record purposes of equipment connections prior to disconnecting to avoid any disputes at time of reconnection.

1.10 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.

1.11 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 apprentice 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 Circuits originating from branch power panels.
 - .2 Controls wiring.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Submit test results for Departmental Representative's review.

1.12 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.
- .7 Temporary wiring and connections shall be removed at completion of project.

1.13 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 Off-the-shelf items such as standard boxes, conduit, wiring 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.

- .5 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.
- .6 Submit list of alternates used, within one week after acceptance of tender.
- .7 Should the contractor substitute a temporary kitchen trailer that requires an electrical power service larger than that indicated on the electrical drawings the contractor shall in the tender for upsizing the electrical feeder accordingly. Any costs related to ensuring the service is compatible with the existing electrical distribution system shall also be included.

1.14 PROTECTION OF EQUIPMENT

- .1 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.

1.15 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.
- .3 It is recommended that contractor take photos for record purposes of any damage noted to existing equipment at the start of the project to avoid any disputes at time of completion.

1.16 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 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the Construction Manager.
- .4 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.
- .5 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 Relevant details with respect to ratings and installation.

1.17 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.
- .5 All openings required for temporary use shall be reinstated prior to completion of project.

1.18 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 manufacturer'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.

1.19 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.

1.20 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.

1.21 CLEAN UP

- .1 Vacuum clean all new raceways and any electrical equipment. Ensure that no debris, tools, 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.

1.22 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.

1.23 SPARE PARTS

- .1 This contract does not call for spare parts or material, however any breakers provided for temporary use may remain in panel rather than removing and providing blank filler. Any such breakers require identification to indicate they are spare.

1.24 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.

1.25 AS-BUILT DRAWINGS

- .1 The electrical documentation for the as-built drawings shall be incorporated in accordance with section 01 01 50.

1.26 OPERATING AND MAINTENANCE MANUALS

- .1 The electrical documentation for the operating and maintenance manuals shall be incorporated in accordance with section 01 01 50.

1.27 DEMONSTRATION OF SYSTEMS

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.

1.28 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 Maintenance from manufacturer and contractor of all equipment shall be included for first year.

1.29 POWER INTERRUPTIONS

- .1 All power interruptions including individual branch circuits require close coordination with the departmental representative.
- .2 The contractor shall follow the operational protocol of the facility and request written permission at least 4 days prior to the date and time required for all shutdowns in common and occupied areas/rooms before proceeding with the shutdown(s). Shutdowns within individual unoccupied cells are not required to follow this requirement.

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 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.

2.4 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.

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 Electrical final from AHJ
 - .5 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.

1.2 GENERAL REQUIREMENTS

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems in service areas and rigid steel conduit in any area/room an inmate has access to unless otherwise indicated.
- .2 Flexible AC90 armoured cabling (BX) shall not be used for the general wiring system unless specifically noted on the drawings.
- .3 Provide Teck 90 for temporary connection of temporary feeder to kitchen replacement trailer.
- .4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .5 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 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.
- .4 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.

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 All wires are to be pulled in together in a common raceway, using liberal amounts of Compound 77 lubricant.

- .3 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.

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.

Part 3 Execution

3.1 INSTALLATION

- .1 Install 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 Grounding conductors: bare stranded copper, soft annealed.
- .2 Insulated grounding conductors: green.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, 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 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Make grounding connections in radial configuration only. Avoid loop connections.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary system.

3.3 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

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 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SURFACE CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches, communication devices, and receptacles.

2.3 FITTINGS – GENERAL

- .1 Bushing and connectors with nylon insulated throats.

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 Provide correct size of openings in boxes for conduit connections. Reducing washers are not to be used.
- .4 No sectional or handy boxes to be installed.
- .5 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.
- .6 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.
- .7 All visible securing components to be a high tamperproof standard suitable to corrections Canada.

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.
- .5 All visible securing components to be a high tamperproof standard suitable to corrections Canada.

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.

1.2 BASIC WIRING METHODS

- .1 Surface raceways - interior:
 - .1 All surface raceways shall be electrical metallic tubing (EMT).

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 Locate light switches on latch side of doors.
- .6 All raceways and wiring shall be installed concealed in building fabric as much as possible.

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 RACEWAY

- .1 Cconduit shall be paintable and have de-burred ends.

2.3 OUTLET BOXES AND JUNCTION BOXES

- .1 All outlet boxes and junction boxes shall be one-piece steel or aluminum.

2.4 CONDUIT FASTENINGS

- .1 One or two hole steel straps to secure surface conduits of all sizes.
- .2 Where surface mounting to the structure is not possible, support channel shall be used and either surface mounted or fastened to the suspended from the structure using threaded rod supports.

2.5 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required.

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 EMT except where specified otherwise.
- .3 Minimum conduit size for lighting and power circuits: 21mm.
- .4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .5 Dry conduits out before installing wire.
- .6 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.
- .7 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.
- .8 On surface wall runs, and visible raceways rising up from the concrete slab all conduit shall be installed in true vertical or horizontal direction. 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.
- .9 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).
- .10 All screws and bolts used as part of fastening devices in areas where inmates dine shall be of a tamperproof type and standard suitable to corrections Canada.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not pass conduits through structural members except as indicated.

- .3 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .4 Provide a sleeve for each conduit rising from the crawlspace below. Sleeves shall match those used for mechanical piping and be placed as detailed and otherwise directed by the Architect. Allow for firestopping between

3.3 FIRESTOPPING

- .1 Apply ULC approved fire stopping assembly to all conduit penetrations passing through fire rated walls and floors.
- .2 Firestopping shall be used to seal the void between each conduit and the sleeve through which it passes. This firestopping is to be neatly finished flush with the top of the sleeve.
- .3 Provide shop drawings showing details for each type of application on the project. Shop drawings shall include catalogue data and installation details.

END OF SECTION

Part 1 General

1.1 PRODUCT INFORMATION

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Where panels are existing and new breakers are required, shop drawings to include branch breaker type, quantity, and ampacity

Part 2 Products

2.1 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 Provide circuit breakers with indicated trip ratings as indicated on the drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Mount breakers in existing panelboards in accordance with manufacturer's instructions and update panelboard directory.
- .2 Where breakers are switched off for construction purposes they shall be easily recognized in a temporary manner in order to avoid unintentional switching by staff or unauthorized personnel.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Wiring devices are generally not required as most equipment uses direct connections. Where receptacles are found to be in less than good condition they shall be replaced. Allow for five devices of each type noted.
- .2 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.

Part 2 Products

2.1 RECEPTACLES – GENERAL

- .1 Heavy duty commercial grade.
- .2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - .1 Decora style.
 - .2 White nylon molded housing.
 - .3 Suitable for No.10 AWG for back and side wiring.
 - .4 Break-off links for use as split receptacles.
 - .5 Eight back wired entrances, four side wiring screws.
 - .6 Triple wipe contacts and non riveted grounding contacts.
- .3 Receptacles of one manufacturer throughout project.
- .4 Standards of acceptance: Specification grade.

2.2 RECEPTACLES – PARTICULAR APPLICATION

- .1 All other single outlet and special purpose receptacles to be equal to Specification grade. Confirm ampacity, voltage and pin configuration prior to installation.

2.3 COVER PLATES

- .1 Stainless steel: Type 302 or 304, No. 4 finish, 1 mm 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 All plates in resident rooms to be secured with two rivets.

3.2 INSTALLATION PARTICULAR

- .1 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.
- .2 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



Public Services and
Procurement Canada

Services publics et
Approvisionnement Canada

HAZARDOUS BUILDING MATERIALS ASSESSMENT

BUILDING “M4” MECHANICAL SYSTEMS / FLOORING UPGRADE MATSQUI INSTITUTION, ABBOTSFORD, BC

PSPC Project Number: R.106277.001

Report prepared for:

**Public Services and Procurement Canada, Environmental Services
Services Publics et Approvisionnement Canada, Services environnementaux**

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Report prepared by:

DST Consulting Engineers Inc.

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EXECUTIVE SUMMARY

DST Consulting Engineers Inc. (DST) was retained by Public Services and Procurement Canada (PSPC) on behalf of Correction Service Canada (CSC), for the purposes of completing a pre-renovation hazardous building materials assessment limited to the flooring finishes of the Kitchen and Dining Room, as well as the associated crawlspace areas, of Building “M4”, (herein referred to as the Project Areas) located at Matsqui Institution, 33344 King Road, Abbotsford, BC (herein referred to as the Subject Facility).

The assessment was completed to identify the presence or absence of Asbestos-Containing Materials (ACMs), Lead-Based Coatings (LBCs), Polychlorinated Biphenyls (PCBs), Ozone-Depleting Substances (ODS), Mould Amplification, Elemental Mercury and Animal Waste in preparation for flooring finishes replacement and Mechanical Systems upgrades planned for the Project Areas, and to provide appropriate recommendations based on the findings of our assessment.

The assessment was completed on November 5th, 2019 by Philip Pow, Asbestos Hazard Emergency Response Act Building Inspector and Project Manager of DST.

FINDINGS

Asbestos-Containing Materials (ACMs)

Based on the analysis of suspect materials, the following ACMs were identified in the Project Areas:

- **The white thermal system insulation (TSI) on the 4” pipe elbows within the Crawlspace area beneath the M4 Kitchen / Dining Room of the Subject Building.**
- **The black tar mastic applied to the pipe insulation of the 2” pipes within the Crawlspace area beneath the M4 Kitchen / Dining Room of the Subject Building.**

Based on the Previous Report, the following ACMs were previously identified within the Project Areas:

- **Tar paper jacketing (black pipe wrap) within the Crawlspace and Kitchen/Dining area;**
- **Silver/grey mastic on the HVAC ductwork within the Crawlspace and Kitchen/Dining area;**
- **Black mastic on HVAC ducts within the Crawlspace area;**
- **Black mastic on the 4” elbow and lagging within the Crawlspace area;**
- **Bell and spigot housings within the M4 Dining area and Crawlspace area;**

- **Concealed packing material on pipe elbows in the M4 Dining area and Crawlspace area;**
- **Black caulking on the internal window panes within the Corridor and Kitchen/Dining areas;**
- **Grey caulking on the internal window panes within the Corridor and Kitchen/Dining areas;**
- **Grey malleable caulking on the windows of the doors at the west and east breezeway entrances;**
- **Silver HVAC duct mastic throughout;**
- **Black mastic and paper on HVAC duct insulation within the Crawlspace;**
- **Grey mesh window pane caulking in Room 38, Corridor, and Inmate Dining Area; and,**
- **Black pipe wrap mastic (tar paper jacketing/black pipe wrap) throughout.**

Lead-Based Coatings (LBCs)

Based on the findings of DST's assessment and analytical results, one (1) of the two (2) suspect lead-based coatings samples were found to have hazardous levels of lead i.e., equal to or >600 mg/kg.

The following LBCs were identified to have hazardous levels of lead:

- **The white paint applied to the walls in the Locker Room (Room 66) of the Project Area.**

Based on the Previous Report, the following LBCs were previously identified within the Project Area:

- **The blue paint on the canopy fascia board of the Project Area; and,**
- **The white paint on the sprinkler pipes located throughout the Project Area.**

Ozone Depleting Substances (ODS)

Based on the results of DST's assessment, suspected ODS-containing equipment are likely present in the refrigerators and freezers in the Kitchen area within the Project Area.

Mercury

Based on DST's assessment, fluorescent light tubes identified throughout the Project Areas are presumed to contain mercury vapor.

Based on the Previous Reports, mercury-containing light tubes within approximately 350 light fixtures were observed within the Project Areas.

Polychlorinated Biphenyl's (PCBs)

Based on DST's assessment, fluorescent light ballasts identified throughout the Project Areas were suspected to be PCB-containing.

Based on the Previous Reports, PCB-containing light ballasts are suspected to be present within the Project Areas.

Mould Amplification

Based on DST's assessment, no visible moulds were observed within the Project Area.

Animal Waste

Based on DST's assessment, no animal droppings were observed within the Project Area. However, animal droppings may be present in concealed ceiling, wall and floor areas.

Crystalline Silica

Sources of crystalline silica and rock dust were identified in the concrete foundations, walls, floors, cinderblocks, ceramic tiles, grouts and mortars.

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Appendices

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1.0 INTRODUCTION

DST Consulting Engineers Inc. (DST) was retained by Public Services and Procurement Canada (PSPC) on behalf of Correction Service Canada (CSC), for the purposes of completing a pre-renovation hazardous building materials assessment limited to the flooring finishes of the Kitchen and Dining Room, as well as the associated crawlspace areas, of Building “M4”, (herein referred to as the Project Areas) located at Matsqui Institution, 33344 King Road, Abbotsford, BC (herein referred to as the Subject Facility).

The assessment was completed to identify the presence or absence of Asbestos-Containing Materials (ACMs), Lead-Based Coatings (LBCs), Polychlorinated Biphenyls (PCBs), Ozone-Depleting Substances (ODS), Mould Amplification, Elemental Mercury and Animal Waste in preparation for flooring finishes replacement and Mechanical Systems upgrades planned for the Project Areas, and to provide appropriate recommendations based on the findings of our assessment.

The assessment was completed on November 5th, 2019 by Philip Pow, Asbestos Hazard Emergency Response Act Building Inspector and Project Manager of DST.

This report provides an outline of applicable regulations and guidelines, our methodology, the results of the assessment, and conclusions with appropriate recommendations.

2.0 REGULATIONS AND GUIDELINES

2.1 Federal Regulations

2.1.1 Canada Labour Code

In federal jurisdictions, hazardous building materials are regulated under the *Canada Labour Code, Part II, Part X, Hazardous Substances*.

2.1.2 Asbestos-Containing Materials (ACMs)

ACMs are regulated under the Canada Occupational Health and Safety Regulations, (SOR/86-304). An asbestos-containing material is defined as a manufactured product that contains >0.5 % asbestos fibres by weight, at the time of manufacture, or vermiculite insulation that contains any asbestos fibres.

Vermiculite insulation is commonly found in the hollow cores of cinderblock walls, masonry brick, used as attic / floor cavity insulation, as well as an additive in wall / ceiling plaster compounds. As per WorkSafeBC requirements, vermiculite that contain any asbestos fibres, regardless of

concentration, must be considered asbestos-containing. The recommended sample volume for vermiculite insulation is ~ one (1) Litre and analysis can be completed following US EPA analytical method EPC/600/R-93/116, or by Transmission Electron Microscopy (TEM) analysis.

In addition, PSPC has developed the Asbestos Management Standard, effective June 5, 2017, that provide specific requirements for the management and abatement of ACMs.

2.1.3 Lead-Based Coatings (LBCs)

The *Hazardous Products Act (HPA)*, *Surface Coating Materials Regulation (SOR/2005-109)* provides regulatory requirements for the sale and labeling of surface coatings.

The Surface Coating Materials Regulation reduced the threshold for lead in paint from 5,000 mg/kg to 600 mg/kg, and in 2010, to 90 mg/kg. However, Provincial regulations do not require lead controls for surface coatings containing <600 mg/kg, as such, DST identifies a lead-based coating as a coating containing >600 mg/kg.

2.1.4 Halocarbon and Ozone Depleting Substances (ODS)

Halocarbon and Ozone Depleting substances are regulated under the Canadian Environmental Protection Act (CEPA), "*Federal Halocarbon Regulations, 2003, (SOR/2003-289)*".

2.1.5 Polychlorinated Biphenyl's (PCBs)

PCBs are regulated under the Canadian Environmental Protection Act, specifically under the "*PCB Regulations*" (*SOR/2008-273*"), including amendments up to the date of this report.

2.1.6 Transportation of Dangerous Goods Act

The Transportation of Dangerous Goods Act provides detailed requirements for the transportation of hazardous materials.

2.2 Provincial Regulations

In British Columbia, the management of hazardous building materials in the work place is regulated by WorkSafeBC under the Workers' Compensation Act (effective April 15, 1998), as amended by the Workers' Compensation (Occupational Health and Safety) Amendment Act (effective October 1, 1999). Specific requirements of the Occupational Health and Safety Amendment Act are prescribed in the British Columbia Occupational Health and Safety (BC OH&S) Regulation.

2.2.1 Mould Amplification

Mould-impacted building materials are regulated under Part 4, section 4.79 of the BC OH&S Regulation.

2.2.2 Elemental Mercury

Management of mercury-containing equipment is regulated under Part 5, section 5.49 of the BC OH&S Regulation.

2.2.3 Crystalline Silica

Rock dust, nuisance dust (including the respirable fraction), crystalline silica, etc. are regulated under the BC OH&S Regulations, specifically Section 5.0 “*Controlling Exposure*”, and 6.111 “*Rock Dust Control*”.

2.3 Hazardous Waste

In British Columbia, environmental matters pertaining to waste generally fall under the jurisdiction of the British Columbia Ministry of Environment (MoE), pursuant to the Environmental Management Act. The key waste regulation under the Environmental Management Act relating to hazardous building materials is the Hazardous Waste Regulation (HWR), as amended from time to time. The HWR provides the requirements for the proper handling, storage, transportation, treatment, recycling and disposal of hazardous wastes in the province. The regulation also outlines the materials and criteria to be used to characterize waste as hazardous.

3.0 METHODOLOGY

The site review and sampling was completed by DST on November 5th, 2019. DST referenced the Appendix 5.26 section of a report prepared by Stantec Consulting Inc. (Stantec) entitled “*Hazardous Building Materials Assessment*”, dated March 2019 (herein referred to as the Previous Reports).

Suspect hazardous building materials were visually identified, based on the surveyor's knowledge of the historic composition of building products. Visual identification of materials suspected to contain hazardous materials were first cross-referenced with the Previous Reports and if identified to not have been previously sampled, were collected and supported by the analysis of representative samples.

Public Services and Procurement Canada Asbestos Management Standard (June 5, 2017), Section 6.1.2.2 recommends adherence to Provincial / Territorial regulations with respect to bulk sampling frequency.

Part 6 and Part 20 of the British Columbia Occupational Health and Safety Regulation provide recommended sampling frequency based on the nature and type of suspected ACMs. Specifically, WorkSafeBC Guideline G20.112 – Hazardous Materials – Asbestos (WorkSafeBC Guideline), specifically, Part 20 provides guidance on the minimum number of bulk samples that should be collected to identify any asbestos that may be present in a residential, industrial or commercial building, prior to renovation, demolition and/or salvage work.

The WorkSafeBC Guideline was developed using the United States Environmental Protection Agency (US EPA) Asbestos Hazard Emergency Response Act (AHERA) sampling frequency. The AHERA sampling protocol provides recommendations for minimum sampling frequency of suspected, friable and non-friable, non-manufactured (i.e. non-homogeneous) building materials. The AHERA sampling protocol does not provide a sampling frequency with respect to homogeneous, non-friable ACMs. The AHERA sampling protocol states that sampling should be completed in a sufficient manner based on site conditions. As such, DST employed a methodology of collecting at least one (1) sample of each visually distinct non-friable, suspected ACMs.

Through the on-site assessments, DST assessed each suspected ACM to determine homogeneity of the application. For homogenous (i.e. manufactured products, including flooring materials, mastics, putties, etc.) materials, one sample of each visually distinct type of application was sampled. For non-homogenous materials (i.e. drywall joint compound, ceiling texture coats, etc.), representative samples were collected based on surface area of the above-mentioned materials.

Suspect LBC samples were analyzed for lead content by an accredited independent laboratory using inductively coupled plasma-atomic emission spectrometry (ICP-AES), following EPA 6010c R3 m. Painted surfaces that were identified to contain a concentration of lead equal to or greater than 600 mg/kg were classified as having a hazardous level of lead and were considered a lead-based coating.

Suspected ozone-depleting substances (ODSs), elemental mercury, sources of polychlorinated biphenyls (PCBs), mould amplification, crystalline silica, and rodent droppings were visually identified based on appearance, age, and knowledge of historic applications/locations.

4.0 FINDINGS

4.1 Asbestos-Containing Materials (ACMs)

Fourteen (14) samples of suspect ACMs were collected and analyzed for asbestos content from the Project Areas. Drawings indicating sample point locations are presented in **Appendix I**. Asbestos analytical reports are included in **Appendix II**. The sample descriptions and analytical results are summarized in **Table 1**, below.

| Table 1: Analysis of Suspect ACMs | | | |
|--|------------------------------------|---------------------------------------|------------------------------------|
| Building M4 – Kitchen and Dining Room – Matsqui Institution, Abbotsford, BC | | | |
| Sample I.D. | Sample Location | Sample Description | Asbestos Content & Type |
| A-1 | Crawl Space – 4” Pipe Elbow | White TSI Insulation | 60% Chrysotile |
| A-2 | Crawlspace Ceiling Penetrations | Red Mastic | None Detected |
| A-3 | Crawlspace Ceiling Penetrations | Red Mastic | None Detected |
| A-4 | Crawlspace Ceiling Penetrations | Red Mastic | None Detected |
| A-5 | Room 56 / M4 Kitchen - Floor | Grey Speckled Battleship Lino | None Detected |
| A-6 | M4 Kitchen (46) - Floor | Blue Mastic (between flooring sheets) | None Detected |
| A-7 | M4 Kitchen (46) - Floor | Blue Battleship Lino | None Detected |
| A-8 | Locker Room (66) – Floor | Tan Cement Flooring | None Detected |
| A-9 | Janitor Room (62) – Floor | Grey Cement Flooring | None Detected |
| A-10 | M4 Kitchen (70) – Floor | Light Blue Battleship Lino | None Detected |
| A-11 Tar Mastic | Crawlspace – 2” Pipe Elbow | Black Tar Mastic | 3% Chrysotile |
| A-11 Insulation | Crawlspace – 2” Pipe Elbow | TSI Insulation | None Detected |
| A-12 | Change Room (65) – Wall | Drywall Joint Compound | None Detected |

| Table 1: Analysis of Suspect ACMs | | | |
|--|-------------------------|---------------------------|------------------------------------|
| Building M4 – Kitchen and Dining Room – Matsqui Institution, Abbotsford, BC | | | |
| Sample I.D. | Sample Location | Sample Description | Asbestos Content & Type |
| A-13 | Change Room (65) – Wall | Drywall Joint Compound | None Detected |
| A-14 | Change Room (65) – Wall | Drywall Joint Compound | None Detected |

Note: **Bold** print indicates asbestos-containing materials.

Based on the analysis of suspect materials, the following ACMs were identified in the Project Areas:

- **The white thermal system insulation (TSI) on the 4” pipe elbows within the Crawlspace area beneath the M4 Kitchen / Dining Room of the Subject Building. At the time of DST’s assessment, the white TSI on the 4” pipe elbows were observed to be in GOOD Condition, posing a LOW risk for persons approaching the material.**
- **The black tar mastic applied to the pipe insulation of the 2” pipes within the Crawlspace area beneath the M4 Kitchen / Dining Room of the Subject Building. At the time of DST’s assessment, the black tar mastic applied to the pipe insulation of the 2” pipes elbows were observed to be in GOOD Condition, posing a LOW risk for persons approaching the material.**

Based on the Previous Report, the following ACMs were previously identified within the Project Areas:

- **Tar paper jacketing (black pipe wrap) within the Crawlspace and Kitchen/Dining area;**
- **Silver/grey mastic on the HVAC ductwork within the Crawlspace and Kitchen/Dining area;**
- **Black mastic on HVAC ducts within the Crawlspace area;**
- **Black mastic on the 4” elbow and lagging within the Crawlspace area;**
- **Bell and spigot housings within the M4 Dining area and Crawlspace area;**
- **Concealed packing material on pipe elbows in the M4 Dining area and Crawlspace area;**
- **Black caulking on the internal window panes within the Corridor and Kitchen/Dining areas;**
- **Grey caulking on the internal window panes within the Corridor and Kitchen/Dining areas;**
- **Grey malleable caulking on the windows of the doors at the west and east breezeway entrances;**

- **Silver HVAC duct mastic throughout;**
- **Black mastic and paper on HVAC duct insulation within the Crawlspace;**
- **Grey mesh window pane caulking in Room 38, Corridor, and Inmate Dining Area; and,**
- **Black pipe wrap mastic (tar paper jacketing/black pipe wrap) throughout.**

4.2 Lead-Based Coatings (LBCs)

Suspect LBC samples that were determined to contain a concentration of lead equal to or > 600 mg/kg were classified as LBCs, i.e., paints or ceramic tiles with hazardous levels of lead.

DST collected two (2) suspected LBCs in the Project Areas. A description of the coatings tested, sample point locations and analytical results are summarized in **Table 2 - Lead-Based Coatings Sample Analytical Results**, below.

| Table 2 – Lead-Based Coating Sample Results Building M4 - Matsqui Institution, Abbotsford, BC | | | | |
|--|---------------------------------------|--------------|-----------------------|---------------------------|
| Sample Number | Location / Description | Color | Result (mg/kg) | Lead-Based Coating |
| L-1 | Locker Room (66) – Wall Paint | White | 700 | Yes |
| L-2 | Janitor Room (62) – Wall Ceramic Tile | White | 32.2 | No |

Notes: **Bold Print** – Indicates a positive result, i.e., hazardous levels of lead in the surface coating.

Based on the findings of DST's assessment and analytical results, one (1) of the two (2) suspect lead-based coatings samples were found to have hazardous levels of lead i.e., equal to or >600 mg/kg.

The following LBCs were identified to have hazardous levels of lead:

- **The white paint applied to the walls in the Locker Room (Room 66) of the Project Area. At the time of DST's assessment, the white paint was observed to be in GOOD Condition, posing a LOW risk for persons approaching the material.**

Based on the Previous Report, the following LBCs were previously identified within the Project Area:

- **The blue paint on the canopy fascia board of the Project Area; and,**
- **The white paint on the sprinkler pipes located throughout the Project Area.**

4.3 Ozone Depleting Substances (ODS)

Based on the results of DST's assessment, suspected ODS-containing equipment are likely present in the refrigerators and freezers in the Kitchen area within the Project Area.

ODS containing equipment was noted to be in **GOOD** condition at the time of the assessment, posing a **LOW** risk of exposure.

4.4 Mercury

Based on DST's assessment, fluorescent light tubes identified throughout the Project Areas are presumed to contain mercury vapor.

Mercury containing equipment was noted to be in **GOOD** condition at the time of the assessment, posing a **LOW** risk of exposure.

Based on the Previous Reports, mercury-containing light tubes within approximately 350 light fixtures were observed within the Project Areas.

4.5 Polychlorinated Biphenyl's (PCBs)

Based on DST's assessment, fluorescent light ballasts identified throughout the Project Areas were suspected to be PCB-containing.

PCB-containing equipment was noted to be in **GOOD** condition at the time of the assessment, posing a **LOW** risk of exposure.

Based on the Previous Reports, PCB-containing light ballasts are suspected to be present within the Project Areas.

4.6 Mould Amplification

Based on DST's assessment, no visible moulds were observed within the Project Area.

4.7 Animal Waste

Based on DST's assessment, no animal droppings were observed within the Project Area. However, animal droppings may be present in concealed ceiling, wall and floor areas.

4.8 Crystalline Silica

Sources of crystalline silica and rock dust were identified in the concrete foundations, walls, floors, cinderblocks, ceramic tiles, grouts and mortars. The silica containing materials were noted to be in **GOOD** condition, posing a **LOW RISK** of exposure.

5.0 RECOMMENDATIONS

5.1 Asbestos-Containing Materials

If a suspected asbestos-containing material is identified through the course of renovation and/or demolition activities, all work in the areas that may disturb the material should be stopped. Sample of the suspected asbestos-containing material should be collected and submitted for laboratory analysis. Any suspected asbestos-containing materials that are deemed to be visually similar to the asbestos-containing materials identified in this report should be considered asbestos-containing and handled as such, unless proven otherwise through representative, analytical testing.

Prior to any renovation and/or demolition activities, identified ACMs should be removed in accordance with the requirements of the Canada Labour Code, Part II and WorkSafeBC, specifically but not limited to include those requirements prescribed through Parts 5.48-5.59 – Controlling Exposure, and Parts 6.1 - 6.32 – Asbestos. The abatement of identified ACMs should be conducted following a minimum of Moderate Risk safe work procedures.

DST recommends reference to WorkSafeBC publication “*Safe Handling of Asbestos, A Manual of Standard Practices*”. This document provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on asbestos and asbestos products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of ACMs.

Asbestos-containing wastes should be managed in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

5.2 Lead-Based Coatings

Control the preparation of painted surfaces in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed in Parts 5.48-5.59 – Controlling Exposure and Parts 6.59-6.69 – Lead of the BC OH&S Regulation. Working in proximity to identified LBCs presents a low risk of exposure. As such, DST would recommend

Low Risk safe work procedures for renovation activities that will be conducted in close proximity to identified LBCs.

Toxicity Characteristic Leaching Procedure (TCLP) testing should be performed on identified lead-based paint, to facilitate the proper disposal of lead-containing wastes.

DST recommends reference to WorkSafeBC publication “*Lead-Containing Paints and Coatings – Preventing Exposure in the Construction Industry*”, 2011. This manual provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on lead and lead products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of LBCs.

Lead-containing wastes should be disposed of in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

5.3 Ozone Depleting Substances (ODSs)

When taken out of service, ODS-containing equipment should be managed in accordance with the requirements prescribed in British Columbia’s Ozone-Depleting Substances and Other Halocarbons Regulation, including amendments up to B.C. Reg. 4/2010, January 14, 2010 and transport ODS-containing wastes in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

DST recommends reference to Federal regulations entitled, “*Federal Halocarbon Regulations, 2003 SOR/2003-289*”. This guideline provides information on the appropriate management, handling and disposal of ODS-containing equipment.

5.4 Elemental Mercury

When taken out of service, mercury-containing wastes should be managed in accordance with the requirements of the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

5.5 Polychlorinated Biphenyls (PCBs)

When taken out of service, PCB-containing equipment should be managed in accordance with the requirements of the Canadian Environmental Protection Act, specifically under the “PCB Regulations” (SOR/2008-273), including amendments up to the date of this report

If identified to contain PCBs, the PCB-containing light ballasts should be removed in accordance with the requirements of WorkSafeBC. PCB-containing wastes should be managed in accordance with the requirements of the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

For fixtures that are operational and are to be sold for reuse, documentation is required confirming that the purchasers understand the ballasts are PCB-containing, and the purchaser assumes all liability and responsibility associated with the fixtures.

5.6 Crystalline Silica

Through the course of renovation activities, the concrete building foundation and should be wetted (saturated) with water, prior to, during and upon completion of mechanical renovation activities in an effort to minimize the potential for crystalline silica or rock dust release.

6.0 REPORT LIMITATIONS

This report is intended for client use only. Any use of this document by a third party, or any reliance on or decisions made based on the findings described in this report, are the sole responsibility of such third parties, and DST Consulting Engineers Inc. accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions conducted based on this report. No other warranties are implied or expressed.

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the client. The sampling program included asbestos bulk sampling and paint chip sampling in select representative areas for laboratory analysis. Note, however, that no scope of work, no matter how exhaustive, can guarantee to identify all contaminants. This report therefore cannot warranty that all building conditions are represented by those identified at specific locations.

Recommendations, when included, are made in good faith and are based on several successful experiences.

Note also that standards, guidelines and practices related to environmental investigations may change with time. Those which were applied at the time of this investigation may be obsolete or unacceptable at a later date.

Any comments given in this report on potential remediation problems and possible methods are intended only for the guidance of the designer. The scope of work may not be sufficient to determine all of the factors that may affect construction, clean-up methods and/or costs. Contractors bidding on this project or undertaking clean-ups should, therefore, make their own

interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the Client.

7.0 CLOSING

We hope the information presented in this document meets your current requirements. If you have any questions, or require additional information please contact us at your convenience.

Yours truly,

DST Consulting Engineers Inc.

Report Prepared By:



Philip Pow, B.Sc.
Project Manager

Report Reviewed By:



Christian Injates, CEC, CEM
Regional Manager, Associate

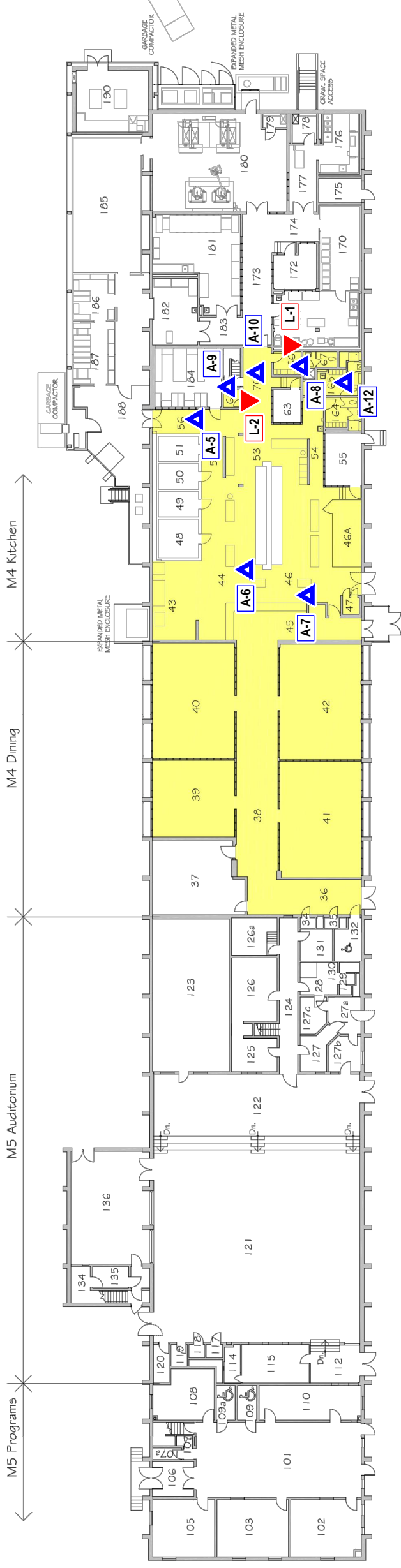
APPENDIX I
Floor Plans

Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

- ▲ Bulk suspect asbestos samples collected on Nov/2019
- ▲ Bulk suspect lead samples collected on Nov/2019



FIRST FLOOR PLAN
SCALE: NTS

Note: Refer to previous reports for locations of other ACMs not pertaining to the flooring finishes.

| | | | | | |
|----------|------------|------|----------|-------|----------|
| Revision | 12/16/2019 | Date | Original | Issue | Approval |
| 0 | | | | | |

Client: **Public Services & Procurement Canada**

Site: **Matsqui Institution, Abbotsford, BC**

Report Title: **Hazardous Building Materials Assessment Building "M4" Mechanical Systems Flooring Upgrade**




Drawing Title: **First Floor Plan**

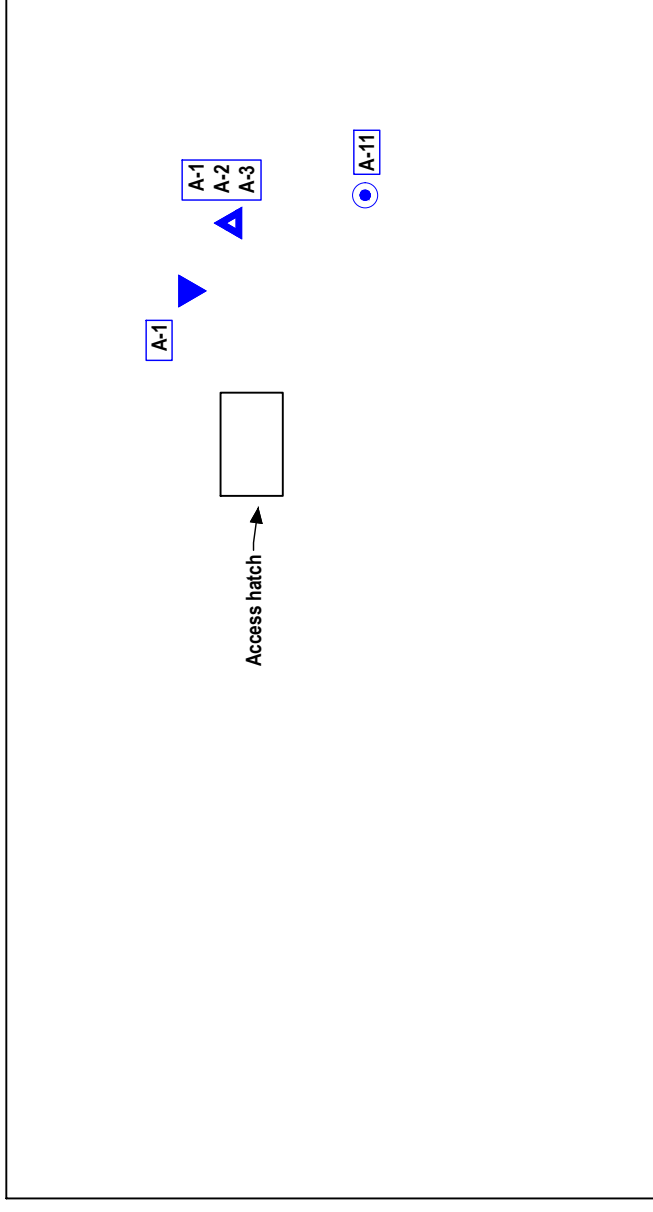
| | | | |
|-------------|------|-------------|---------------|
| Designed By | P.P | Scale | As shown |
| Drawn By | J.M. | Date | December 2019 |
| Approved By | | Project No. | GV-VC-040081 |
| Figure No. | | | 1 |

Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

-  Bulk suspect asbestos samples collected on Nov/2019
-  Asbestos containing white TSI 4" pipe elbow insulation
-  Asbestos containing black tar mastic on 2" pipe elbow



| Revision | Date | Original | Issue | Approval |
|----------|------------|----------|-------|----------|
| 0 | 12/16/2019 | | | |

Client: **Public Services & Procurement Canada**

Site: **Matsqui Institution, Abbotsford, BC**

Report Title: **Hazardous Building Materials Assessment Building "M4" Mechanical Systems Flooring Upgrade**

Drawing Title: **Crawlspace**

| | | | |
|-------------|----------|-------------|---------------|
| Designed By | P.P | Scale | As shown |
| Drawn By | J.M. | Date | December 2019 |
| Approved By | | Project No. | GV-VC-040081 |
| Figure No. | 2 | | |

APPENDIX II
Certificates of Analysis



EMSL Canada Inc.

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EMSL Canada Order: 691902924

Customer ID: 55DSTV42

Customer PO:

Project ID:

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Phone: (604) 436-4588

Fax:

Received Date: 11/06/2019 11:43 AM

Analysis Date: 11/12/2019

Collected Date:

Project: GV-VC-040081 / BLG M4 - MATSQUI INSTITUTION - 33344 KING ROAD, ABBOTSFORD, BC

Test Report: Polarized Light Microscopy (PLM) Performed by Modified NIOSH Method 9002, Issue 2

| Sample | Description | Appearance | Non-Asbestos | | Asbestos |
|------------------------------------|---|--------------------------------------|--------------|--------------------------|----------------|
| | | | % Fibrous | % Non-Fibrous | % Type |
| A-1 691902924-0001 | CRAWLSPACE - 4" PIPE ELBOW - WHITE TSI ISULATION | Beige Non-Fibrous Homogeneous | | 40% Non-fibrous (Other) | 60% Chrysotile |
| A-2 691902924-0002 | CRAWLSPACE CEILING PENETRATION - RED MASTIC | Red Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-3 691902924-0003 | CRAWLSPACE CEILING PENETRATION - RED MASTIC | Red Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-4 691902924-0004 | CRAWLSPACE CEILING PENETRATION - RED MASTIC | Red Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-5 691902924-0005 | ROOM 56/M4 KITCHEN FLOOR - GREY SPECKLED BATTLESHIP LINO | Gray Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-6 691902924-0006 | M4 KITCHEN (46) - FLOOR - BLUE MASTIC (B/T SHEETS) | Blue Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-7 691902924-0007 | M4 KITCHEN (46) - FLOOR - BLUE BATTLESHIP LINO | Blue Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-8 691902924-0008 | LOCKER ROOM (66) - FLOOR - TAN CEMENT FLOORING | White Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-9 691902924-0009 | JANITOR ROOM (62) - FLOOR - GREY CEMENT FLOORING | White Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-10 691902924-0010 | M4 KITCHEN (70) - FLOOR - LIGHT BLUE BATTLESHIP LINO | Blue Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-11-Tar Mastic 691902924-0011 | CRAWLSPACE - 2" PIPE - BLACK TAR MASTIC ON ELBOW | Brown Non-Fibrous Homogeneous | | 97% Non-fibrous (Other) | 3% Chrysotile |
| A-11-Insulation 691902924-0011A | CRAWLSPACE - 2" PIPE - BLACK TAR MASTIC ON ELBOW | Orange Non-Fibrous Homogeneous | 90% Glass | 10% Non-fibrous (Other) | None Detected |
| A-12 691902924-0012 | CHANGE ROOM (65) - WALL - DRYWALL JOINT COMPOUND | White Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |
| A-13 691902924-0013 | CHANGE ROOM (65) - WALL - DRYWALL JOINT COMPOUND | White Non-Fibrous Homogeneous | | 100% Non-fibrous (Other) | None Detected |

Initial report from: 11/14/2019 13:16:00



EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1

Tel/Fax: (604) 757-3158 / (604) 757-4731

<http://www.EMSL.com> / vancouverlab@EMSL.com

EMSL Canada Order: 691902924

Customer ID: 55DSTV42

Customer PO:

Project ID:

Test Report: Polarized Light Microscopy (PLM) Performed by Modified NIOSH Method 9002, Issue 2

| Sample | Description | Appearance | Non-Asbestos | | Asbestos |
|----------------|------------------|-------------|--------------|--------------------------|---------------|
| | | | % Fibrous | % Non-Fibrous | % Type |
| A-14 | CHANGE ROOM (65) | White | | 100% Non-fibrous (Other) | None Detected |
| | - WALL - DRYWALL | Non-Fibrous | | | |
| 691902924-0014 | JOINT COMPOUND | Homogeneous | | | |

Analyst(s)

Dane Sorochuk (15)

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

Disclaimers: EMSL maintains liability limited to the cost of analysis. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for data reported that relies on information provided by the client, sample collection activities, or analytical method limitations. The results relate only to the materials received, and the data supplied by the customer. Interpretation and use of test results are the responsibility of the client. All samples received in acceptable condition, unless otherwise noted. This report format is a modification to report discreet asbestos concentrations instead of ranges. Non-friable organically bound materials present a problem matrix, and therefore, EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available upon request.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 11/14/2019 13:16:00



Your Project #: GV-VC-040081
 Site Location: MATSQUI INSTITUTION 33344 KING RD,
 ABBOTSFORD
 Your C.O.C. #: 08474513

Attention: CHRISTIAN INJATES

DST CONSULTING ENGINEERS
 Unit B - 4125 McConnell Drive
 Burnaby, BC
 CANADA V5A 3J7

Report Date: 2019/11/07
 Report #: R2808157
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B995837

Received: 2019/11/06, 12:21

Sample Matrix: Bulk
 # Samples Received: 1

| Analyses | Quantity | Date | Date | Laboratory Method | Analytical Method |
|--|----------|------------|------------|-------------------|-------------------|
| | | Extracted | Analyzed | | |
| Elements by ICP-AES (acid extr. solid) | 1 | 2019/11/07 | 2019/11/07 | BBY7SOP-00018 | EPA 6010d m |

Sample Matrix: Paint
 # Samples Received: 1

| Analyses | Quantity | Date | Date | Laboratory Method | Analytical Method |
|--|----------|------------|------------|-------------------|-------------------|
| | | Extracted | Analyzed | | |
| Elements by ICP-AES (acid extr. solid) | 1 | 2019/11/07 | 2019/11/07 | BBY7SOP-00018 | EPA 6010d m |

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



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Unit B - 4125 McConnell Drive
Burnaby, BC
CANADA V5A 3J7

Report Date: 2019/11/07
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CERTIFICATE OF ANALYSIS

BV LABS JOB #: B995837
Received: 2019/11/06, 12:21

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Linsay Sunderman, Key Account Specialist
Email: linsay.sunderman@bvlabs.com
Phone# (403)735-2237 Ext:2237

=====
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU
VERITAS

BV Labs Job #: B995837

Report Date: 2019/11/07

DST CONSULTING ENGINEERS

Client Project #: GV-VC-040081

Site Location: MATSQUI INSTITUTION 33344 KING RD,
ABBOTSFORD

Sampler Initials: PP

LEAD IN PAINT CHIPS (BULK)

| | | | | |
|----------------------------------|--------------|--|------------|-----------------|
| BV Labs ID | | WW5070 | | |
| Sampling Date | | 2019/11/05 | | |
| COC Number | | 08474513 | | |
| | UNITS | L-2-JANITOR RM (62)-WALL-WHITE CERAMIC TILE | RDL | QC Batch |
| Total Metals by ICP | | | | |
| Total Lead (Pb) | mg/kg | 32.2 | 2.0 | 9660734 |
| RDL = Reportable Detection Limit | | | | |



BUREAU
VERITAS

BV Labs Job #: B995837
Report Date: 2019/11/07

DST CONSULTING ENGINEERS
Client Project #: GV-VC-040081
Site Location: MATSQUI INSTITUTION 33344 KING RD,
ABBOTSFORD
Sampler Initials: PP

LEAD IN PAINT CHIPS (PAINT)

| | | | | |
|----------------------------------|--------------|--|------------|-----------------|
| BV Labs ID | | WW5069 | | |
| Sampling Date | | 2019/11/05 | | |
| COC Number | | 08474513 | | |
| | UNITS | L-1-LOCKER RM (66)-WALL-WHITE PAINT | RDL | QC Batch |
| Total Metals by ICP | | | | |
| Total Lead (Pb) | mg/kg | 700 | 16 | 9660734 |
| RDL = Reportable Detection Limit | | | | |



**BUREAU
VERITAS**

BV Labs Job #: B995837

Report Date: 2019/11/07

DST CONSULTING ENGINEERS

Client Project #: GV-VC-040081

Site Location: MATSQUI INSTITUTION 33344 KING RD,
ABBOTSFORD

Sampler Initials: PP

GENERAL COMMENTS

LEAD IN PAINT CHIPS (PAINT) Comments

Sample WW5069 [L-1-LOCKER RM (66)-WALL-WHITE PAINT] Elements by ICP-AES (acid extr. solid): Detection limits raised due to insufficient sample volume.

Results relate only to the items tested.



BUREAU
VERITAS
1875

BV Labs Job #: B995837
Report Date: 2019/11/07

QUALITY ASSURANCE REPORT

DST CONSULTING ENGINEERS
Client Project #: GV-VC-040081

MATSQUI INSTITUTION 33344 KING RD,
Site Location: ABBOTSFORD
Sampler Initials: PP

| QC Batch | Parameter | Date | Spiked Blank | | Method Blank | | RPD | | QC Standard | |
|----------|-----------------|------------|--------------|-----------|--------------|-------|-----------|-----------|-------------|-----------|
| | | | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits | % Recovery | QC Limits |
| 9660734 | Total Lead (Pb) | 2019/11/07 | 100 | 75 - 125 | <2.0 | mg/kg | 34 | 40 | 112 | 70 - 130 |

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.



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VERITAS

BV Labs Job #: B995837
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DST CONSULTING ENGINEERS
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ABBOTSFORD
Sampler Initials: PP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

A handwritten signature in black ink, appearing to read 'Andy Lu', written over a horizontal line.

Andy Lu, Ph.D., P.Chem., Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

COM-UI
08474513

ge: 1 of 1

PO #: _____
 Quotation #: _____
 Project #: **6V-VG-040081**
 Proj. Name: **MATHEVA INDUSTRIAL**
 Location: **33344 King Rd, Abbotsford**
 Sampled by: Philip Pow

Report To:
 DST Consulting Engineers
 Unit B 4125 McConnell Drive, Burnaby, BC
 PC: V5A 3J7
 Ph: 604-436-4588 Fax: _____

Company Name: DST Consulting Engineers
 Contact Name: **Christina Injates**
 Address: Unit B 4125 McConnell Drive, Burnaby, BC
 PC: V5A 3J7
 Phone / Fax#: **604-436-4588**
 E-mail: **cinjates@dsgroup.com**

REGULATORY REQUIREMENTS: **ppme dsgroup.com**
 CSR Regular Turn Around Time (TAT) (5 days for most tests)
 CCME RUSH (Please contact the lab)
 BC Water Quality 1 Day 2 Day 3 Day
 Other DRINKING WATER
 Date Required: _____

SPECIAL INSTRUCTIONS: Ship Sample Bottles (please specify)
 Return Cooler

| Sample Identification | Lab Identification | Sample Type | Date/Time (24hr) Sampled |
|--|--------------------|-------------|--------------------------|
| 1 1-1- Lumber Pm (66)-Wall-White paint | | bulk | Nov 5/19 |
| 2 1-2 Janitor room (62)-Wall-White ceramic tile | | bulk | Nov 5/19 |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

| Print name and sign | | Time (24 hr) | | Received by: | | Date (yy/mm/dd) | | Time (24 hr) | | Time (24 hr) | | Temperature on Receipt (°C) | | Custody Seal | | Does source supply multiple households? | | Samples are from a Drinking Water Source? | | | |
|---------------------|--|--------------|--|-------------------|--|-----------------|--|--------------|--|--------------|--|--|--|-----------------------------------|--|---|--|--|--|--|--|
| Philip Pow | | 10:15 | | Philip Pow | | 19/11/06 | | 12:21 | | 12:21 | | A) 11/11/06 B) 11/11/06 | | Present? <input type="checkbox"/> | | Intact? <input type="checkbox"/> | | Yes <input type="checkbox"/> No <input type="checkbox"/> | | Yes <input type="checkbox"/> No <input type="checkbox"/> | |

IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS, AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.
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