



Public Works and Government Services Canada

Requisition No. EZ899-180332/A

DRAWINGS & SPECIFICATIONS
for

Mission Medium Institution
Living Units 1 to 5
Cell Ventilation Upgrade

R.082477.001

APPROVED BY:

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Regional Manager, AES

May 24/2017
Date

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2016-09-20
Date

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Project Manager

2017.05.24
Date

Project No.: R.082477.001
Mission Medium Institution
Living Units 1 to 5
Cell Ventilation Upgrade

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Seals Page
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CONSULTANTS – SEAL & SIGNATURE

Discipline

Seal / Signature / Date

Mechanical
(Prime)



A circular professional engineer seal for the Province of Ontario. The seal contains the text "PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO" around the perimeter. In the center, it reads "M. H. C. M. D." and "#30213". A handwritten signature in blue ink is written across the seal. Below the seal, the date "2017.04.26" is handwritten in blue ink.

END OF SECTION

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CONSULTANTS – SEAL & SIGNATURE

Discipline

Seal & Signature

Electrical



END OF SECTION

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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 Mission Medium Institution, Living Units 1 to 5 (LU-1, LU-2, LU-3, LU-4, LU-5), Mission, B.C.
 - .1 Remove existing exhaust grilles in the Living Unit cells and replace with new. Refer to Appendix A for Line Drawings of Living Units (LU's).
 - .1 LU-1, LU-3, LU-4, LU-5: forty-six (46) cells per LU.
 - .1 Lower Floor – 8 cells; including Cells N1, N2, N3, N4, N5, N6, N7, N8, N9; S1, S2, S3, S4, S5, S6, S7, S8, S9.
 - .2 Upper Floor – 28 cells; including Cells N10, N11, N12, N13, N14, N15, N16, N17, N18, N19, N20, N21, N22, N23; S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23.
 - .2 LU-2: forty-four (44) cells.
 - .1 Lower Floor – 8 cells; including Cells N1, N2, N3, N4, N5, N6, N7, N8, N9; S1, S2, S3, S4, S5, S6, S7, S8, S9.
 - .2 Upper Floor – 26 cells; including Cells N10, N11, N12, N13, N14, N15, N16, N17, N18, N19, N20, N21; S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23.
 - Refer to Appendix B for details.
 - .2 Remove existing exhaust fans in the Living Units 1 to 5, and replace with new. Refer to equipment schedule and sketch MSK-4 in Appendix B. Balance exhaust airflows per "Room Airflow Table" on Line Drawings (Appendix A).
 - .3 Refer to Division 2 specifications for hazardous materials, related requirements and procedures.
 - .2 Work to be performed under this Contract includes, but not limited to, the following items covered further in the Contract documents:
 - .1 Provide a detailed work plan including a project schedule and phasing. This detailed work plan shall be submitted to the Departmental Representative for review to verify that there will be no interruption of service.
 - .2 Do not start work until all essential equipment is delivered to the site and the work can proceed without delays.
 - .3 Provide as-built drawings and closeout submittals.
 - .3 Contractor's Use of Premises:
 - .1 Contractor has limited use of site for work of this contract until Substantial Completion:
 - .1 Contractor use of premises for storage and access, as approved by the Departmental representative.

- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .2 Vehicular access through the Sally Port will be restricted during the inmate "count" at breakfast, lunch and dinner hours. Confirm times with Departmental Representative. Delays may occur when entering and exiting the Institution with vehicles due to security situations and heavy traffic.

1.2 WORK RESTRICTIONS

- .1 Notify Departmental Representative of intended interruption of power, communication and water services and provide schedule of interruption times.
- .2 Where Work involves breaking into or connecting to existing services, give departmental Representative 48 hours of notice for necessary interruption of services throughout course of work. Keep duration of interruptions to a minimum. Coordinate interruptions with local authority having jurisdiction and local residences and businesses affected by the disruption.
- .3 Provide for access by pedestrian and vehicular traffic on and around site where work is in progress.
- .4 Construct barriers in accordance with Section Temporary Barriers and Enclosures.
- .5 Security Requirements: refer to Section 01 14 10 - Security Requirements.
- .6 Hours of work:
 - .1 Perform work during normal working hours of the Institution 0730 to 1600, Monday through Friday except holidays.
 - .2 When it is necessary, arrange in advance with Departmental Representative to work outside of normal working hours.

1.3 CONSTRUCTION WORK SCHEDULE

- .1 Commence work immediately upon official notification of acceptance of offer and complete the work within 26 weeks from the date of such notification.
 - .1 Work shall be carried out in five (5) phases – each Living Unit will be vacated for a period of one (1) month and turned over to the Contractor. Contractor can only access one Living Unit on any working day. Contractor shall complete all work for one Living Unit within 3 weeks and allow 5 working days after turn over the completed Living Unit for inmate relocations before commencing work for the next living unit. Living unit working sequence will be determined during the construction period. Allow for all costs of phased construction in the bid price.
 - .2 There is a "Cell Furniture Replacement" project at the Living Units (under a separate contract) scheduled to take place between July to November. As such, there will be a period of time when the "Cell Ventilation Upgrade" and the "Cell Furniture Replacement" projects are concurrently being executed. During this overlapping period, the Contractor for the "Cell Furniture Replacement" contract will be assigned the roles and responsibilities of a Prime Contractor. Contractor for this "Cell Ventilation Upgrade" contract shall coordinate work schedule with the Prime Contractor during the overlapping period.

- .2 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Substantial Certificate and Final Certificate as defined times of completion are of essence of this contract.
- .3 Submittal:
 - .1 Submit to Departmental Representative within 10 working days of Award of Contract, a Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of construction progress.
 - .2 Identify each trade or operation.
 - .3 Show dates for delivery of items requiring long lead time.
 - .4 Departmental Representative will review schedule and return one copy.
 - .5 Re-submit two (2) copies of finalized schedule to Departmental Representative within five (5) working days after return of reviewed preliminary copy.
- .4 Project Scheduling Reporting:
 - .1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.
 - .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
- .5 Project Meetings:
 - .1 Discuss Project Schedule at bi-weekly site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
 - .2 Weather related delays with their remedial measures will be discussed and negotiated.
 - .3 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price. After approval by Departmental Representative cost breakdown will be used as basis for progress payments. Only PWGSC paper work is acceptable.

1.4 SUBMITTAL PROCEDURES

- .1 Administrative:
 - .1 Submit to Departmental Representative submittal listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .2 Work affected by submittal shall not proceed until review is complete.
 - .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
 - .4 Where items or information is not produced in SI Metric units converted values are acceptable.
 - .5 Review submittal prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with

- requirements of Work and Contract Documents. Submittal not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
 - .7 Verify field measurements and affected adjacent Work are coordinated.
 - .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittal.
 - .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
 - 10 Keep one reviewed copy of each submission on site.
- .2 Shop Drawings:
- .1 Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate sections.
- .3 Product Data:
- .1 Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings, provided that the product concerned is clearly identified. Submit in sets, not as individual submissions.
- .4 Samples:
- .1 Submit samples in sizes and quantities specified.
 - .2 Where colour is criterion, submit full range of colours.
 - .3 Submit all samples as soon as possible after the contract is awarded, to facilitate production of complete colour scheme by the Departmental Representative.
- .5 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.
- .6 Coordination of Submissions:
- .1 Review shop drawings, product data and samples prior to submission.
 - .2 Coordinate with field construction criteria.
 - .3 Verify catalogue numbers and similar data.
 - .4 Coordinate each submittal with requirements of the work of all trades and contract documents.

- .5 Responsibility for errors and omissions in submittal is not relieved by Departmental Representative's review of submittal.
- .6 Responsibility for deviations in submittal from requirements of Contract documents is not relieved by Departmental Representative's review of submittal, unless Departmental Representative gives written acceptance of specified deviations.
- .7 Notify Departmental Representative, in writing at time of submission, of deviations in submittal from requirements of Contract documents.
- .8 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and re-submit as directed by Departmental Representative.
- .9 After Departmental Representative's review, distribute copies.
- .10 Shop Drawings Review:
 - .1 Review of shop drawings by Public Works and Government Services Canada (PWGSC) is for the sole purpose of ascertaining conformance with the general concept.
 - .2 The Departmental Representative's review does not mean that PWGSC approves the detail design inherent in the shop drawings, responsibility remains with the contractor submitting same, and such review will not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents.
 - .3 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work of all subtrades.

1.5 HEALTH AND SAFETY

- .1 Specified in Section 01 35 33.

1.6 ENVIRONMENTAL PROCEDURES

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

1.7 REGULATORY REQUIREMENTS

- .1 References and Codes:
 - .1 Perform Work in accordance with National Building Code of Canada (NBCC2015) and where applicable British Columbia Building Code (BCBC2012) including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.8 QUALITY CONTROL

- .1 Inspection:
 - .1 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work:
 - .2 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
 - .3 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
- .2 Procedures:
 - .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
 - .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- .3 Rejected Work:
 - .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
 - .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .4 Reports:
 - .1 Submit (4) four copies of inspection and test reports to Departmental Representative.

- .5 Equipment and Systems:
 - .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
 - .2 Refer to specific Section for definitive requirements.

1.9 TEMPORARY UTILITIES

- .1 Installation and Removal:
 - .1 Provide temporary utilities controls in order to execute work expeditiously.
 - .2 Remove from site all such work after use.
- .2 Temporary Communication Facilities:
 - .1 Provide and pay for temporary telephone and fax hook up, line(s) necessary for own use.

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 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.
- .3 Construction Parking:
 - .1 Make good damage to existing roads used for access to project site.
 - .2 Build and maintain temporary access where required and provide snow removal during period of Work.
 - .3 Park vehicles outside perimeter fence in designated parking areas.
- .4 Contractor's Site Office and enclosure:
 - .1 Provide office of size to accommodate site meetings and Contractor's operations.
 - .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
 - .3 Provide temporary fenced area to enclose site and operations.
- .5 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.
- .6 Sanitary Facilities:
 - .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

- .2 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures. Permanent facilities may be used on approval of Departmental Representative.

1.11 TEMPORARY BARRIERS AND ENCLOSURES

- .1 N/A

1.12 COMMON PRODUCT REQUIREMENTS

- .1 Reference Standards:
 - .1 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
 - .2 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
 - .3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
- .2 Quality:
 - .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
 - .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
 - .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
 - .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
 - .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.
 - .6 The use of asbestos containing materials is prohibited in this project. Contractor shall provide a letter to the Departmental Representative prior to Substantial Completion confirming that asbestos containing materials are not used in this project.
- .3 Storage, Handling and Protection:
 - .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .4 Transportation:
 - .1 Pay costs of transportation of products required in performance of Work.
 - .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.
- .5 Manufacturer's Instructions:
 - .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
 - .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
 - .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- .6 Quality of Work:
 - .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
 - .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
 - .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

- .7 Co-ordination:
 - .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
 - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- 8 Concealment:
 - .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
 - .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.
- .9 Remedial Work:
 - .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
 - .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner neither to damage nor to put at risk any portion of Work.
- .10 Location of Fixtures:
 - .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
 - .2 Inform Departmental Representative of conflicting installation. Install as directed.
 - .3 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.
- .11 Fastenings:
 - .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
 - .2 Prevent electrolytic action between dissimilar metals and materials.
 - .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
 - .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
 - .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
 - .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- .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.
- .16 Substitution after award of Contract:
 - .1 No substitutions are permitted without prior written approval of the Departmental Representative.
 - .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
 - .3 Proposals will be considered by the Departmental Representative if:
 - .1 products selected by tenderer from those specified are not available;

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

1.13 EXAMINATION AND PREPARATION

- .1 Existing Services:
 - .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
 - .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.
- .2 Location of Equipment and Fixtures:
 - .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
 - .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
 - .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
 - .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.14 EXECUTION REQUIREMENTS

- .1 Preparation:
 - .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
 - .2 After uncovering, inspect conditions affecting performance of Work.
 - .3 Beginning of cutting or patching means acceptance of existing conditions.
 - .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
 - .5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.
- .2 Execution:
 - .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
 - .2 Fit several parts together, to integrate with other Work.

- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using purpose made saw or core drill. Pneumatic or impact tools not allowed on brittle materials without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.15 CLEANING

- .1 Project Cleanliness:
 - .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
 - .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
 - .3 Provide on-site containers for collection of waste materials and debris.
 - .4 Provide and use clearly marked separate bins for recycling. Refer to Construction/Demolition Waste Management And Disposal.
 - .5 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
 - .6 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
 - .7 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
 - .8 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
 - .9 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 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
 - .9 Remove dirt and other disfiguration from exterior surfaces.
 - .10 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

1.16 CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

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

1.17 CLOSEOUT PROCEDURES

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

- .3 Request Departmental Representative's Inspection.
- .2 Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Substantial Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Authority Having Jurisdictions for seismic restraints.
 - .5 Operation of systems have been demonstrated to Departments personnel.
 - .6 Work is complete and ready for Final Inspection.
 - .7 Asbestos containing materials are not used in this project.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.18 CLOSEOUT SUBMITTAL

- .1 Record Drawings:
 - .1 N/A.
- .2 Operation and Maintenance Manuals:
 - .1 On completion of project submit to Departmental Representative four (4) CD R/disk copies and four (4) paper copies (in loose leaf type binder) of Operation and Maintenance Manual, made up as follows:
 - .1 Provide maintenance manual on CDs using pdf, or other approved format for descriptive writing, page size images and page size drawings. Organize manuals into industry standard maintenance manual tabs with links in index to each descriptive section describing the component or maintenance procedure etc.
 - .2 Organize files into CSI Masterformat numbering system or other approved descriptive titles.
 - .3 Label disk "Operation and Maintenance Data", project name, date, names of Contractor, subcontractors, consultants and subconsultants.
 - .4 Include scanned guarantees, diagrams and drawings.
 - .5 Organize contents into applicable sections of work to parallel project specification break-down. Mark each section by labeled tabs (navigational buttons).
 - .6 Drawings, diagrams and manufacturer's literature must be legible.
 - .7 Refer to Mechanical and Electrical Divisions for specific details for Mechanical and Electrical data.

- .3 Maintenance Materials, Special Tools and Spare Parts:
 - .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections.
 - .2 Deliver maintenance materials, special tools and spare parts to Departmental Representative and store in designated area as directed by Departmental Representative.
 - .3 Prepare lists of maintenance materials, special tools and spare parts for inclusion in Manual specified in Clause 18.2.
 - .4 Maintenance materials:
 - .1 Deliver wrapped, identify on carton or package, colour, room number, system or area as applicable where item is used.
 - .5 Special tools:
 - .1 Assemble as specified;
 - .2 Include identifications and instructions on intended use of tools.
- .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, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Director or Warden of the Institution as applicable or their representative.
- .6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.
- .8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .9 "Construction zone" means the area, as indicated in the contract documents, that the contractor will be allowed to work". This area may or may not be isolated from the security area of the institution. Limits to be confirmed at construction start-up meeting.

1.3 Preliminary Proceedings

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

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

1.4 Construction Employees

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

1.5 Vehicles

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

1.6 Parking

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

1.7 Shipments

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

1.8 Telephones

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

1.9 Work Hours

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

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

1.13 Security Hardware

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

1.14 Prescription Drugs

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

1.15 Smoking Restrictions

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

1.16 Contraband

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

1.17 Searches

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

1.18 Access and Removal from Institution Property

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

1.19 Movement Vehicles

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

1.20 Movement of Construction Employees on Institutional Property

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

1.21 Surveillance and Inspection

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

1.22 Stoppage of Work

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

1.23 Contact with Inmates

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

1.24 Completion of Construction Project

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

END OF SECTION

PART 1 - GENERAL

PSPCC Update on Asbestos Use

Effective April 1, 2016, all Public Works and Government Services Canada (PWGSC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at <http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html>

1.1 References

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

1.2 Related Sections

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

1.3 Workers' Compensation Board Coverage

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 Compliance with Regulations

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

1.5 Submittals

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

1.6 Responsibility

- .1 Assume responsibility as the Prime Contractor for work under this contract.

- .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 Health and Safety Coordinator

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

1.8 General Conditions

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

1.9 Project/Site Conditions

- .1 Work at site will involve contact with:
 - .1 Multi-employer work site.
 - .2 Federal employees and general public.
 - .3 Energized electrical services.
 - .4 Working from heights
 - .5 Working in the open exposed to unpredictable weather.
 - .6 High volumes of vehicular and pedestrian traffic

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

1.14 Health and Safety Plan

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

- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of 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 Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 Emergency Procedures

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

- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.16 Hazardous Products

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 01 50.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
 - .3 Provide adequate means of ventilation in accordance with Section 01 51 00.
 - .4 The contractor shall ensure that the product is applied as per manufacturers recommendations.
 - .5 The contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

1.17 Asbestos Hazard

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

1.18 PCB Removals

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

1.19 Electrical Safety Requirements

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

1.20 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.

1.21 Overloading

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

1.22 Falsework

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

1.23 Scaffolding

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

1.24 Confined Spaces

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

1.25 Power-Actuated Devices

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

1.26 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.

1.27 Fire Safety Requirements

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

1.28 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.

1.29 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.

1.30 Posted Documents

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

1.31 Meetings

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

1.32 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 Description of Work

- .1 Includes general requirements for commissioning facilities and facility systems.
- .2 Refer to sections of Mechanical, Electrical and Communications disciplines.

1.2 Definitions

- .1 Acronyms:
 - AFD - Alternate Forms of Delivery, service provider.
 - BMM - Building Management Manual.
 - Cx - Commissioning.
 - EMCS - Energy Monitoring and Control Systems.
 - O&M - Operation and Maintenance.
 - PI - Product Information.
 - PV - Performance Verification.
 - TAB - Testing, Adjusting and Balancing.
- .2 Cx - a required program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

1.3 Quality Assurance

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

1.4 References

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

1.5 Submittals

- .1 Prior to start of Work, submit name of organization proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
 - .1 Submit documentation to confirm organization compliance with quality assurance provision.
- .2 Submit 3 preliminary specimen copies of each of report forms proposed for use.
- .3 Ten (10) days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.

- .4 Submit reports of testing, adjusting and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.6 Procedures

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

1.7 Contractor's Responsibilities

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

1.8 Preparation

- .1 Provide instruments required for testing, adjusting, and balancing operations.
- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify lighting is turned on when lighting is included in cooling load.
- .6 Verify equipment such as computers, laboratory and electronic equipment are in full operation.

1.9 Final Reports

- .1 Organization having managerial responsibility shall make reports.
- .2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.10 Completion of Commissioning

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx deliverables have been submitted and accepted by Departmental Representative.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

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

1.2 References

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

1.3 Health and Safety

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

1.4 Waste Management and Disposal

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

1.5 Environmental Protection

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

1.5 Site Condition

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

1.6 Hazardous Materials

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

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 Preparation

- .1 Inspect site and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.

3.2 Protection

- .1 Prevent movement, settlement, or damage to adjacent structures, utilities and parts of building to remain in place. Provide bracing and shoring required.
- .2 Keep noise, dust, and inconvenience to occupants to minimum.
- .3 Protect building systems, services and equipment.
- .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
- .5 Do Work in accordance with Section 01 35 33 - Health and Safety Requirements.
- .6 Prevent debris from blocking drainage which must remain in operation.
- .7 Take precaution during demolition to protect all adjacent finished surfaces. Make good any damage to adjacent surfaces.

3.3 Salvage

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

3.4 Disposal

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

- .1 Assessment Reports: See 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 or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
 - .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .3 Reference Standards:
 - .1 Canadian Environmental Protection Act, 1999 (CEPA 1999)
 - .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
 - .2 Department of Justice Canada (Jus)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDG Act), (c. 34).
 - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
 - .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .4 National Research Council Canada Institute for Research in Construction (NRC-IRC)
 - .1 National Fire Code of Canada 2015.
 - .5 WorkSafe BC
 - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
 - .2 "Lead-Containing Paints and Coatings; Preventing Exposure in the Construction Industry", 2011
 - .6 British Columbia Hazardous Waste Regulation (BC Reg. 63/88)
 - .7 The Federal Transportation of Dangerous Goods Regulation
 - .8 Canadian Construction Association
 - .1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2004)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 01 50 – General Instructions.
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Sections 01 35 33 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
 - .3 Submit environmental exposure control plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
 - .4 Submit Provincial and/or local requirements for Notice of Project Form.
 - .5 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.
 - .6 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.
 - .7 Construction Waste Management:
 - .1 Submit project Demolition Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentage of construction wastes were recycled or salvaged
 - .8 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 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 Coordinate storage of hazardous materials 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.
 - .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 degrees C.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
 - .11 When hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with 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.
- .5 Develop Demolition Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Description:
 - .1 Bring on site only quantities hazardous material required to perform Work.
 - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 HAZARDOUS MATERIALS ABATEMENT

- .1 Scope of Abatement Activities for the project.
 - .1 Abatement shall be conducted to remove and dispose of hazardous building materials as identified in the Assessment Report(s) in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such identified hazardous building materials will be impacted (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 The listing below is a summary of the hazardous building material categories and associated removal and disposal regulations, guidelines and/or standards.
 - .1 Asbestos-Containing Materials (ACMs)

- .1 Removal, alteration and/or disposal of ACMs is not anticipated to be required during the work.
 - .2 Should a material suspected to contain ACMs become uncovered during renovation activities, all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if ACMs are present.
 - .3 Actions that will disturb identified ACMs are to be conducted in accordance with the requirements of the 2012 WorkSafe BC publication "Safe Work Practices for Handling Asbestos", by appropriately trained personnel.
 - .4 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.
 - .5 Waste disposal to be conducted in accordance with BC Reg. 63/88.
 - .6 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 DCC Representative.
 - .7 From beginning of Work until completion of cleaning operations, Departmental Representative will separately engage an Environmental Specialist to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia's Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled "Safe Work Practices for Handling Asbestos".
 - .8 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Contract
 - .9 Ensure that respiratory safety factors are not exceeded.
- .2 Lead and Lead-Containing Paints (LCPs)
- .1 Refer to the Assessment Report for identities and locations of lead-containing materials (including LCPs) that may require disturbance during the Work.
 - .2 Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding). Actions that will disturb lead-containing materials (including paints and materials coated with LCPs) are to be conducted in accordance with the requirements of the current version of the WorkSafe BC publication "Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry." Airborne lead dust or fumes should not exceed the BC Reg. 296/97 eight-hour occupational exposure limit (OEL) of 0.05 mg/m³ during the removal of paints and products containing any

concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust.

- .3 Although LCPs and items coated with LCPs will be disturbed and/or removed for disposal during the Work, unless deemed necessary through risk assessment or cost analysis conducted by the Contractor, comprehensive removal of LCPs from items or surfaces is not expected to be required during the Work.

- .1 Refer to the provisions of the 2012 WorkSafe BC publication "Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry" for removal of LCPs from surfaces before any welding and torch-cutting, should the Contractor plan to use such methods to complete the Work.

- .1 Contractor will be responsible for verification testing of surfaces where LCPs have been removed. Confirmation of acceptable results is to be provided to the Departmental Representative for review before proceeding with any welding or torch-cutting on surfaces where LCPs were present.

- .4 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

- .5 Waste disposal to be conducted in accordance with BC Reg. 63/88.

- .3 Polychlorinated Biphenyls (PCBs)

- .1 When decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada publication Identification of Lamp Ballasts Containing PCBs, 1991.

- .2 Should a material suspected to contain PCBs become uncovered during renovation activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present.

- .3 PCB-containing items identified for removal and disposal should be handled, transported, stored and disposed of in accordance with the following:

- .1 The transportation and disposal requirements of BC Reg. 63/88 .

- .2 The transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

- .3 The Federal PCB Regulations (SOR/2008-273)

- .4 Mercury

- .1 When mercury-containing items are removed, ensure all mercury waste is handled, stored and disposed of in accordance with the requirements the following:

- .1 The transportation and disposal requirements of BC Reg. 63/88.
- .2 The transportation requirements of the Federal Transportation of Dangerous Goods Regulation.
- .2 Precautions should be taken if workers may potentially be exposed to mercury or mercury vapours to ensure that workers exposure levels do not exceed the occupational exposure limit of 0.025 mg/m³ as per the BC Reg. 296/97. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.
- .5 Silica
 - .1 When silica-containing materials are to be disturbed and/or removed (e.g., coring through concrete slabs, demolition of masonry or concrete units), 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.
- .6 Biohazard Materials (Rodent Droppings)
 - .1 Refer to the Assessment Report for identities and locations of Biohazard Materials (Rodent Droppings) that may require disturbance during the Work.
 - .2 When renovation or demolition work proceeds, it is expected that biohazard materials will be encountered during that process. Due to the actual or potential presence of biohazard materials in the work area, workers should be notified of the potential presence of the biohazard material.
 - .3 Work associated with removal of biohazard materials building materials should be conducted by using personal protective equipment and procedures in accordance with industry accepted work practices for biohazard materials removal (e.g. Worksafe BC).

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 01 50 – General Instructions. Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 01 50 – General Instructions.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

- .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, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 01 50 – General Instructions

1.3 REFERENCES

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

1.4 SUBMITTALS

- .1 Submit product data, samples and manufacturer's instructions in accordance with Section 01 01 50 – General Instructions
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit duplicate samples of each type of material and colour.
- .4 Cured samples of exposed sealants for each color where required to match adjacent material.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 01 50 – General Instructions.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.

- .5 Handle and dispose of hazardous materials in accordance with the Regional and Municipal regulations.
- .6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .9 Fold up metal banding, flatten, and place in designated area for recycling.

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

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units and air distribution systems.
- .2 Where sealants are qualified with primers use only these primers.

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

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Security Sealants – Interior
 - .1 One-component, moisture curing, non-saging, flexible (Shore A 55 +/-5), tamper resistant elastomeric STPU (silyl-terminated polyurethane) sealant for interior joints or openings found in correctional and institutional facilities. TT-S-00230C, Type II, Class B and ASTM C920, Type S, Grade NS, Class 12.5. VOC <20 g/L
 - .2 Acceptable Product: Pecora Dynaflex SC.
 - .3 Application: Interior joints between grille and adjacent walls, continuous.
- .2 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
 - .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

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

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 Paint touch up.
 - .1 Paint the new sealant with same colour as adjacent finish.
- .4 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.

END OF SECTION

1.1 Related Sections

- ## 1.2 Submittals

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 01 50 – General Instructions: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection. Also see "Mandatory Requirements for O&M Manuals" in this Section.
 - .3 Operation data to include:

- .1 Control schematics for systems including environmental controls.
- .2 Description of systems and their controls.
- .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for systems and component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment performance verification test results.
 - .2 Special performance data as specified.
 - .3 For each fan and pump installed, provide performance data in "Curve" or multi rating table.
 - .4 For each plumbing fixture, floor and roof drain installed, provide manufacturer's "cut" of that item and "cuts" of associated brass goods.
- .6 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.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .2 Copies of extended guarantees and warranties for equipment items such as hot water tanks and heat exchangers shall be included in a separate section of the manual.
- .8 Site records:
 - .1 N/A.
- .9 As-built drawings:
 - .1 N/A.

1.3 Regulations

- .1 Comply with most stringent requirements of NBC, Provincial and Municipal regulations and by-laws, specified standards, codes and this specification. Practices contained in these standards or standards suggested or recommended by reference organizations, are to be taken as minimum requirements.
- .2 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.
- .3 Drawings and specifications should not conflict with these Regulations but where there are apparent discrepancies, notify the Departmental Representative in writing and obtain clarifications before proceeding with the work.

1.4 Quality Assurance

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
- .2 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by Departmental Representative and the Trade. Departmental Representative has the right to reject any items of work that does not conform to the Contract and accepted standards of performance, quietness of operation, finish and appearance.
- .3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits.

1.5 Guarantee Warranty

- .1 Correct promptly at own expense, defects or deficiencies in the work in accordance with the Warranty requirements of the Contract.
- .2 The Departmental Representative shall be the judge as to whether the failure is due to defective workmanship, improper usage or ordinary wear and tear.
- .3 Make good any damage resulting from defective materials or workmanship.
- .4 Rectify any deficiencies or omissions in respect to plans or Specifications which may appear during the guarantee period even though work has been accepted as complete.

1.6 Definitions

- .1 Definitions used in this Division will have the following meaning:
 - .1 "Concealed": pipes, ducts, etc., in trenches, chases, furred spaces, pipe shafts, or hung ceilings.
 - .2 "Exposed": regarding insulation and painting of piping, ducts, etc., will mean that they are not "concealed", as defined herein.
 - .3 "Piping": includes, in addition to pipe, all fittings, valves, hangers, other accessories which comprise a system.
 - .4 "Provide": to supply and install, complete and ready for use.

1.7 Drawings

- .1 Drawings:
 - .1 Are not intended to show structural details or architectural features.
 - .2 Are not to be scaled.
 - .3 Except where dimensioned, indicate general mechanical layouts only.
 - .4 The drawings are mainly schematic and do not attempt to show all offsets. Make such offsets at no additional cost to contract. Offset angles shall be as small as possible.
 - .5 All figured dimensions shall have precedence over scale. Detail drawings shall have precedence over small scale drawings; any difference between same shall be decided upon by the Departmental Representative.
- .2 Provide field (shop) drawings to indicate relative position of various services when required by Departmental Representative and obtain approval before commencing work.
- .3 Shop drawing review by Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for quantities and 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 coordination of the work of all sub-trades.

1.8 Maintenance

- .1 Furnish spare parts in accordance with Section 01 01 50 – General Instructions as indicated in the detailed product specification clauses.
- .2 Provide access doors for concealed expansion joints, traps, strainers, cleanouts, balance dampers, fire dampers, other parts requiring accessibility for operating and maintenance.
- .3 In suspended panel ceilings, use panel in place of access door; provide in such panel a button or other means of identification and easy removal when necessary.

1.9 Delivery, Storage and Handling

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

1.10 Discrepancies and Omissions

- .1 Bidders finding discrepancies in, or omissions from, Drawings, Specifications, or other documents, or having any doubt as to the meaning or intent of any part thereof, shall at

once notify the Departmental Representative, who will send explanatory written instructions to all bidders. No verbal information will be considered valid.

- .2 Should there be conflict(s) within or between the Specifications and/or Drawings, the most stringent or higher quality requirement shall apply.

1.11 Mandatory Requirements for O&M Manuals

- .1 Employ an independent firm with minimum five (5) years experience in preparing professional quality O&M manuals.
- .2 Hard Copy Requirements:
 - .1 Hard copies shall be placed in D-ring binders with clear overlay on front and spine with labels inserted on front cover and spine. Labels shall include the following information: Front cover label shall include the project name, project location, owner, architect, mechanical consultant, general contractor, mechanical contractor, firm preparing the manuals, and the month and year that the manuals were prepared. It shall also bear the label "Operating & Maintenance Manual for Mechanical Systems".
 - .2 Spine label shall include the project name, project location, and the year that the manuals were prepared. It shall also bear the label "Operating & Maintenance Manual for Mechanical Systems".
 - .3 Indicate Volume X of Y if more than one volume is required.
 - .4 Insert a Title page and Table of Contents in clear plastic covers.
 - .5 Title page shall include the project name, project location, as well as the name, address, phone number of the owner, architect, mechanical consultant, general contractor, mechanical contractor, firm preparing the manuals, and the month and year that the manuals were prepared. It shall also bear the label "Operating & Maintenance Manual For Mechanical Systems".
 - .6 Index the binder according to the following system:

Tab 1.1 Mechanical Drawing Schedule

Tab 1.2 Description of Systems

- Provide a schematic drawing and component description for each major mechanical system including air handling systems, boiler and hot water heating piping distribution systems and (where applicable) water chillers and chilled water distribution systems. The schematic drawing shall identify each component with a letter designation corresponding to a description briefly explaining the purpose of each component and how it relates to the other components, and be presented in a current version of AutoCAD or similar computer aided drafting program.
- The component description shall be clearly written in a language that may be easily understood by the building operators and maintainers who will be using them.

Tab 1.3 Operating Division

Provide the following:

- Specific operating instructions for each major item of equipment, including air handling systems, pumps, boilers, chillers, etc.
 - Ventilation requirements, Energy considerations, Automatic temperature control settings, Information regarding air filters and pressure drops for clean and dirty conditions.
 - Trouble Shooting Procedure Guide in spreadsheet form with the most likely causes and recommended actions for all foreseeable problems. Trouble Shooting Procedure guides are required for all the major items of equipment including air handling systems, exhaust fans, circulating pumps, mechanical cooling equipment, etc.
 - Mechanical Equipment Starting Procedures.

Tab 1.4 Maintenance and Lubrication Division

Tab 1.5 Equipment Supplier and Contractor Schedule

- Provide a list of Equipment Suppliers and Contractors and include their address, telephone number.
- Provide the Equipment Make/Manufacturer

Tab 2.0 Guarantees, Certificates and Reports

- Including assurance letters, balancing and commissioning reports

Tab 2.1 Valve Tag Schedule

Tab 2.2 Labeling and Identification Schedule

- Piping colour code schedules
- Access panel identification schedules

Tab 2.3 Chemical Cleaning and Treatment

- Chemical cleaning shop drawings, water treatment data

Tab 3.0 Equipment Shop Drawings and Maintenance Data

- Organize this section into numbered tabs.
- Insert final shop drawings that have been reviewed and as-built control schematics.

- For each fan and pump installed, provide performance curves indicating the design point of intersection and the actual operating point.
- For each plumbing fixture, floor and roof drain installed, provide manufacturer's "cut" of that item and "cut" of associated brass goods.
- In addition to the shop drawings provided for the various items of mechanical equipment, this section shall also include the Manufacturers' Literature on:
 - Operating and maintenance instructions
 - Spare parts lists
 - Trouble Shooting information

Tab 4.0 Balance Report

The divider tabs shall be custom laminated mylar plastic and shall be in accordance with the following colour scheme:

- Tabs 1.1 to 1.5 – Orange
- Tabs 2.0 to 2.3 – Green
- Tab 3.0 – Yellow

- .7 Furnish sufficient copies of equipment manufacturer's literature, a set of drawings, approved shop drawings, and Mechanical Specification to the company preparing the O&M manuals to meet the above requirements.

.2 Digital Manual Requirements

- .1 The digital version of the manuals and the hard cover version shall be prepared by the same company.
- .2 In addition to the operating and maintenance manuals provided in hard covered binders, two copies of all information shall be provided in digital format as follows:
- .3 The information shall be organized into sections in a user-friendly format to make it easy to search for specific information. An indexing system shall be included that remains on an expandable portion of the screen that allows the end user to scroll through the manual information that appears on the main portion of the screen. The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version. The specific requirements are listed below:

- .1 Utilize Adobe Acrobat PDF format.

- .2 If there is more than one volume of manual, indicate "Volume X of Y" for each volume.
 - .3 Include a copy of the latest Adobe Acrobat Reader.
 - .4 The final Digital copies are to be copied to CDR with a custom CDR label. The custom CDR label shall include: Project Name, Location of Project, Date of Assembly, name of Mechanical Consultant, and shall be titled "Operating & Maintenance Manual for Mechanical Systems".
 - .5 The Digital Manual shall be enhanced with the following features: Bookmarks, Thumbnails, Internet Links, Internal Document Links and Optical Character Recognition (OCR). Refer to Scanning Requirements and Organizational Requirements listed below.
- .4 Scanning Requirements:
- .1 All pages contained within the hard copy manual are to be scanned and/or digitized to Adobe Acrobat PDF format.
 - .2 Provide a minimum 300 DPI for all scanned pages.
 - .3 All scanned shop drawings may be searched for text with minimum 75% Optical Character Recognition (OCR).
 - .4 All shop drawings are to be scanned to a minimum 8.5"X11" size. If the original page size is 11"X17", the digital copy shall also be 11"X17". Page sizes exceeding 11"X17" may be shrunk down to 11"X17".
 - .5 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.
- .5 Organizational Requirements:
- .1 Digital Manual shall be organized in the same manner as the approved Hard Copy Manual. (e.g. Tabs 1.1, 1.2, 1.3, 1.4, 1.5, 2.0, 3.0, 4.0, etc).
 - .2 Bookmark all major tabs and subsections.
 - .3 Bookmark each set of shop drawings (Section 3.0).
 - .4 Link the Table of Contents page to the referenced sections.
 - .5 Insert an introduction/summary page for Sections 1.2, 1.3, 1.4, and 3.0 indicating major subsections. Link these pages to their referenced sections.
 - .6 Link the system descriptions to the referenced schematic drawings contained in section 1.2.

- .7 Insert Internet Links and Internal Document Links from Section 1.5 to Mechanical Equipment Manufacturers/Suppliers/Contractors official websites.
- .8 Mechanical Equipment Shop Drawings located in Section 3.0.
- .6 Use the following colour code for links contained in Sections 1.2, 1.3, 1.4, and 1.5.:
 - .1 Internet Links (light blue with underline).
 - .2 Internal Document Link (dark blue) (excludes AutoCAD schematic links).
- .7 Insert a title page for each major piece of equipment located in Section 3.0. The title page shall include the Shop Drawing name, and a link (dark blue in colour) to Section 1.5.
- .8 It is the responsibility of the Mechanical Trade to provide high quality documentation for scanning.
- .9 Digital Manual shall be reviewed by the Departmental Representative for content and layout prior to final submission.

1.12 Security Fasteners

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 Installation

- .1 Coordinate work with work of other sections to avoid conflict.
- .2 Locate distribution systems, equipment, and materials to provide minimum interferences and maximum usable space.
- .3 Where interference occurs, Departmental Representative shall approve relocation of equipment and materials, regardless of installation sequence.
- .4 Provide tamperproof screws for new and relocated equipment located in inmate accessible areas.

3.2 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 Cutting and Patching

- .1 Make arrangements with General Contractor for all cutting and patching in this work.
- .2 Minimize cutting and patching. Set sleeves and mark openings in concrete or masonry.
- .3 Conduct ground penetrating radar (GPR) scans prior to coring or cutting existing concrete structure.

3.4 Waterproofing

- .1 Where any work pierces waterproofing including waterproofing concrete, the method of installation shall be as approved by the Departmental Representative before the work is done. Supply and install all necessary sleeves, caulking, roof curbs, and flashing required and make the openings watertight.

3.5 Protection of Work

- .1 Protect equipment and material during construction from the weather, moisture, dust, painting, plastering and physical damage. Clean and return to "as new" condition.
- .2 Mask or grease and cover machined surfaces. Firmly secure covers over equipment openings and open ends of piping, conduit and ductwork as work progresses. Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
- .3 Any equipment that has operating parts, bearings or machined surfaces that show signs of rusting, pitting or physical damage will be rejected.
- .4 Refinish damaged or marred factory finishes to the satisfaction of the Departmental Representative, using equal quality materials.

3.6 Field Quality Control

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

3.7 Demonstration and Operating Instructions

- .1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Provide training to Departmental Representative for the controls and operation of mechanical equipment and systems installed and/or modified as part of this project.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual and as-built drawings as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 During substantial performance review of the work the Mechanical Contractor, together with the Departmental Representative, Controls Contractor, and other Subcontractors designated by the Departmental Representative, shall instruct the Owner's operating personnel in the proper operation and maintenance of all systems and equipment installed under the contract.
- .7 It shall be the Mechanical Contractor's responsibility to have the specified equipment manuals prepared, previously approved by the Departmental Representative, and ready for presentation to the Owner at this meeting.
- .8 Convene the meeting with the aforementioned parties at the time called for in the substantial performance review. The arrangements shall include written notices to all the parties concerned. Should the equipment manuals, or system installation not be complete and operable at the proper time, he shall then convene the operating instruction meeting at a later date and pay any additional costs including time and travelling expenses for the personnel involved which are attributable to the delay.
- .9 Keeping a sign-in sheet is mandatory for the demonstration and training session. Submit a copy of the sign-in sheet to Departmental Representative for record.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical
- .3 This Section applies to all related work under Divisions 22 and 23.

1.2 References

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-2013, Energy Code for Buildings Except Low-Rise Residential Buildings.
- .2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)
- .3 Workplace Hazardous Material Information System (WHMIS)
- .4 National Energy Code for Buildings (NECB) 2011.

1.3 Section Includes

- .1 Electrical work to conform to Division 26 including the following:
 - .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.4 Shop Drawings

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

1.5 Closeout Submittals

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

1.6 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 PRODUCTS

2.1 General

- .1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of ASHRAE 90.1.

2.2 Motors

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120V, unless otherwise specified or indicated.

PART 3 EXECUTION

3.1 Installation

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

END OF SECTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.
- .2 Performance Requirements:
 - .1 Design supports and hangers to withstand seismic events as specified Section 23 05 48 – Vibration & Seismic Control for Ductwork, Piping and Equipment.

1.4 Submittals

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .3 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

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

PART 2 PRODUCTS

2.1 Design Requirements:

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 General

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

2.3 Upper Attachment

- .1 Concrete:
 - .1 Carbon steel plate with clevis for surface mount: malleable iron socket with expansion case and bolt. Minimum two expansion cases and bolts for each hanger – Grinnell/Anvil, plate fig. 49, socket fig. 290, expansion case fig. 117.

2.4 Middle Attachments (Rod)

- .1 Carbon steel black (electro-galvanized/cadmium plated for mechanical rooms) continuous threaded rod - Grinnell/Anvil fig. 146.
- .2 Ensure that hanger rods are subject to tensile loading only.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems per Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

- .3 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations. Supporting piping from underside of light weight roof deck (without concrete) is not permitted.
- .5 Use expansion anchor on existing concrete structure.

3.2 Hanger Installation

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

3.3 Cleaning

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 23 05 00 Common Work Results – Mechanical
- .3 This Section applies to all related work under Divisions 22 and 23.

1.2 References

- .1 National Building Code of Canada (NBC)
- .2 American National Standards Institute / Sheet Metal and Air Conditioning Contractors National Association (ANSI/SMACNA):
 - .1 ANSI/SMACNA 001-2008, Seismic Restraint Manual, Guidelines for Mechanical Systems, 3rd Edition.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.
- .2 Provide vibration isolation systems shop drawings complete with performance and product data. Shop drawings shall demonstrate compliance with the National Building Code and shall bear the seal of a Professional Engineer.
- .3 Provide detailed drawings of all seismic restraint systems for piping and equipment.

1.4 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 PRODUCTS

2.1 Vibration Isolation System – General

- .1 Performance of vibration isolation systems shall be designed by manufacturer specializing in vibration isolation materials and devices.
- .2 Size and shape of bases type shall be coordinated with submitted equipment.
- .3 Products shall of the same manufacturer unless otherwise noted.

2.2 Springs

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

2.3 Hangers

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, molded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with molded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

2.4 Seismic Control Measures

- .1 General:
 - .1 Design anchorage and attachment methods for all systems and/or equipment as specified herein.
 - .2 Seismic control systems to work in all directions.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .4 Drilled or power driven anchors and fasteners not permitted.
 - .5 No equipment, equipment supports or mounts to fail before failure of structure.
 - .6 Supports of cast iron or threaded pipe not permitted.
 - .7 Seismic control measures not to interfere with integrity of firestopping.
 - .8 For equipment mounted on housekeeping pad, specify the minimum distance between anchor bolt and edge of housekeeping pad.
- .2 Static equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment:
 - .1 Use one or more of following methods depending upon site conditions or as indicated:
 - .1 Install tight to structure.
 - .2 Cross brace in every direction.

- .3 Brace back to structure.
- .4 Cable restraint system.
- .2 Seismic restraints:
 - .1 Cushioning action to be gentle and steady.
 - .2 Shall never reach metal-like stiffness.
- .3 Vibration isolated equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Provide seismic restraints in addition to vibration isolation system to resist complete isolator unloading.
- .4 Ductwork systems:
 - .1 Provide seismic restraints for all ductwork in accordance to the latest edition of SMACNA Seismic Restraint Manual as described below:
 - .1 All rectangular ducts with cross sectional areas 0.56m^2 [6 ft²] and larger.
 - .2 All round ducts with diameters 711 mm [28"] and larger.
 - .2 Diffusers, Grilles and Registers:
 - .1 Diffusers, grilles and registers installed in a suspended grid ceiling shall be provided with wire retainers or duct straps connecting the fixture at diagonally opposite corners to the building structure.
 - .3 Seismic restraints may be omitted for the following conditions:
 - .1 All ductwork suspended by hangers 305mm [12"] or less in length, as measured from the top of the duct to the bottom of the structural support for the hanger.
- .5 Bracing methods:
 - .1 Approved by Departmental Representative.
 - .2 Structural angles or channels.
 - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .3 Ensure ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 Field Quality Control

- .1 Provide the services of the Professional Engineer(s) who designed the restraint systems for "Field Review" of the installed components, and submit the following to the Departmental Representative:
 - .1 Schedule B, signed and sealed; provided at the commencement of the project.
 - .2 Signed and sealed shop drawings of seismic restraints for equipment, piping and ductwork; provided prior to installation.
 - .3 Typewritten inspection reports; provided during the construction period.
 - .4 Schedule C-B, signed and sealed; provided after performing "Field Review".

3.4 Cleaning

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

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 01 35 33 Health and Safety Requirements
- .3 Section 23 05 00 Common Work Results – Mechanical
- .4 This Section applies to all related work under Divisions 21, 22 and 23.

1.2 Quality Assurance

- .1 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.3 Delivery, Storage, and Handling

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

PART 2 - PRODUCTS

2.1 Manufacturer's Equipment Nameplates

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 System Nameplates

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

- .2 Construction:
 - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

	<u>Sizes (mm)</u>	<u>No. of Lines</u>	<u>Height of Letters (mm)</u>
1	10 x 50	1	3
2	13 x 75	1	5
3	11 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Identification for PWGSC Preventive Maintenance Support System (PMSS):
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: Size #9.
 - .2 Source and Destination identifiers: Size #6.
 - .3 Terminal cabinets, control panels: Size #5.
 - .3 Equipment elsewhere: Sizes as appropriate.

2.3 Controls Components Identification

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.4 Language

- .1 Identification in English.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Timing

- .1 Provide identification only after painting specified has been completed.

3.3 Installation

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 Nameplates

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.

3.5 Cleaning

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

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 Qualifications of TAB Company

- .1 Testing and balancing shall be performed by an agency that specializes in this type of work.
- .2 All work shall be performed by persons with proven ability and thoroughly versed in the type of testing and balancing. Submit names, complete with experience, record and references for review by the Departmental Representative prior to work being carried out.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 Purpose of TAB

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

1.4 Exceptions

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

1.5 Coordination

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

1.6 Pre-TAB Review

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

1.7 Start-Up

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 Operation of Systems during TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 Start of TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weather-stripping, sealing, caulking.
 - .3 All pressure, leakage, other tests specified elsewhere Division 23.
 - .4 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Duct systems clean.
 - .2 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .3 Correct fan rotation.
 - .4 Fire, smoke, volume control dampers installed and open.
 - .5 Access doors, installed, closed.

- .6 Outlets installed, volume control dampers open.

1.10 Application Tolerances

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems (cell exhaust): plus 10%, minus 0%.

1.11 Accuracy Tolerances

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

1.12 Instruments

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

1.13 Submittals

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

1.14 Preliminary TAB Report

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

1.15 TAB Report

- .1 Format to be in accordance with Associated Air Balance Council Manual.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Include final TAB report in O&M manual. Provide one (1) copy of final TAB Report to Departmental Representative.

1.16 Verification

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

1.17 Settings

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

1.18 Completion of TAB

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

1.19 Air Systems

- .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC, NEBB, SMACNA and ASHRAE.
- .2 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, air flow rate, pressure drop, duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .3 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of dampers, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .4 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

PART 2 - PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 - EXECUTION

3.1 General

- .1 Test and balance the exhaust air systems served by EF-1 to EF-4 in Living Units 1 to 5. Work shall be carried out in phases. Refer to 01 01 50 – General Instructions to phasing.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|--|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 35 33 | Health and Safety Requirements |
| .3 | Section 23 05 00 | Common Work Results - Mechanical |
| .4 | Section 23 05 29 | Hangers and Supports for HVAC Piping and Equipment |

1.2 References

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B209M-10, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335/C335M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-11, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-12, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .9 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-1989, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .5 Thermal Insulation Association of Canada (TIAC):
 - .1 Mechanical Insulation Best Practice Guide, 2013.

- .6 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation Polyotrene, Boards and Pipe Covering.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 Definitions

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED"-will mean "not concealed" as defined herein.
- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.4 Submittals

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.
- .4 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

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

1.6 Delivery, Storage and Handling

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

PART 2 PRODUCTS

2.1 Fire and Smoke Rating

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 Insulation

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612. Provide factory applied vapour retarder jacket to CGSB 51-GP-52Ma as scheduled in PART 3 of this Section.

- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553. Provide factory applied vapour retarder jacket to CGSB 51-GP-52Ma as scheduled in PART 3 of this section.
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.
- .5 Evidence shall be provided to the Departmental Representative on the site of ULC listings of all products being used. Duct insulation adhesives and coatings shall be non-toxic as defined by WCB Regulations.

2.3 Jackets

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.
 - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

2.4 Accessories

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .5 Contact adhesive: quick-setting
 - .1 Maximum VOC limit 80 g/L to SCAQMD Rule 1168.
- .6 Canvas adhesive: washable.
 - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .7 Tie wire: 1.5 mm stainless steel.
- .8 Fasteners: 2 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Pre-Installation Requirement

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

3.3 Installation

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .3 Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Seal vapor barrier penetrations with vapor barrier adhesive.
- .6 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .7 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

3.4 Duct Insulation Schedules

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

	TIAC Code	Vapour Retarder	Thickness (mm)
Exhaust ducts between dampers and louvers	C-1	No	25

- .2 Finish: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, exposed	CRF/1	CRD/1

3.5 Cleaning

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

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 01 91 00 Commissioning
- .2 Section 23 05 93 Testing, Adjusting and Balancing

1.2 Quality Assurance

- .1 The commissioning of mechanical systems shall be executed in accordance with the intent of:
 - .1 ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for the Commissioning Process.
 - .2 ANSI/ASHRAE/IES Standard 202-2013, Commissioning Process for Buildings and Systems.

1.3 General

- .1 Commissioning of the mechanical systems, including the HVAC, and Plumbing and Drainage Systems, shall be carried out by an independent Commissioning Agent acceptable to the Departmental Representative with technicians specifically trained in commissioning procedures.
- .2 The Mechanical Subcontractor shall retain a Commissioning Agent, who shall be active in the commissioning process and actively encourage his own forces and sub-trades to work together to achieve optimum system performance for the mechanical systems in timely manner. Refer to Section 01 91 00 – Commissioning for additional requirements.
- .3 It is not intended that this work shall, in any way, replace normal factory startup service for equipment or relieve the Contractor or his sub-trades of their responsibility for providing first-class installation in satisfactory working order.
- .4 As part of the final commissioning report, submit a Certificate stating that the commissioning procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and finally, that follow-up testing, after the correction of faults and omissions has been completed and recorded.
- .5 Be responsible for the performance and commissioning of all equipment supplied under the Sections of Division 23. Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the contract documents and design intent. It is the activation of the completed installation.
- .6 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.

1.4 Commissioning and Demonstration

- .1 Submit a schedule for the commissioning phase of the work. This schedule shall show:
 - .1 Equipment start-up schedule.
 - .2 Submission dates for the various documents required prior to substantial completion.

- .3 Timing of the commissioning, testing, balancing, and demonstration process.
- .2 Commissioning is concluded when the air and water system is balanced and the installation is in full working order and acceptable for use. The work shall include the following:
 - .1 Balancing of the air systems as specified in this section.
 - .2 Set up air diffusers, registers and grilles for optimum distribution/comfort.
 - .3 Plug all air pressure and flow measuring holes.
 - .4 Adjust vibration isolators and earthquake restraints for optimum performance.
 - .5 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations. Forms in Section 23 08 02 shall be used for this purpose.
 - .6 Verification of water tightness of all roof and exterior wall penetrations.
 - .7 Verification that coil drain pan operates.
 - .8 Set up all automatic control valves/dampers and automatic temperature control devices.
 - .9 Set up and test all alarm and protective devices.
 - .10 EMCS:
 - .1 Commissioning of EMCS is primarily responsible by Controls Contractor. Refer to Section 25 05 01 EMCS General Requirements.
 - .2 The Commissioning Agent shall assign one person experienced and qualified in commissioning control systems through practical experience and a comprehensive knowledge of the interactive nature of HVAC systems and DDC controls to **verify** the performance of the control systems by conducting random tests of the control sequences until the Commissioning Agent is satisfied that the controls are performing according to the intended control sequences.
 - .3 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Controls Contractor for the purchase price of the material.
- .3 At the conclusion of commissioning, demonstrate the operation of the systems to the Departmental Representative. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to section 25 05 01 EMCS: General Requirements.
- .4 The verification process shall include the demonstration of the following:
 - .1 The ease of access that has been provided throughout for servicing motors, drives and damper operators.
 - .2 Location of and opening and closing of all access panels.
 - .3 Operation of all equipment and systems under each mode of operation, and failure.

- .6 At the completion of commissioning, testing, balancing and demonstration submit the following to the Departmental Representative:
 - .1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.
 - .2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.
 - .3 "As-Built" record drawings, as specified.
 - .4 A list of all alarm and protective devices tested, with the final operating settings.
- .7 Training
 - .1 During "Substantial Performance" review, the Mechanical Contractor, Control Subcontractor, and other Subcontractors designated by the Departmental Representative shall provide training to the operating personnel in the proper operation and maintenance of all systems and equipment installed under the contract.
 - .2 It shall be the Mechanical Contractor's responsibility to have the specified equipment manuals prepared, previously approved by the Departmental Representative, and ready for presentation to the Departmental Representative at this meeting.
 - .3 Convene the meeting with the aforementioned parties at the time called for in the substantial performance review. The arrangements shall include written notices to all the parties concerned. Should the equipment manuals, or system installation not be complete and operable at the proper time, he shall then convene the operating instruction meeting at a later date and pay any additional costs including time and travelling expenses for the personnel involved which are attributable to the delay.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|---------------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 23 05 00 | Common Work Results-Mechanical |
| .3 | Section 23 05 93 | Testing Adjusting and Balancing |

1.2 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.
- .2 Dispose of unused cleaning solutions at official hazardous material collections site approved by the Departmental Representative.
- .3 Do not dispose of unused cleaning solutions into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.
- .4 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .5 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.3 Scope

- .1 All air systems installed by this contract including existing related systems shall be cleaned by a Cleaning Contractor.
- .2 The Cleaning Contractor shall visit the site in the case of existing systems or shall review the drawings and specifications of new systems, in order to be fully acquainted with the scope of work and requirements before tendering. No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site or inspect the contract documents.
- .3 The following air systems shall be cleaned, as applicable:
 - .1 Exhaust
- .4 All components within each system shall be thoroughly cleaned to the Departmental Representative's satisfaction and shall include but not be limited to the following:
 - .1 Exhaust louvres
 - .2 Bird screens
 - .3 Fans & motors - complete assembly
 - .4 All plenum surfaces
 - .5 Existing and new exhaust ductwork (within mechanical room and pipe/duct chases) between cells
 - .6 Exhaust air grilles

1.4 Qualifications

- .1 Cleaning shall be performed by a cleaning service company with high capacity cleaning equipment designed specifically for the work involved, executed by personnel specifically trained for the application.

PART 2 PRODUCTS

2.1 Cleaning Equipment

- .1 Cleaning shall generally by high capacity power vacuum.
- .2 High pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise.

PART 3 EXECUTION

3.1 Cleaning HVAC Systems

- .1 The Cleaning Contractor shall provide access as required for the work and shall reseal and make good any duct or insulation damaged in the process of this work.
- .2 Remove cheesecloth from grilles, etc., let over from the temporary use of the air systems.
- .3 Air systems must not be shut down without prior approval from the Departmental Representative.
- .4 The Cleaning Contractor shall mark balancing damper positions before cleaning and return them to their original position when cleaning is completed unless the system is to be balanced.
- .5 Re-install any grilles, registers and diffusers which may have been removed for cleaning purposes.

3.2 Report

- .1 After completion of the work, the Contractor shall provide four copies of a certificate stating that all systems have been cleaned as specified and that all access panels for all cleaning openings are in place. This certificate shall be placed in the Operating and Maintenance Manuals.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|---|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 35 33 | Health and Safety Requirements |
| .3 | Section 23 05 00 | Common Work Results - Mechanical |
| .4 | Section 23 05 48 | Vibration and Seismic Controls for Ductwork, Piping and Equipment |
| .5 | Section 23 07 13 | Thermal Insulation for Ducting |
| .6 | Section 23 31 10 | Cleaning of Mechanical Duct Systems |

1.2 References

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A653/A653M-2013, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Agency (NFPA)
 - .1 NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.
- .7 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

- .8 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.
- .9 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 Submittals

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets for the following:
 - .1 Sealants.
 - .2 Adhesive
 - .3 Duct tape.
 - .4 Duct liners.

1.4 Quality Assurance

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Delivery Storage and Handling

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

- .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Seal Classification

- .1 Classification as follows:

Pressure Class	Maximum Pressure (Pa)	SMACNA Seal Class
Low Pressure	500	[B]

- .2 Seal classification:

- .1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 Ductwork - General

- .1 Duct dimension noted on drawings are clear inside dimensions. Insulation thickness shall be as noted on the drawings.
- .2 All seams, joints and raw edges shall be sealed and covered with glassfab.
- .3 Insulation shall be applied with mechanical fasteners and suitable adhesives. Duct insulation adhesive and coatings shall be non-toxic as defined by WCB Regulations.
- .4 Round duct: with spiral seams. Sections shall be joined with a RT1 slip joint, screw fastened and sealed with no visible duct sealant to interfere with finish painting.
- .5 Exposed round duct shall be installed in a neat workmanlike manner parallel to building walls and roof with no sags or misalignment, and shall be true and round.
- .6 Ductwork shall be constructed to 500 Pa low pressure duct.

2.3 Fittings

- .1 Fabrication: to SMACNA. Fittings shall be 2 gauges heavier than connecting ductwork.
- .2 Radius elbows:
- .1 Rectangular: Centre-line radius equal to 1.5 times width of duct, with single thickness turning vanes.
- .2 Round: Centre-line radius equal to 1.5 times diameter. 5-gore for 300mm [12"] and larger; die-stamped for 254mm [10"] and smaller.
- 3 Mitered elbows, rectangular:
- .1 To 400mm [16"]: with single thickness turning vanes.
- .2 Over 400mm [16"]: with double thickness turning vanes.
- .4 Branches:
- .1 Rectangular main and branch: 45° entry on branch.

- 2 Round main and branch: enter main duct at 45° or with conical connection. The use of spin-in collars is not acceptable.
- .5 Transitions:
 - .1 Diverging: 20° maximum angle.
 - .2 Converging: 30° maximum angle.
- .6 Offsets: full radius elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.

2.4 Galvanized Steel

- .1 Lock forming quality: to ASTM A653, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.
- .4 Applications:
 - .1 All supply, return and exhaust ductwork unless otherwise noted.

2.5 Hangers and Supports

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500mm [20"].
- .2 Hangers, hanger configuration and attachment to structure: to SMACNA.

2.6 Duct Liner

- .1 Fibrous glass duct liner: air stream side faced with FSK facing.
- .2 Rigid:
 - .1 Use on flat surfaces.
 - .2 25mm [1"] or 50mm [2"] thick fibrous glass rigid board duct liner.
 - .3 Density: 36 kg/m³ [2.2 lb/ft³].
 - .4 Thermal resistance: RSI-0.76 [R-4.3] for 25mm [1"], RSI-1.53 [R-8.7] 50mm [2"].
- .3 Flexible:
 - .1 Use on round or oval surfaces.
 - .2 25mm [1"] or 50mm [2"] thick fibrous glass blanket duct liner as indicated.
 - .3 Density: 24 kg/m³ [1.5 lb/ft³].
 - .4 Thermal resistance: RSI-0.74 [R-4.2] for 25mm [1"], RSI-1.47 [R-8.3] 50mm [2"].
- .4 Fasteners shall be weld pins with metal retaining clips and square head.
- .5 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.7 Sealant

- .1 For indoor and outdoor applications:
 - .1 Water based, fiber reinforced, non-toxic, elastomeric duct sealant. Suitable for indoor and outdoor use, non-sagging, non-cracking, UV resistant, freeze/thaw stable, paintable. Temperature range of -32°C to 99°C [-26°F to 210°F]. ULC listed and comply with NFPA 90A and NFPA 90B.
 - .2 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.
- .2 For outdoor applications only:
 - .1 Solvent based, fiber reinforced, elastomeric duct sealant. Suitable for outdoor use, non-sagging, non-cracking, UV-proof, freeze/thaw stable, paintable. Temperature range of -45°C to 120°C [-50°F to 250°F].
- .3 Maximum VOC limit 420 g/L to SCAQMD Rule 1168 and SMACNA Technical Resource Bulletin (TRB) #9-09.

2.8 Adhesive

- .1 Water-based vinyl copolymer adhesive. Temperature range of -23°C to 71°C [-10°F to 160°F]. ULC listed and comply with NFPA 90A and NFPA 90B. Adhesive shall be non-toxic as defined by WorksafeBC Regulations.
- .2 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.
- .3 Maximum VOC limit 80 g/L to SCAQMD Rule 1168.

2.9 Duct Tape System

- .1 Two part system combined of treated woven fibreglass tape and liquid sealant/adhesive. ULC listed and comply with NFPA 90A and NFPA 90B.
- .2 Flame and smoke ratings:
 - .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

PART 3 EXECUTION

3.1 General

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA, and as indicated.

- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- .7 All openings in ductwork shall be sealed with temporary duct cover during construction. Failure to maintain duct cleanliness will require the inside of all air ducts, plenums and equipment in the air stream to be cleaned with an industrial vacuum cleaner before system balancing is started.
- .8 Apply protective galvanize coating to galvanized ductwork and accessories which have been welded.
- .9 Apply duct sealer to all joints of metal ducts, connections to diffusers, plenums and flexible duct.
- .10 The use of plastic duct tape is not permitted.
- .11 Thermal insulation to Section 23 07 13 – Thermal Insulation for Ducting.

3.2 Hangers

- .1 Strap hangers: Install in accordance with SMACNA.
- .2 Rectangular duct: Extend strap hanger down on both sides of duct, turn under bottom 25mm [1"] minimum. On each strap provide two sheet metal screws on the side and one in the bottom.
- .3 Angle hangers: complete with locking nuts and washers.
- .4 Hanger spacing: to SMACNA.
- .5 Seismic restraint to Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.3 Duct Liner

- .1 Install in accordance with manufacturer's recommendations, and as follows:
 - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
 - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425mm on centres.
 - .3 Acoustically lined round ducts shall have perforated inner metal liner.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

- .4 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply two coats of sealer over tape.
- .5 Replace damaged areas of liner.
- .6 Protect leading and trailing edges of duct sections with sheet metal nosing having 15mm [1/2"] overlap and fastened to duct.
- .7 Provide 50mm [2"] liner for ductwork exposed to weather which is not insulated.

3.4 Sealing and Taping

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

3.5 Cleaning

- .1 Perform cleaning operations as specified in Section 01 01 50 – General Instructions, Section 23 31 10 – Cleaning of Mechanical Duct Systems and in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|-------------------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 35 33 | Health and Safety Requirements |
| .3 | Section 23 05 00 | Common Work Results - Mechanical |
| .4 | Section 23 31 10 | Cleaning of Mechanical Duct Systems |

1.2 References

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S110-07, Standard Method of Tests for Air Ducts.
 - .2 UL 181-2013, Standard for Factory-Made Air Ducts and Air Connectors.

1.3 Submittals

- .1 Submittals in accordance with Section 01 01 50 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible duct connectors.
 - .2 Duct access doors.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: manufacturer's field reports specified.

- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan (WMP).
 - .5 Divert unused materials from landfill to recycling facility as approved by Departmental Representative.

PART 2 PRODUCTS

2.1 General

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

2.2 Flexible Duct Connectors

- .1 Frame: galvanized sheet metal frame 0.66mm [24 gauge] thick with fabric clenched by means of double locked seams.
- .2 Fabric:
 - .1 Indoor: Fire resistant, self extinguishing, neoprene coated fibreglass fabric, temperature rated at -40°C to 90°C [-40°F to 200°F], thickness of 0.63mm [0.025"].
 - .2 Outdoor: Fire resistant, self extinguishing, DuPont Hypalon coated fibreglass fabric, temperature rated at -40°C to 120°C [-40°F to 250°F], thickness of 0.61mm [0.024"].

2.3 Access Doors in Ducts

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm [24 gauge] thick complete with sheet metal angle frame.

- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6mm [24 gauge] thick complete with sheet metal angle frame and 25mm [1"] thick rigid fibreglass insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .2 301 to 450 mm: four sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

2.4 Instrument Test Ports

- .1 Alloy casting with screw-in cap, neoprene gasket, 18 mm [3/4"] inside diameter opening for pitot tube or velometer.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

- .1 Flexible Duct Connectors
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100mm [4"].
 - .3 Minimum distance between metal parts when system in operation: 75mm [3"].
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
 - .6 Flexible duct connector exposed to weather shall have a sheet metal shield for additional UV protection.
- .2 Access Doors in Ducts
 - .1 Size:
 - .1 610mm x 1520 mm [24"x60"] for person size entry.

- .2 460mm x 460 mm [18"x18"] for service.
 - .3 300mm x 200mm [12"x8"] for cleaning.
 - .4 As indicated.
 - .2 Locations:
 - .1 Fire dampers and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 On both sides of turning vanes.
 - .7 At the base of all duct risers.
 - .8 At 12,000m [40'-0"] intervals in all duct systems, and 6,000mm [20'-0"] intervals in horizontal exhaust ducts for cleaning purposes.
- .4 Instrument Test Ports
 - .1 Install in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.

3.3 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, and Section 23 31 10 - Cleaning of Mechanical Duct Systems.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|-------------------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 35 33 | Health and Safety Requirements |
| .3 | Section 23 05 00 | Common Work Results – Mechanical |
| .4 | Section 23 31 10 | Cleaning of Mechanical Duct Systems |
| .5 | Section 23 33 00 | Air Duct Accessories |

1.2 References

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 ANSI/SMACNA 006-2006, HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition.

1.3 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.
 - .1 Indicate the following:
 - .1 Volume dampers.
 - .2 Backdraft dampers.
- .2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

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

PART 2 PRODUCTS

2.1 General

- .1 Manufacture to SMACNA standards.

2.2 Multi-Bladed Volume Dampers

- .1 Opposed blades: 1.2mm [18 gauge] of same material as adjacent duct, stiffened.
- .2 Maximum blade width: 150mm [6"].
- .3 Axles: 9.5mm [3/8"] or 13mm [1/2"] continuous square rod.
- .4 Bearings: bronze oilite.
- .5 Linkage: shaft extension with locking quadrant and position indicator.
- .6 Frame: 51mm [2"] or 40 x 13 x 3 mm [1-1/2"x1/2"x1/8"] structural or roll-formed channel, complete with angle stop.

2.4 Backdraft Dampers

- .1 Multi-blade, gravity-operated, centre pivoted, constructed of same material as duct with nylon bearings.

PART 3 EXECUTION

3.1 General

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.

3.2 Volume Damper

- .1 For exhaust systems, locate balancing dampers in each branch duct.
- .2 All dampers to be vibration free.

3.3 Field Quality Control

- .1 Tests:
 - .1 Tests to cover period of not less than 2 days and demonstrate that system is functioning as specified.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, and Section 23 31 10 - Cleaning of Mechanical Duct Systems.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|--|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 35 33 | Health and Safety Requirements |
| .3 | Section 01 91 00 | Commissioning |
| .4 | Section 23 05 13 | Common Motor Requirements for HVAC Equipment |
| .5 | Section 23 05 48 | Vibration & Seismic Controls for HVAC Piping & Equipment |
| .6 | Section 23 08 00 | Commissioning of Mechanical Systems |
| .7 | Section 23 33 00 | Air Duct Accessories |
| .8 | Section 23 31 10 | Cleaning of Mechanical Duct Systems |

1.2 References

- .1 Air Movement and Control Association (AMCA)
 - .1 ANSI/AMCA 99-10, Standards Handbook.
 - .2 ANSI/AMCA 204-12: Balance Quality and Vibration Levels for Fans.
 - .3 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .4 ANSI/AMCA 300-08, Reverberant Room Method for Sound Testing of Fans.
 - .5 AMCA 301-90, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
 - .2 Capacity: flow rate, static pressure, BHP, HP, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
 - .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
 - .4 Sound ratings: comply with AMCA 301, tested to AMCA 300.
 - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

1.4 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.
- .3 Provide:
 - .1 Fan performance curves showing point of operation, BHP and efficiency.
 - .2 Sound rating data at point of operation.
- .4 Indicate:
 - .1 Motors and sheaves details.
- .5 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.5 Quality Assurance

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

1.6 Delivery, Storage and Handling

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

PART 2 PRODUCTS

2.1 Fans General

- .1 Motors:
 - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
 - .2 For use with variable speed controllers where specified.
 - .3 Sizes as specified.
- .2 Accessories and hardware: as specified.
- .3 Scroll casing drains: as indicated.
- .4 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .5 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for Ductwork Piping and Equipment.
- .6 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 Inline Centrifugal Fans

- .1 Cabinet construction: Fan housing shall be constructed of rigid structural members and minimum 18 gauge galvanized steel panels. The cabinet construction features two removable access panels permitting easy access to all interior components.
- .2 Drive frame: Constructed heavy gauge steel.
- .3 Wheels: Aluminum, backward inclined, non-overloading centrifugal wheel. Wheel shall be statically and dynamically balanced.
- .4 Duct collars: Provide square inlet and discharge duct collars.
- .5 Motor: EC motor.
- .6 Bearings: heavy duty grease lubricated ball or roller self-aligning type with oil retaining, dust excluding seals and a certified minimum rated life (L50) of 500,000 hours.
- .7 Disconnect switch: NEMA-1, factory-mounted and wired.
- .8 Provide packaged constant pressure control designed to regulate fan speed based on demand. Control shall include a Proportional Integral Derivative (PID) feedback loop and shall have all components prewired to labeled terminal strips for easy wiring. System shall include the appropriate pressure tap and preset pressure transducer. Fan shall be direct drive including an electronic commutation (EC) motor. Indoor installations shall include pressure tap (duct type) and control box with integral pressure transducer.
- .9 Provide other accessories as scheduled.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Fan Installation

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Bearings and extension tubes to be easily accessible.
- .3 Access doors and access panels to be easily accessible.

3.3 Anchor Bolts and Templates

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment. Provide seismic bracing for suspended equipment as specified in Section 23 05 48.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, and Section 23 31 10 - Cleaning of Mechanical Duct Systems.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 Field Quality Control

- .1 Commissioning:
 - .1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|-------------------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 35 33 | Health and Safety Requirements |
| .3 | Section 23 05 00 | Common Work Results – Mechanical |
| .4 | Section 23 31 10 | Cleaning of Mechanical Duct Systems |

1.2 System Description

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- .2 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.4 Quality Assurance

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

1.5 Delivery, Storage and Handling

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

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

PART 2 PRODUCTS

2.1 General

- .1 Size as indicated.
- .2 Capacity, pressure drop, terminal velocity, throw, noise level, neck velocity shall conform to intended performances of specified materials.
- .3 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified on architectural reflected ceiling plans.
 - .3 Concealed fasteners.
- .4 Where balancing damper is scheduled, damper shall be of opposed blade type.
- .5 Diffusers, grilles and registers in areas with high humidity shall be of aluminum construction.
- .6 Provide neck transition as required.

2.2 Manufactured Units

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

2.3 Security Grilles

- .1 Exhaust air grille, Type EG-S1:

Risk resistant perforated steel maximum security grille: 5mm [3/16"] hot rolled steel faceplate with 5mm [3/16"] staggered 60° on 7mm [9/32"] centres. Faceplate is to be attached with tamperproof screws in countersunk screw holes, for mounting on a custom-fabricated frame (by Sheet Metal Contractor). Finish: white baked enamel.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.

- .3 Provide tamperproof screws for security grilles/diffusers located in inmate accessible areas.

3.3 Cleaning

- .1 Proceed in accordance with Section 01 01 50 – General Instructions, and Section 23 31 10 - Cleaning of Mechanical Duct Systems.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

EXHAUST FANS									
Mark	EF-1		EF-2		EF-3		EF-4		
Service	General Exh.		General Exh.		General Exh.		General Exh.		
Location	Mechanical Room L2		Mechanical Room L2		Mechanical Room LA8		Mechanical Room LA14		
Type	Square Inline		Square Inline		Square Inline		Square Inline		
Make	Greenheck		Greenheck		Greenheck		Greenheck		
Model	SQ-120		SQ-120		SQ-95		SQ-95		
Drive	Direct c/w EC motor		Direct c/w EC motor		Direct c/w EC motor		Direct c/w EC motor		
Air Flow - L/s (cfm)	590	1,250	590	1,250	172	365	172	365	
External S.P. - Pa (in w.g.)	188	0.75	188	0.75	150	0.60	150	0.60	
BHP Motor HP		1/2		1/2		1/4		1/4	
Power Supply	120/1/60		120/1/60		120/1/60		120/1/60		
RPM									
Tip Speed	-		-		-		-		
Sones	10.0		10.0		8.0		8.0		
Notes	1, 2, 3		1, 2, 3		1, 2, 3		1, 2, 3		

Specification for accessories not scheduled. Refer to drawings for installation details.

Note: Equipment tags are typical for each of the five (5) Living Units.

1. Complete with flexible duct connectors, isolator brackets, spring isolators, pre-wired disconnect switch.
2. Complete constant pressure control package and transformer. See specifications.
3. Acceptable Materials: Greenheck, Loren Cook
Alternative Materials: Approved by addendum in accordance with Instructions to Tenderers.

PART 1 GENERAL

1.1 Related Sections

- | | | |
|----|------------------|-------------------------------------|
| .1 | Section 01 01 50 | General Instructions |
| .2 | Section 01 91 00 | Commissioning |
| .3 | Section 23 05 00 | Common Work Results - Mechanical |
| .4 | Section 23 08 00 | Commissioning of Mechanical Systems |

1.2 General

- .1 Provide, install, program and commission a DDC controls system to achieve the performance specified in the following clauses. The new DDC system shall be integrated to the existing Modern Systems Management DDC system at this site (TAC I/A Series system in Living Units 1 to 5; Tridium Niagara R2 platform at the DDC head end.).
- .2 Work covered by sections referred to above consist of fully operational EMCS, including, but not limited to, following:
 - .1 Building Controllers.
 - .2 Control devices as listed in I/O Summaries.
 - .3 Software and graphics upgrade complete with full documentation for software and equipment.
 - .4 Complete operating and maintenance manuals and field training of operators, programmers and maintenance personnel.
 - .5 Acceptance tests, technical support during commissioning, full documentation.
 - .6 Wiring interface co-ordination of equipment supplied by others.
- .3 Work shall be carried out in phases. Refer to Section 01 01 50 – General Instructions for phases.

1.3 Metric Reference

- .1 Conform to CAN/CSA-Z234.1.
- .2 Provide required adapters between Metric and Imperial components.

1.4 Standard Compliance

- .1 All equipment and material to be from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
- .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
- .3 Submit proof of compliance to specified standards with shop drawings and product data. Label or listing of specified organization is acceptable evidence.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

- .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by an organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

1.5 Existing Control Components

- .1 Existing control wiring and conduits may be re-used provided that they conform to applicable codes, standards, specifications.
- .2 Field control devices that are usable in their original configuration may be re-used provided that they conform to applicable codes, standards, specifications. Do not modify original design of any existing devices without written permission from the Departmental Representative. Provide for new, properly designed device where components are not certain as to reusability. Provide list of equipment so included in bid. Include unit price of all for this equipment.
- .3 Within 30 days of award of contract, and prior to installation of any new devices, inspect and test all existing devices intended for re-use. Furnish test report listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.
- .4 Non-functioning items:
 - .1 Provide with report specification sheets or written functional requirements to support findings.
 - .2 Departmental Representative will provide directions related to repair or replacement existing items judged defective yet deemed necessary for EMCS.
- .5 Submit written request for permission to disconnect any controls and to obtain equipment downtime before proceeding with work.
- .6 Assume responsibility for existing controls to be incorporated into EMCS, to commence upon approval for disconnection of controls or equipment downtime.
 - .1 Be responsible for repair costs due to negligence or abuse of Departmental Representative's equipment.
 - .2 Responsibility for existing devices to terminate upon acceptance of EMCS or applicable portions thereof.
- .7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

1.6 Submittals

- .1 Submit in accordance with Section 01 01 50 – General Instructions.
- .2 Provide shop drawings including complete operating data, system drawings, wiring diagrams, and type written detailed operational description of sequences, and description and engineering data on each control system component.
- .3 At completion of work, make detailed check of automatic control system and submit written report to the Departmental Representative.
- .4 Provide sufficient copies of complete parts and repair manuals for binding in O&M Manuals.

- .5 Provide "record" control drawings and schedules; incorporate into O&M Manuals.
- .6 The submittals shall be prepared using the dynamic graphics software normally provided with system and be incorporated into the dynamic graphics system for on-line reference. Provide original, registered software disks of Windows, the Graphics Software package, the Operating System software, and the project graphic schematics, floor plan layouts, and control drawings.

1.7 Preliminary Design Review Meeting

- .1 Convene a Preliminary Design Review meeting within 45 working days of award of contract to:
 - .1 Undertake functional review of preliminary design documents, resolve inconsistencies.
 - .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
 - .3 Review interface requirements of materials supplied by others.
 - .4 Review "Sequence of Operations".
- .2 Contractor's programmer to attend meeting.
- .3 Departmental Representative retains right to revise sequence or subsequent Control Description Logic prior to software finalization without cost to Departmental Representative and Owner.

1.8 Monitoring and Control Features

- .1 Operator defined digital and analogue alarms and automatic alarm condition reporting.
- .2 Direct keyboard override of all inputs and outputs, with an indication on the display for any point that is operating under keyboard override.
- .3 Addition, deletion, definition and modification of all points from operator keyboard.
- .4 Trend log graphing and reporting of user selected points at user defined intervals.
- .5 Run time logging of digital points.
- .6 Ability to accept a variety of standard analogue and digital input signals.
- .7 Ability to generate a variety of standard analogue and digital output signals.

1.9 Offline Storage

- .1 The DDC system shall have the capability to be taken off-line in the event of failure or for maintenance and returned to operation without the need for entering any portion of the software program manually.
- .2 An off-line disk storage device shall be utilized to provide software backup and reload. Backup and verification of the entire system, with full applications software, shall be less than TWO (2) seconds per real point.

1.10 Power Surge Protection

- .1 The DDC system shall be protected from power line surges and voltage transients by installation of a power line filter.

1.11 Power Failure Protection

- .1 The DDC system shall have automatic protection from any power failure of at least TWENTY-FOUR (24) hours duration.
- .2 This protection shall at a minimum include continuous real-time clock operation and automatic system restart upon power return.
- .3 Outputs shall have the option of being set to "staggered start" upon power reset.

1.13 Electrical Components, and Conduit

- .1 Provide all control system components, except those supplied as part of packaged equipment controls, but including all auto sequencing devices, electric relays, safety devices and electrical interlocks required to accomplish specified sequences. Refer to the electrical motor schedule in the electrical drawings and/or specification, which delineate the limits of electrical work in Division 26 (Electrical) serving mechanical systems.
- .2 Provide all control circuit transformers required for control systems and not supplied by Division 26 including line voltage power connection from indicated outlets shall be included by Division 25.
- .3 All line voltage wiring shall be copper with RW90 X-Link P.E. insulation #12 minimum size. AWG wire shall be sized to meet code.
- .4 All wiring installed under this contract shall be plenum rated FT-6, or FT-4 if installed in conduits. Locate wiring away from top or bottom of ceiling joists or trusses to minimize possibility of accidental damage. Number 18 gauge wire may be used in Class 2 circuits unless voltage drops are excessive. THHN wire will not be acceptable. Twisted shielded wiring, minimum of 22 gauge wire shall be used for all DDC or co-axial communication wiring. Line voltage alternating current wiring shall not be run in the same conduit, or cabling as DDC wiring.
- .5 Use 1m of flexible conduit for all connections to vibrating equipment. Use liquid tight flex cable and connections where required.
- .6 The Control Contractor shall locate magnetic starters from the electrical drawings. All electrical work provided by this Contractor shall comply with all requirements of the Division 26 electrical specification, the Canadian Electrical Code and Local Codes and Ordinances.
- .7 Wire all line voltage thermostats, pressure switches or aquastats for single phase equipment.
- .8 Division 26 has been requested to provide specific devices, including magnetic starters supplied with 120 volt holding coils, HOA switching and space for the addition of auxiliary contacts. The Control Contractor shall provide all necessary normally open and normally closed contacts, wired to a terminal strip within the starter enclosure, required to achieve the specified control interlocking and sequencing. Manual starters for 120 volt equipment are to contain On-Off selector, external H.O.A., integral overload protection and pilot lights. The Controls Contractor shall provide control wiring interlocks from the control contacts provided on the automatic branch lines of the assembly, which will be contained within the associated Motor Control or Starter Assembly.
- .9 Refer to Division 26 Specifications and Motor Schedule for the scope of work to be provided by the Electrical Contractor. Division 25 shall supply and install all components, in addition to those outlined within the Division 26 documents, as may be deemed

necessary to provide all interlocks or sequences as called for elsewhere within the specifications. Include for the supply and installation of 2- 4 pair U.T.P. Level 5, plenum rated cables from the hub location to the communications backboard. Coordinate with Division 26 and the Owner for interconnection of the hub into the Telephone System services.

- .10 All power supplies for controls are this Contractor's responsibility unless otherwise specified in the Electrical Specifications. All control transformers to be located in fan rooms or mechanical rooms only and are to be mounted in serviceable locations.
- .11 Line voltage will not be run with signal or trunk wiring or be present in the same junction box.
- .12 All shielded wiring will be grounded at the BMS panels and prevented from grounding at the terminal end.
- .13 Run all wiring parallel to building lines. All wiring to be installed in a neat, workmanlike manner.
- .14 Support wiring independent of piping, ductwork, and equipment. Keep wiring clear of hot piping, ductwork/equipment.
- .15 Identify all junction boxes with control company label.
- .16 There are to be no splices in any of the control wiring except at devices or control panels.
- .17 LAN wiring shall be CAT5E UTP to TIA/EIA-568.

1.14 Identification, Calibration and Programming

- .1 Provide a written sequence of operation for each piece of equipment or system being controlled that does not require knowledge of DDC programming. Provide a print out of the complete data base, including program listings, inputs, outputs, controllers, virtual points, trend logs, alarm points, etc. Provide in an organized manner, separated for each panel.
 - .1 Procedures for daily operation of the system.
 - .2 Theory of operation of the equipment.
 - .3 Theory of operation of the control program.
- .2 Mount an input/output layout sheet within each controller. This sheet shall include the name of the points connected to each controller channel.
- .3 Identify all controllers and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:
 - .1 Point descriptor.
 - .2 Point type and channel number.
 - .3 Corresponding controller number.
- .4 Program each controller immediately following installation. Setup and tune all control loops during the initial startup of the systems. Submit a well documented print out of the controller program for review.
- .5 At the time of the Owner's Demonstration and Instruction Period:

- .1 Demonstrate and confirm that all systems are programmed and operating correctly. Submit trend logs, 1 week in duration, that confirm systems are operating as designed and follow the internal building loads in an energy efficient manner.
- .2 Submit CD's (including back-up diskettes) containing up to date copies of the programs in each controller.
- .3 Submit (4) CD's with printed PDF copies of the final programs that include all point definitions, weekly and annual schedule settings, controller set points and tuning parameters, and documented general control language programs. (As Built control shop drawings)
- .4 Provide the original software diskettes and the users manuals for all software programs provided as part of this contract. Provide one set of original disks for each notebook, laptop, and desktop computer the software has been installed on. The controls contractor shall be responsible for registering all software with the manufacturer in the owner's name. Provide copies of the registration of all software to the Departmental Representative as part of the final inspection.
- .6 Check sensor calibration and control system operation twice during the first year of operation including the first heating season and prior to the first cooling season. Include all parts and labour in service. Following each visit submit:
 - .1 A report indicating all work performed.
 - .2 Printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each controller.
 - .3 Update printed and diskette copies of any changes made to programs for any controller.
- .7 Provide one day of on-site instruction to the Owner's operating personnel during the first year of operation, scheduled as requested by the Owner, during one or more of the 2 visits.

1.15 Controller Software

- .1 Each stand alone control panel shall contain a complete software development system in each panel. The software development system shall consist of a menu driven, prompted programming language containing complete libraries of control algorithms for DDC, Energy Management, and Facilities Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application specific programming of each individual stand alone control panel.
- .2 Four user access levels shall be provided with a user access code available at each level. Each level shall permit identifiable multiple user access.
- .3 Point names shall be defined using a minimum of 128 alphanumeric characters to provide an English language description of the point function.
- .4 The stand alone control panel shall be capable of generating sorted alarm, trend log, energy management, maintenance time remainder, and exception log reports on a prioritized basis. Segregated report generation shall be invoked by manual request, time of day, calendar, accumulated run time, or event occurrence.
- .5 DDC Control:

- .1 The network of standalone control panels shall individually perform set point reset, ramping functions, 2-position ON/OFF control, PID loop control, linear sequencing, rotating sequencing, binary sequencing, HI/LO/AVE selection, energy dead band, and thermostat controls as required to control their connected systems of equipment.
- .6 Energy Management Control:
 - .1 The network of standalone control panels shall individually perform time of day scheduling, optimum start/stop, enthalpy optimization, trend logging, demand limiting and all control optimization strategies, such as supply air reset, and soft ramp-up, for their connected systems of equipment.
 - .2 Coordination of strategies involving multiple systems of equipment shall be performed by sharing of necessary data between the stand-alone control panels on the communicating network.
- .7 Facilities Management Control:
 - .1 The Owner shall be provided the ability to read out temperatures and other values and to adjust specific items from localized, as well as remote centralized location. Every controller shall provide the following reports:
 - .2 Facility Diagnostics
 - .1 The facilities management system shall provide diagnostic reports for selected systems of equipment as specified.
 - .3 Alarm Occurrence Status
 - .1 When specified alarm conditions occur, provide a report available to printout, listing the status of specific items associated with the equipment generating the alarm. Report shall be routed through auto dial out feature to a specific printer or combination of printers. Report shall record the time the status information was taken, and shall allow operational personnel to use this information to diagnose the alarm situation.
- .8 SAC and Micro Controller Trend Logs:
 - .1 Controllers shall be capable of storing up to twenty-five (25) full trend logs with a minimum of 200 data samples each. They shall be able to collect and store samples of the value of any system variable (i.e. temperature). The operator shall be able to create a trend log, with each trend log containing up to 4 points. The sample frequency shall be selectable for each trend log between 1 second and 24 hours. The ability to graphically display to 4 points on the screen simultaneously, print a log, or store a log on disk in an ASCII format that can be imported into a standard spreadsheet program shall be provided. This capability shall be provided for all forms of access.
- .9 Network communication/controllers Trend Logs:
 - .1 Trend logs shall be provided to collect and store samples of the value of a point i.e., temperature. The network communication/controllers shall have sufficient memory to create and store 200 full trend logs. Each trend log shall be capable of monitoring 1 I/O or virtual point from any controller or combination of controllers across the network, and storing a minimum of 2000 data samples for each trended point. The sample frequency shall be selectable for each trend log between 1 second and 24 hours. The network communication/controllers shall be capable of

archiving the trended data to the Host computer or dialing out to a remote trend computer and downloading the data automatically. The ability to indefinitely retain the contents of a trend log in the controller or automatically transfer the contents of a trend log to disk storage, printer or remote site and restart the log shall be provided.

- .10 Host Level Trending:
 - .1 Shall be provided to collect and store samples of the value of any system variable (i.e. temperature Trend Logs: Shall be provided to collect and store samples of the value of any system variable. The operator shall be able to create a trend log, with each trend log containing 1 point. The sample frequency shall be selectable for each trend log between 1 second and 99 hours. The ability to link multiple single point trend logs to be displayed on a 8 point Multi-trend log for comparative analysis shall be provided. Ability to print a log, or store a log on disk in an ASCII format that can be imported into a standard spreadsheet program shall be provided. This capability shall be provided for all forms of access.
- .11 The Ethernet interface with the remote operator's terminal shall provide all features listed above.

1.16 Computer Graphics Software

- .1 Incorporate the following standards for the required host capabilities and installed features:
 - .1 The host computer operator interface, network interface and graphical interface software shall be Microsoft Windows based.
 - .2 Provide one licensed copy of the complete HOST software package complete with operating manuals, installation manuals, setup manuals, programming manuals, and original diskettes.
 - .3 Host operator interface.
- .2 The following functionality shall be available to the operator from either the onsite host, remote host, or colour laptop connected to anywhere on the network inside the building. These workstations shall operate as graphic interface devices. Attention must be paid to developing an interface to the system using a minimum of user keystrokes. The primary user interface must be the mouse.

Provide functionality such that any of the following may be performed simultaneously, at either workstation and in any combination, via user-sized windows.

 - .1 Dynamic color graphics and graphic control
 - .2 Alarm management and control
 - .3 Time of day scheduling
 - .4 Trend data definition and presentation
 - .5 Graphic definition
 - .6 Graphic construction
 - .7 Database functions
- .3 Graphic generation and design:

- .1 Provide a default graphic consisting of a visual overview of the entire control system. The display shall be in a tree format. Indicate the various branches of graphic access available from the tree for each mechanical system and building zone. The site plan of the facility should be used as a reference tree to show the relationship of each system to a particular building zone. Graphic links for each zone must be available to allow the user to link directly to the desired graphic or step systematically forward or backward through the tree to each graphic associated with the mechanical system. The operator must be able to return directly to the default from any level of graphic menu penetration.
- .2 As a minimum, provide the following graphic screens and dynamic linking:
 - .1 A default graphic to be used as a central starting point for penetrating the menu of available graphic screens.
 - .2 Zone summary graphic. Dynamically indicate zone high select (Hsel) and low select (Lsel) temperatures, AHU supply air temperatures and setpoints, and status of the air handling units serving the zone.
 - .3 Dynamic graphic floor plans for each building zone, scaled appropriately to be readable from a laptop. Indicate room temperatures, architectural room number, control valve position, supply fan system serving the area, and any associated equipment such as exhaust fans, fume hoods, etc. From this screen the operator shall be able to command the control valve, adjust the room setpoint, access the graphic screen for the supply fan system, view a trend log of the room temperature, or access a graphic for associated mechanical equipment.
 - .4 A schematic of each mechanical system. As a minimum, each graphic will indicate all DDC I/O points and software variables associated with each system. Indicate the DDC point names, current status value, and operator priority.

All graphic screens shall be created using the same software supplied to the owner. Provide the graphic data files in a format suitable for inclusion into the graphical operator interface and for direct loading into the graphic editor. The graphic data files shall be the sole property of the Owner.

DEFAULT GRAPHIC COLOURS			
Normal On	GREEN	Text Arial 12 pt	BLACK
Heating Equipment	RED	Normal Off	BLACK
Background	WHITE	Cooling Equipment	BLUE
Ducts	BLACK	ALARM	RED
Sensors	BLUE		

- .4 Graphical links:
 - .1 All system graphical links will be located in the upper left corner of the screen. These links will be displayed in sequential order representative of the menu tree.

PART 2 PRODUCTS

2.1 Not Used

PART 3 EXECUTION

3.1 General

- .1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats and temperature sensors 1.5m above floor. For existing installations, locate thermostats and temperature sensors at same locations as existing but not less than 1.5m above floor.
- .2 Install damper motors on outside of ducts. Do not locate in outside air stream.
- .3 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.
- .4 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.
- .5 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- .6 Equipment shall be installed in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation.
- .7 Permanently identify each wire, cable, conduit and tube at each terminal.
- .8 Wiring and tubing shall be identified at each DDC panel by termination number. Wiring and tubing shall be identified at terminal device by termination and DDC panel numbers.
- .9 All transmitters, interfaces, terminations and control relays, etc. shall be mounted in field cabinets that may be locked.
- .10 Freeze protection devices shall be hard wired and also wired to alarm through DDC system.
- .11 All wall mounted devices in new finished space shall be mounted on a wall box. The wall box shall be connected to the ceiling space by a conduit stub. On renovations, when sensors are mounted in existing finished walls, wiring or tubing may be fished into the walls without conduit.
- .12 Provide tamperproof screws to new and relocated equipment, controls enclosures and devices which are located in inmate accessible areas. Tamperproof screws shall be stainless TORX with pin.

3.2 Enclosure and Conduit

- .1 Relays, transformers, and I/O devices and peripherals shall be installed in separate enclosures and not in the enclosures containing the controllers.
- .2 All wires penetrating the enclosure that are not required to be in conduit must be neatly bundled and strapped in place.

- .3 All Building Controllers will be installed in CSA rated enclosures that are complete with hinged and key-locked doors. The door will be painted and labeled suitably bearing the manufacturer's system name/logos, the controller address, and the installing contractor's contact information. This enclosure will be mounted at a height that provides easy access without the need of a ladder.
- .4 A hard points list shall be affixed on the inside of the door/cover of the enclosure.
- .5 The inside bottom of the enclosure shall be clean of dirt, metal shavings, and debris.
- .6 Wiring is to be in EMT conduit with set screw metal fittings in all wall spaces and exposed locations as well as in pipe chases, service spaces, attics, and crawl spaces which are entered for service access. Wiring in suspended ceiling spaces does not require conduit but shall be neatly installed parallel to building lines using bridle rings. All conduits shall be piped smoothly and neatly following building lines. Wiring above existing ceilings and wall cavities may be run free-air.
- .7 Exposed conduits located in areas where inmates have access to shall comply with the following security measures:
 - .1 Use two-hole straps.
 - .2 Install straps within 100mm of device boxes.
 - .3 Install straps within 100mm of both sides of fittings.
 - .4 Install straps at a maximum spacing of 500mm.
 - .5 All fittings steel.
 - .6 Keep conduit close to the wall and avoid spaces behind the conduit.
 - .7 Route conduit along top of walls where possible.
- .8 Liquid-tight flexible conduit to be used for rooftop unit wiring c/w liquid-tight fittings. Provide spun aluminum roof jack where control wiring penetrates roof unless penetration is within waterproof rooftop unit curb.
- .9 All junction boxes will have covers properly and firmly affixed after installation completion.

3.3 I/O Wiring

- .1 All input/output device wiring will use #18-2 solid core cable with individually jacketed conductors and jacketed sheath over the pair.
- .2 Use plenum cable where required.
- .3 All I/O wiring passing near or within the enclosure of a VFD will be shielded, with the shield terminated at the device end.
- .4 All I/O wiring will be identified using Panduit adhesive wire-marker at the controller and end device ends. Description of point to include point mnemonic, point type and network location.
- .5 All I/O wiring within controller enclosure shall be neat and tidy and suitably bundled and strapped or contained in plastic wire duct or equivalent.
- .6 All I/O wiring that requires a transition to a different conductor to meet electrical code requirement shall be executed using a terminal strip.

- .7 Low voltage I/O wiring may be mixed together within a conduit. Low and line voltages may not be mixed together within a conduit.

3.4 Power Wiring

- .1 Provide power wiring and transformers and grounding to each controller and transducer as per the manufacturer's specification.
- .2 Each Building Controller will have its own dedicated power supply. No other controller or I/O device will be powered from this supply.
- .3 Power wiring shall not be mixed with I/O wiring in a conduit.

3.5 Control System Commissioning

- .1 Upon completion of the installation of the controls system and the calibration of all sensors, this Subcontractor shall carry out all required testing, debugging, and revision of operations to suit the intent of the Sequence of Operation and to the review of the Departmental Representative.
- .2 The contractor is to supply digital point and non digital checkout data sheets for all controlled components installed in this contract, including components supplied by others. The data sheets shall indicate each components physical installation is complete, End to End, identification, tagged, the result of the functional test, calibration deviation recorded, set points and set-up of each device, digital and non digital.
- .3 Each digital input or control device shall be checked by physical operation of the monitored device in the field with the result noted. Each digital output or controlled device shall be commanded or tested On/Off, Open/Close as required and the corresponding field device checked for correct operation with the result and comments noted.
- .4 Each analog input or control device shall have its field values measured with a calibrated test instrument, with the deviation recorded and adjusted, if necessary, at the AI set up. The field measurement and analog point deviation must be reported. A hard copy of the set up for each digital and non digital controller with adjustments is required. Field set up and set points of other devices shall be reported.
- .5 Each analog output, control or controlled device shall be field tested. The physical test data sheet is to indicate each controlled device function through its range 0, 25, 50, 75, 100% and 1 to 100% as required with no leakage or bypass of the controlled medium.
- .6 Submit copies of all test data sheets intended to be used to the Departmental Representative and Commissioning Authority prior to the contractor's verification at least three months before the scheduled substantial completion of the project.
- .7 The controls contractor shall provide sequence of operation check sheets, to the Departmental Representative, Commissioning Agent and Commissioning Authority, in standard letter size for each DDC and non DDC system sequence. Each sequence to be verified with each item/page signed off with comments noted.
- .8 The commissioning contractor is not to commence controls checks until the above documentation is received. The Temperature Control Supplier and Installer shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Control Supplier in good working order at the completion of the commissioning process,

or the Commissioning Agent must reimburse the Temperature Control Supplier for the purchase price of the material.

- .9 All documentation, tagging, identification, as-builts, software, instruction manuals, special control connection to access all devices and panels must be in place before the granting of substantial performance.
- .10 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Controls Contractor for the purchase price of the material. The Temperature Control Supplier shall cooperate fully with the Commissioning Agent to work together to obtain a fully operating system, providing additional technicians and trades people to assist the designated commissioning person as required. Refer to Section 01 91 00 – Commissioning.
- .11 The controls contractor is to provide the technicians for field checks, calibration, checkouts, and commissioning necessary for a complete and fully operational system. Provide two 2-way portable radios for the commissioning period.

3.6 Cleaning

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 25 05 01 EMCS: General Requirements

1.2 References

- .1 Canadian Standards Association (CSA)
 - .1 C22.2 No.205-12, Signal Equipment.
- .2 Institute of Electrical and Electronics Engineers
 - .1 IEEE C37.90.1-2002, Standard Surge Withstand Capabilities (SWC) Test for Protective Relays and Relays Systems.

1.3 Maintenance Procedures

- .1 Provide manufacturers recommended maintenance procedures for insertion in Section 01 01 50 – General Instructions, and 25 05 01 – EMCS: General Requirements.

1.4 Submittals

- .1 In accordance with Section 01 01 50 – General Instructions, and Section 25 05 01 – EMCS: General Requirements. Submit product data sheets for each product item proposed for this project.

PART 2 PRODUCTS

2.1 System Descriptions

- .1 Provide a fully networked system of controllers which use LAN communications to support the distributed control features as specified herein. Each controller shall be connected directly to the LAN. Each controller shall have equal LAN access priority and shall NOT REQUIRE A SEPARATE GATEWAY or interface controller to accomplish normal, network communications.
- .2 Provide a means to ensure communication integrity. At a minimum indicate for each controller in system: on-line/off-line status, residence of program or no program, the scan rate (frequency at which the controller updates all I/O and runs all programs), the number of network points imported and exported.
- .3 The system will display an error message, in the event of a communication error.
- .4 To prevent damage to the system, each connection to the LAN shall be provided with a means of isolation, either optically or fast-blow fuse or by some other means.
- .5 Upon failure of the LAN to communicate information, each controller will retain the last legitimate value of its imported network points, and continue to control the systems based on those values. Failure of any controller, or any part of a controller on the LAN, shall not affect the ability of the LAN to communicate among the remaining controllers.

- .6 Each hard point and soft point shall have a user-definable, unique, system-wide logical point mnemonic. The format of the point mnemonic shall conform to the naming convention of the incumbent system.

2.2 Memory

- .1 Each controller shall have enough random access memory for all of the following:
 - .1 Variables - ONE (1) for each hard point connected to the controller.
 - .2 PID Controllers - TWO (2) for each analogue output point connected to the controller.
 - .3 Weekly Schedules - ONE (1) for every major system connected to the controller.
 - .4 Annual Schedule - ONE (1) for the entire LAN.
 - .5 Trend Logs - ONE (1) for each pair of hard points connected to the controller with 100 samples each.
 - .6 Runtime Logs - ONE (1) for each digital hard and soft point.
 - .7 Programs - ONE (1) for each output point connected to the controller. Each program must contain enough memory for TWENTY (20) syntactically correct lines of OCL with at least four operators.

2.3 Processing Speed

- .1 Scan Rate - The maximum permissible scan rate is ONE (1) second. The scan rate is defined as the time it takes to controller CPU to sample all inputs, calculate all variables, update all timers and PID controllers, check all schedules, update all trend logs and runtime logs execute all OCL programs and assign values to all outputs.

2.4 Field Panels

- .1 Provide local panels of unitized cabinet type for relays/devices. Mount relays, switches, transducers and controllers with set point adjustment in cabinet and pilot lights, push buttons, and switches flush on cabinet panel face.
- .2 Fabricate panels from 3.0 mm furniture steel with baked enamel finish and removable hinged key lock door.
- .3 Mount panels adjacent to associated equipment on vibration free walls or free standing angle iron supports.
- .4 Field panels are not to be located in ceiling spaces.
- .5 All main panels are to be located in Mechanical/Fan Rooms only.
- .6 All panels serving microzone controllers (reheat/radiation) should be located in fully recessed panels located in mechanical rooms, fan rooms, storage rooms or janitors' rooms. The panel locations are to be approved by the consultant during the shop drawing stage.
- .7 All field panels shall be labeled with lamacoid labels.

PART 3 EXECUTION

3.1 General

- .1 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.
- .2 All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Anti-vibration mounts to be provided, if required, for the proper isolation of the equipment.
- .3 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- .4 Equipment shall be installed in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation.
- .5 System Expansion: Provide five spare input and five spare output points in each Mechanical Room for future expansion and renovations. In addition, further expansion of the system shall be possible by simply adding more controllers to the network. The system shall be expandable to a maximum capacity in excess of 2500 points with out making any of the original equipment redundant. The central control console shall directly support a minimum of 99 stand alone controllers.
- .6 The DDC panel points shall be defined such that the primary input sensor for a PID loop resides on the same panel as the output.
- .7 Application specific controllers shall only be used where specified.
- .8 Controller Memory: The non-volatile ROM, EPROM, EEPROM memory will, as a minimum, support all performance and technical specifications, communications, operating system, executive, application subroutines, etc. and other configuration description software. Tape or disk media systems are not acceptable. All control algorithms, application functions, and operating data or software shall reside in EEPROM. or battery backed RAM. That is, data or control program (such as I/O point characteristics, schedules, set points, alarm limits, and control sequences) must remain in EEPROM and/or RAM and hence modifiable on-line through an operators terminal connected to any panel on the system. RAM must include battery or other backup for a minimum of 72 hours to eliminate operating data reload in case of power failure.
- .9 Controller Diagnostics: Control panel diagnostics, for both the primary controller and the micro-controllers, shall consist of built-in, continuous operational and board level tests, software control sequence analysis and alarm exception logging. Light emitting diodes and/or the alphanumeric display shall annunciate hardware failures, and control program errors or problems.
- .10 All micro-controllers and central communications controllers shall be located in Mechanical rooms, Electrical rooms or Janitor rooms. Locations elsewhere shall be subject to Engineer's prior approval.
- .11 Application specific controllers shall have a minimum of one spare universal input and one spare universal output point for future connections. Point expander cards are not to be used in the original installation.
- .12 All controllers shall contain ports to interface to a Personal Computer. This access port shall provide full capabilities including programming.

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- .13 The control system shall operate independently from the Host Computer Workstation. All control, inter-panel communications and data collection functions shall continue to operate when the Host Computer Workstation is taken off line.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 01 50 General Instructions
- .2 Section 25 05 01 EMCS: General Requirements

1.2 References

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C12.7-1993, Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13-1978(R1987), Requirements for Instrument Transformers.
- .2 National Electrical Manufacturer's Association (NEMA)

1.3 Submittals

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 01 50 – General Instructions and Section 25 05 01 – EMCS: General Requirements.
- .2 Include:
 - .1 Information as specified for each device.
 - .2 Manufacturer's detailed installation instructions.
- .3 Pre-Installation Tests
 - .1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.
- .4 Manufacturer's Instructions
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 Closeout Submittals

- .1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 01 01 50 – General Instructions and Section 25 05 01 – EMCS: General Requirements.

PART 2 PRODUCTS

2.1 General

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.
- .3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.

- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters to be unaffected by external transmitters (e.g. walkie talkies).
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in NEMA 3R enclosures.
- .8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 Current Sensors (CT)

- .1 Shall vary the output voltage with a change in current.
- .2 Provide actual analog current indication for status of all motors 1 horsepower and larger.
- .3 In software provide multiple switch points to determine both motor status and belt breakage. Size for inrush and F.L.A.
- .4 Provide alarm indication for high and low current.
- .5 Provide digital current indication for all motors 3/4 HP and smaller by using current switches (CS) which shall open or close a contact from motor induced current to indicate motor status.
- .4 Temperature operating range: -20°F to 160°F
- .5 Power supply: 24VAC
- .6 Output: analog, RS-485 and Ethernet (BACnet Ethernet, TCP/IP)

2.3 Combination Relay, HOA and Current Sensor (CR-HOA)

- .1 Enclosed relay, current sensor, SPST and built in HOA for manual control. Designed for fractional HP motors (up to 1 HP at 120/1/60).
- .2 Relay type: One (1) SPST.
- .3 Relay status: LED with
- .4 Current sensor range: adjustable set point;
- .5 Current sensor range: 0-10 Amps
- .6 Current sensor output: 0-5 VDC, 0-10 VDC.

PART 3 EXECUTION

3.1 General

- .1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats and temperature sensors 1.5m above floor.
- .2 Install damper motors on outside of ducts. Do not locate in outside air stream.

- .3 The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances.
- .4 Equipment shall be installed so as to allow for easy maintenance access. Equipment shall be installed such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.
- .5 All transmitters, interfaces, terminations and control relays, etc. shall be mounted in field cabinets that may be locked.
- .6 Freeze protection devices shall be hard wired and also wired to alarm through DDC system.
- .7 All wall mounted devices in new finished space shall be mounted on a wall box. The wall box shall be connected to the ceiling space by a conduit stub. On renovations, when sensors are mounted in existing finished walls, wiring or tubing may be fished into the walls without conduit.
- .8 Provide tamperproof screws to new and relocated equipment, controls enclosures and devices which are located in inmate accessible areas. Tamperproof screws shall be stainless TORX with pin.

3.2 Sensors

- .1 Sensors provided shall be installed in accordance with the Manufacturer's prescribed procedures.
- .2 Sensors shall be rigidly mounted and mountings shall be adequate for the environment within which the sensor operates.

3.3 Combination Relay, HOA and Current Sensor (CR-HOA)

- .1 Combination Relay, HOA and Current Sensor may be used for equipment up to 3/4 horsepower where starters are not provided under Division 26.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 25 05 01

EMCS: General Requirements

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 Sequence of Operation

- .1 Exhaust Fans (typical for all 5 Living Units):
- .1 Existing EF-1 and EF-2 are controlled (started/stopped/monitored) at the DDC, and the controls shall be retained for the new fans.
 - .2 EF-3 and EF-4 shall be started, stopped and monitored at the DDC (note: they are currently not on DDC). Fans shall operate on the same schedule as existing EF-1/EF-2.
 - .3 EF-1, EF-2, EF-3 and EF-4 are supplied with EC motors and constant pressure control package; refer to fan schedule and shop drawings. Provide all field wiring and install per manufacturer's instruction. Install probe in duct (at fan inlet) to maintain static pressure. Coordinate with balancing contractor to set up static pressure set point.

3.2 Point List

- .1 The following point lists are typical of the Analog and Digital output and input points required to achieve the intended sequence of operation and provide the required level of monitoring and control. They are intended to set a minimum level of acceptability. All additional points required to achieve the specified features and sequence of operation shall be provided by the control contractor.

.2

EXHAUST FANS							
POINT DESCRIPTION	POINTS				ALARM/INDICATION		
	AI	AO	DI	DO	HI	LO	FAIL
EXH. FANS (EF-3, EF-4; TYPICAL) START/STOP/STAT	CT			CR			X

NOTE: POINT COUNT IS APPROXIMATE. CONTROLS CONTRACTOR SHALL VERIFY EXACT QUANTITY AND PROVIDE ADDITIONAL POINTS AS REQUIRED TO ACHIEVE THE SEQUENCE OF OPERATION DESCRIBED IN THE CONTRACT DOCUMENT.

CR Digital Relay
CT Analog Current transformer

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 This section covers items common to all Electrical sections and is intended to supplement the requirements of Division 01.
 - .2 Scope of electrical work includes but is not limited to:
 - .1 Removal of existing fan disconnect switches and installation of new fan disconnect switches supplied by Division 23.
 - .2 Disconnecting existing fan wiring and reconnecting new fans.
 - .3 Re-use existing fan circuits.
 - .4 Extending power wiring to new fans.
 - .5 Extending power wiring to new contactors supplied by Division 23.
 - .6 Coordinating work with Division 23.
 - .7 Other related electrical work as required for the fan circuits.
 - .3 Reference to "Electrical Divisions" shall mean all related Electrical Sections and components including Divisions 26, 27, and 28.
 - .4 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. This applies to the entire Contract.
 - .5 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, establishing orderly completion and the delivery of a fully commissioned installation.
 - .6 The most stringent requirements of this, other electrical Sections and Division 01 shall govern.
 - .7 All work shall be in accordance with the Project Drawings and Specifications and their intents, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
 - .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up, test and
-

commission. Include all field assembly of loosely/separately packaged accessories.

- .9 Obtain and pay for an electrical permit. Provide electronic copy to Departmental Representative.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-2015 Canadian Electrical Code, Part 1

1.03 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 01 50 – General Instructions.
- .2 Shop drawings:
 - .1 Submit drawings as specified in other Sections.
- .3 Quality Control:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.05 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 01 50 – General Instructions.
 - .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices.
-

- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.06 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 01 50 – General Instructions.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

2.02 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.03 EQUIPMENT IDENTIFICATION

- .1 Identify equipment with lamicaid nameplates.
- 2. Wording on nameplates to be approved by Departmental Representative prior to manufacture.

2.04 WIRING IDENTIFICATION

- .1 Identify cabling with permanent indelible identifying labels.
-

3 EXECUTION

3.01 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.02 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.03 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

3.04 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

1 GENERAL

1.01 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 01 50.

2 PRODUCTS

2.01 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE. .

3 EXECUTION

3.01 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.

3.02 GENERAL CABLE INSTALLATION

- .1 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .2 Conductor length for parallel feeders to be identical.
- .3 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

3.03 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

END OF SECTION

1 General

1.1 REFERENCES

- .1 CSA C22.1-2015 Canadian Electrical Code.
- .2 This Section covers items common to Section of Division 26, 27 and 28.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 01 50 - Submittal Procedures.

2 Products

2.1 EQUIPMENT (GENERAL)

- .1 Clamps for grounding of conductor, size as required.
- .2 Insulated grounding conductors: green, type RW90.
- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous, telecommunications, equipment, grounding systems including, ground bars, conductors, connectors, accessories, as indicated, to conform to requirements of departmental representative, and local authority having jurisdiction over installation.
 - .2 Install connectors in accordance with manufacturer's instructions.
 - .3 Protect exposed grounding conductors from mechanical injury.
 - .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
 - .5 Soldered joints not permitted.
-

- .6 Use high-pressure compression type connectors where indicated.
- .7 Provide a green insulated bond conductor in all conduits and ducts.
- .8 Ground all new raceways.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to transformers, panels, distribution panels, raceways, telecommunications and security systems.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of departmental representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing equipment.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18.1-13, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.

2 PRODUCTS

2.01 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.02 CONDUIT FASTENINGS

- .1 Two hole steel straps to secure surface conduits.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.03 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
 - .2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.
 - .3 Steel EMT fittings.
-

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in
 - .1 mechanical and electrical service rooms
 - .2 unfinished spaces such as bare concrete walls
- .3 Use electrical metallic tubing (EMT) except in cast concrete. Use flexible metal conduit for final 600mm connections to motors.
- .4 Minimum conduit size 21 mm.
- .5 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .6 Mechanically bend steel conduit over 19 mm diameter.
- .7 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .8 Dry conduits out before installing wire.

3.03 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
 - .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
 - .3 Run conduits in flanged portion of structural steel.
 - .4 Group conduits wherever possible on surface channels.
 - .5 Do not pass conduits through structural members except as indicated.
 - .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
-

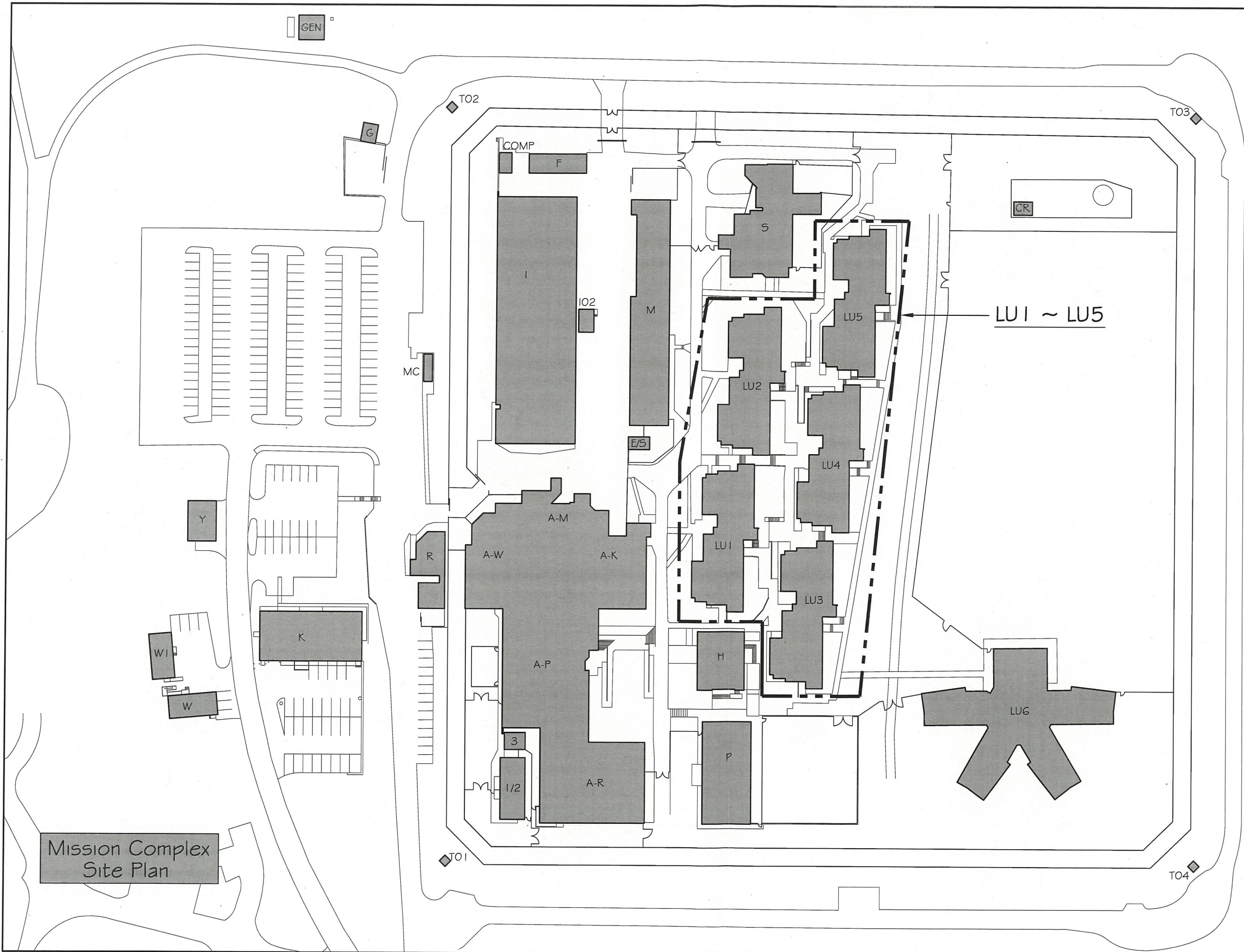
3.04 CLEANING

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

END OF SECTION

APPENDIX A

LINE DRAWINGS



Mission Complex
Site Plan



Real Property Line Drawings

Region:

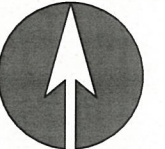
Pacific

Institution:

Mission Medium

BUILDING INDEX

#	Name	Area m ²
A	ADMINISTRATION BLDG	3954.1
LU1	LIVING UNIT 1	694.7
LU2	LIVING UNIT 2	694.7
LU3	LIVING UNIT 3	694.7
LU4	LIVING UNIT 4	694.7
LU5	LIVING UNIT 5	694.7
LU6	96 BED LIVING UNIT	1448.9
S	HEALTH CARE / SEGREGATION	676.6
I	INDUSTRIES	2028.3
M	MAINTENANCE	866.8
R	PRINCIPAL ENTRANCE	210.3
1-2	P.F.V. 1 & 2	158.5
3	P.F.V. 3	36.8
GEN	GENERATOR BLDG	65.2
COMP	COMPRESSOR BLDG	26.5
TO1	TOWER 1	6.7
TO2	TOWER 2	6.7
TO3	TOWER 3	6.7
TO4	TOWER 4	6.7
E-S	ELECTRICAL / STORAGE	28.6
H	JENSEN CENTRE	287.9
IO2	CORCAN OFFICE	36.4
F	GROUNDS STORAGE	114.2
Y	STORAGE SHED	118.5
W	PUBLIC WORKS OFFICE	114.8
W1	ADGA OFFICE / BOARD ROOM	106.3
G	OUTSIDE GROUNDS	29.8
CR	ABORIGINAL CHANGE ROOM BLDG	26.0
MC	MOTORCYCLE SHELTER	25.0
K	MULTI-PURPOSE BLDG	525.1
P	PROGRAMS BLDG	525.1
Total Area		13860



Scale:
1:1200

Issue Date:
30-09-2015



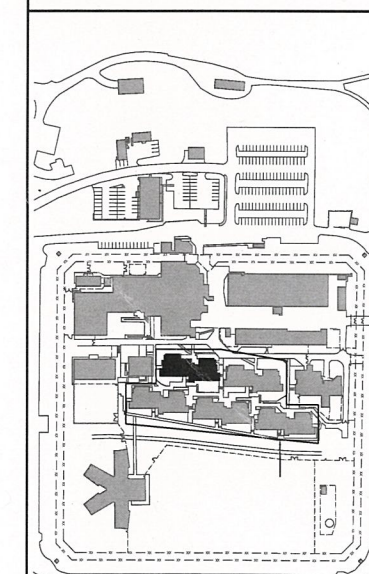
Real Property Line Drawings

Region:

Pacific

Institution:

Mission Medium
Institution



Building Number:
LU1

Building Name:
Douglas Living Unit

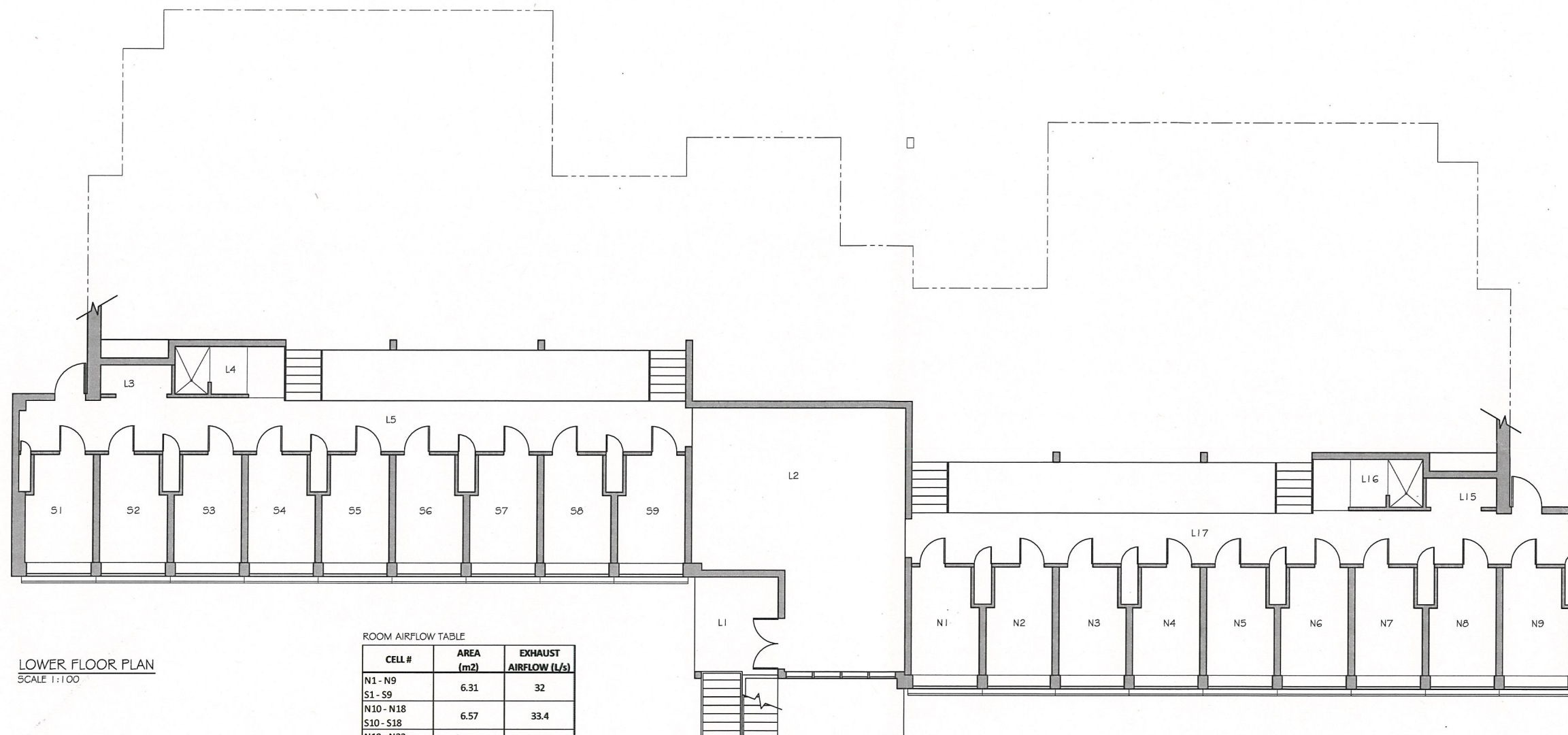
Floor:
Main Level

Area m²:
284.37

Scale:
N.T.S.

Tag Number:
849-09

Issue Date:
30-09-2015

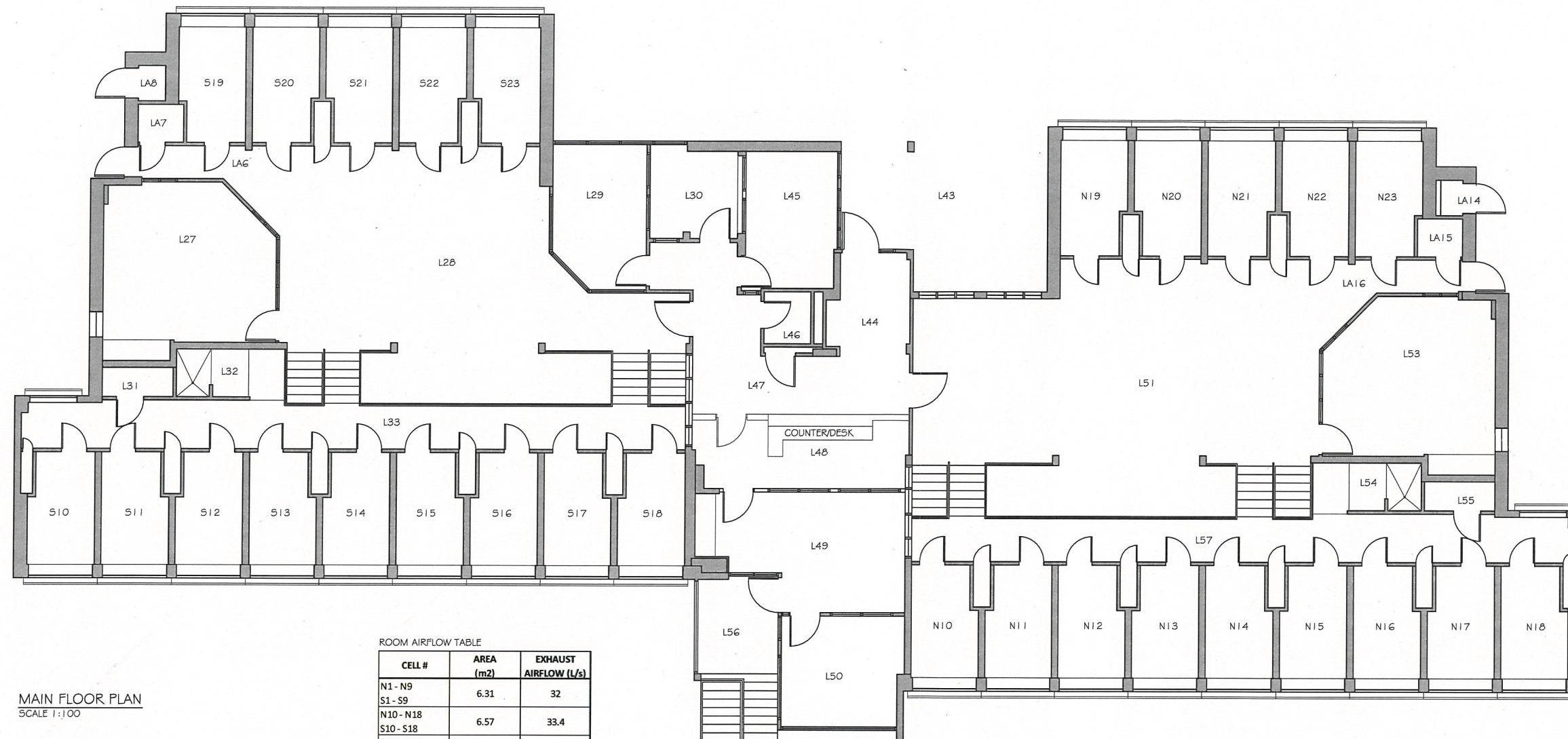


LOWER FLOOR PLAN
SCALE 1:100

ROOM AIRFLOW TABLE

CELL #	AREA (m2)	EXHAUST AIRFLOW (L/s)
N1 - N9 S1 - S9	6.31	32
N10 - N18 S10 - S18	6.57	33.4
N19 - N23 S19 - S23	6.76	34.3

Unit LU1			S8	Cell	7.93
Douglas Living Unit - Lower Level			S9	Cell	7.93
Rm. #	Name	Area m ²	L15	Laundry	2.94
L1	Covered Entry		L16	Shower	5.86
L2	Mechanical Room	48.04	L17	Corridor	37.22
L3	Laundry	2.94	N1	Cell	7.93
L4	Shower	5.86	N2	Cell	7.93
L5	Corridor	37.22	N3	Cell	7.93
S1	Cell	8.69	N4	Cell	7.93
S2	Cell	7.93	N5	Cell	7.93
S3	Cell	7.93	N6	Cell	7.93
S4	Cell	7.93	N7	Cell	7.93
S5	Cell	7.93	N8	Cell	7.93
S6	Cell	7.93	N9	Cell	8.69
S7	Cell	7.93			



MAIN FLOOR PLAN
SCALE 1:100

ROOM AIRFLOW TABLE

CELL #	AREA (m2)	EXHAUST AIRFLOW (L/s)
N1 - N9 S1 - S9	6.31	32
N10 - N18 S10 - S18	6.57	33.4
N19 - N23 S19 - S23	6.76	34.3

Unit LU1			L47	Electrical Room	21.93	S20	Cell	8.40
Douglas Living Unit - Upper Level			L48	Open Control Post	15.19	S21	Cell	8.40
Rm. #	Name	Area m ²	L49	Clerk Office	22.25	S22	Cell	8.40
LA6	Corridor	15.91	L50	U M Office	13.89	S23	Cell	9.60
LA7	Storage	2.27	L51	North Lobby	84.64	N10	Cell	8.02
LA8	Mechanical	2.48	L53	N. Common Room	28.41	N11	Cell	8.21
LA14	Mechanical	2.48	L54	Shower	5.45	N12	Cell	8.21
LA15	Storage	2.27	L55	Janitor	2.68	N13	Cell	8.21
LA16	Corridor	15.91	L56	Balcony Exit		N14	Cell	8.21
L27	S. Common Room	28.42	L57	Corridor	34.61	N15	Cell	8.21
L28	South Lobby	71.56	S10	Cell	8.97	N16	Cell	8.21
L29	IPO Office	12.62	S11	Cell	8.21	N17	Cell	8.21
L30	Interview Room	8.45	S12	Cell	8.21	N18	Cell	8.97
L31	Janitor	2.68	S13	Cell	8.21	N19	Cell	9.60
L32	Shower	5.45	S14	Cell	8.21	N20	Cell	8.40
L33	Corridor	34.68	S15	Cell	8.21	N21	Cell	8.40
L43	Covered Entry		S16	Cell	8.21	N22	Cell	8.40
L44	Main Lobby	7.67	S17	Cell	8.21	N23	Cell	8.63
L45	IPO Office	13.60	S18	Cell	8.21			
L46	Staff Washroom	3.16	S19	Cell	8.63			



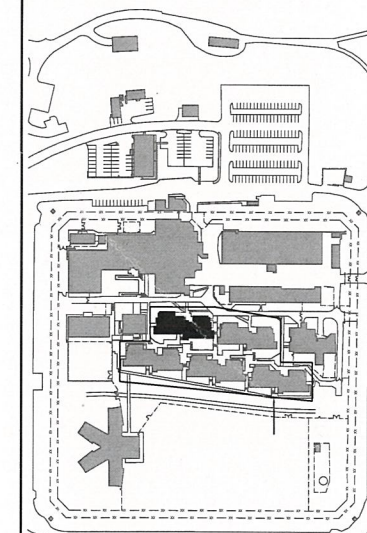
Real Property Line Drawings

Region:

Pacific

Institution:

Mission Medium
Institution



Building Number:
LU1

Building Name:
Douglas Living Unit

Floor:
Main Level

Area m²:
694.72

Tag Number:
849-09

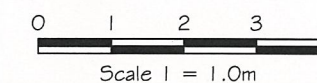
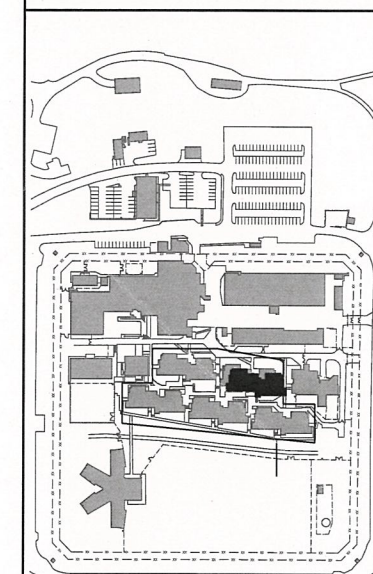
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Issue Date:
30-09-2015

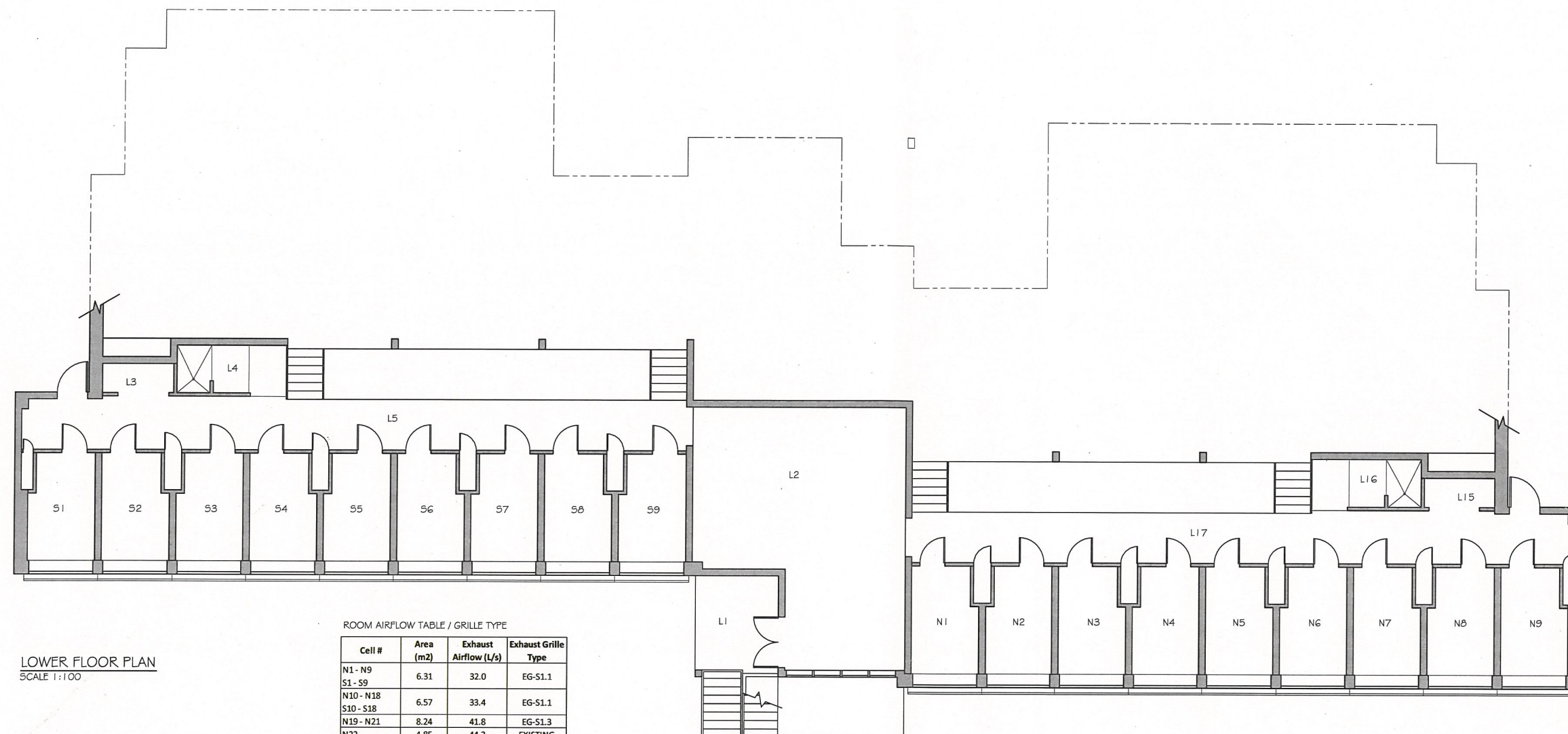


Real Property
Line Drawings

Region:
Pacific
Institution:
Mission Medium
Institution



Building Number:
LU2
Building Name:
Oak Living Unit
Floor:
Main Level
Area m²:
284.37
Scale:
1 : 100
Tag Number:
849-08
Issue Date:
30-09-2015

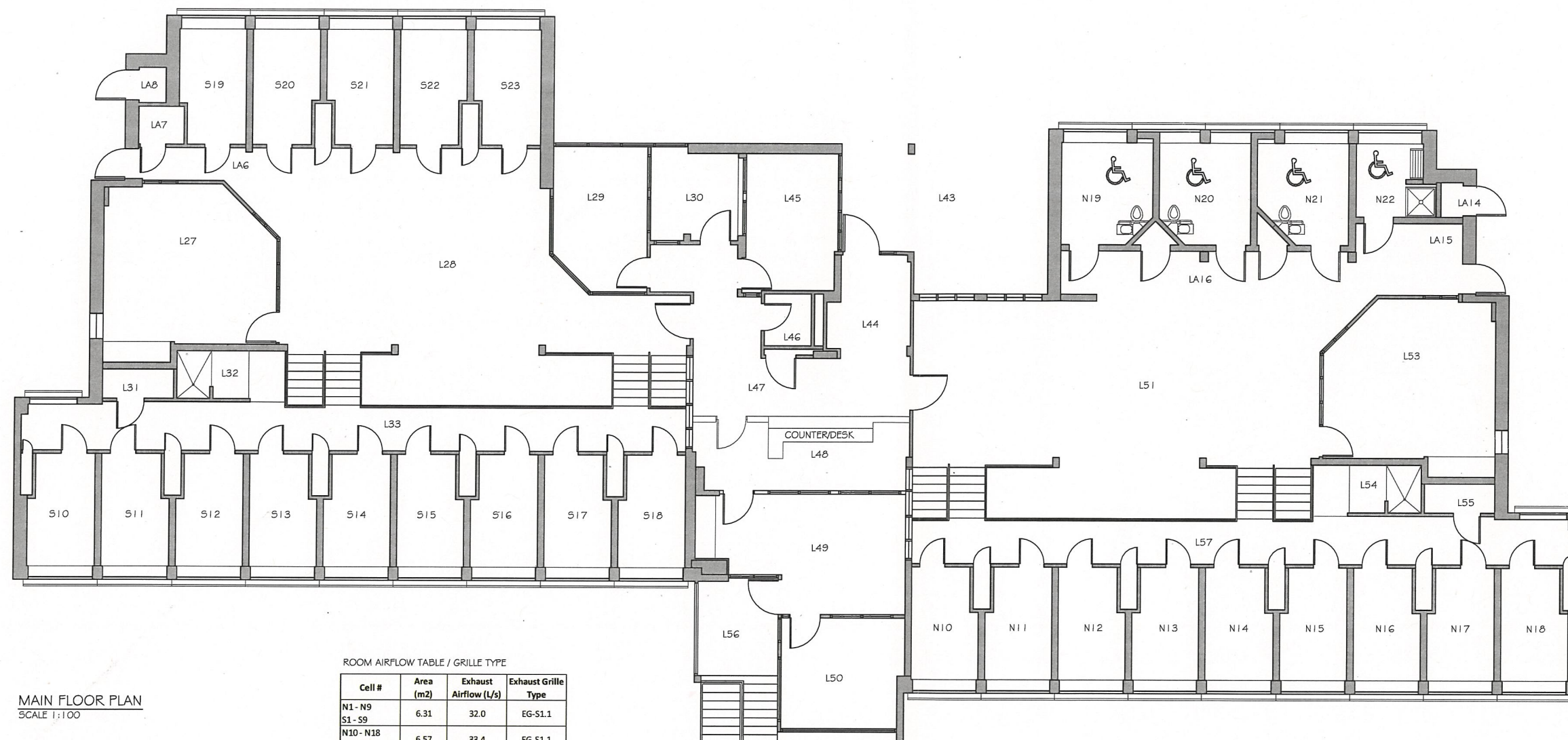


ROOM AIRFLOW TABLE / GRILLE TYPE

Cell #	Area (m ²)	Exhaust Airflow (L/s)	Exhaust Grille Type
N1 - N9	6.31	32.0	EG-S1.1
S1 - S9	6.57	33.4	EG-S1.1
N10 - N18	8.24	41.8	EG-S1.3
S10 - S18	4.85	44.3	EXISTING
N19 - N21	6.76	34.3	EG-S1.2
N22			
S19 - S23			

LOWER FLOOR PLAN
SCALE 1:100

Unit LU2			S8	Cell	7.93
Oak Living Unit - Lower Level			S9	Cell	7.93
Rm. #	Name	Area m ²	L15	Laundry	2.94
L1	Covered Entry		L16	Shower	5.86
L2	Mechanical Room	48.04	L17	Corridor	37.22
L3	Laundry	2.94	N1	Cell	7.93
L4	Shower	5.86	N2	Cell	7.93
L5	Corridor	37.22	N3	Cell	7.93
S1	Cell	8.69	N4	Cell	7.93
S2	Cell	7.93	N5	Cell	7.93
S3	Cell	7.93	N6	Cell	7.93
S4	Cell	7.93	N7	Cell	7.93
S5	Cell	7.93	N8	Cell	7.93
S6	Cell	7.93	N9	Cell	8.69
S7	Cell	7.93			



MAIN FLOOR PLAN
SCALE 1:100

ROOM AIRFLOW TABLE / GRILLE TYPE

Cell #	Area (m ²)	Exhaust Airflow (L/s)	Exhaust Grille Type
N1 - N9 S1 - S9	6.31	32.0	EG-S1.1
N10 - N18 S10 - S18	6.57	33.4	EG-S1.1
N19 - N21	8.24	41.8	EG-S1.3
N22	4.85	44.3	EXISTING
S10 - S12	6.76	34.3	EG-S1.2

Unit LU2								
Oak Living Unit - Upper Level								
Rm. #	Name	Area m ²						
LA6	Corridor	15.91	L46	Staff Washroom	3.16	S18	Cell	8.21
LA7	Storage	2.27	L47	Electrical Room	21.93	S19	Cell	8.63
LA8	Mechanical	2.48	L48	Open Control Post	15.19	S20	Cell	8.40
LA14	Mechanical	1.80	L49	Clerk Office	22.25	S21	Cell	8.40
LA15	Storage	8.13	L50	U M Office	13.89	S22	Cell	8.40
LA16	Corridor	15.65	L51	North Lobby	84.64	S23	Cell	9.60
L27	S. Common Room	28.42	L53	N. Common Room	28.41	N10	Cell	8.02
L28	South Lobby	71.56	L54	Shower	5.45	N11	Cell	8.21
L29	IPO Office	12.62	L55	Janitor	2.68	N12	Cell	8.21
L30	Interview Room	8.45	L56	Balcony Exit		N13	Cell	8.21
L31	Janitor	2.68	L57	Corridor	34.61	N14	Cell	8.21
L32	Shower	5.45	S10	Cell	8.97	N15	Cell	8.21
L33	Corridor	34.68	S11	Cell	8.21	N16	Cell	8.21
L43	Covered Entry		S12	Cell	8.21	N17	Cell	8.21
L44	Main Lobby	7.67	S13	Cell	8.21	N18	Cell	8.97
L45	IPO Office	13.60	S14	Cell	8.21	N19	Cell	11.32
			S15	Cell	8.21	N20	Cell	10.27
			S16	Cell	8.21	N21	Cell	9.91
			S17	Cell	8.21	N22	Cell B.F. Inmate Washroom	7.02



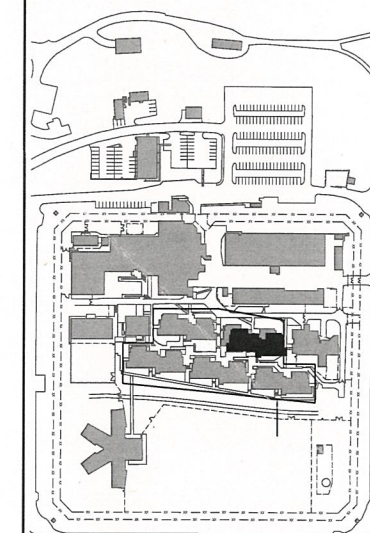
Real Property
Line Drawings

Region:

Pacific

Institution:

Mission Medium
Institution



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Building Number:
LU2

Building Name:
Oak Living Unit

Floor:
Main Level

Area m²:
694.72

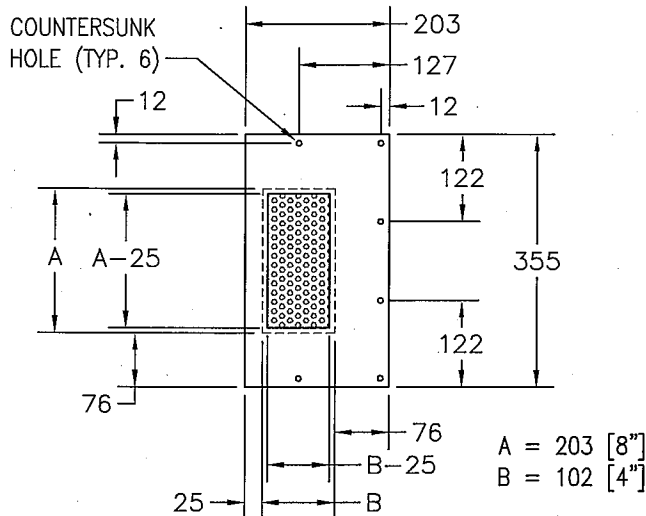
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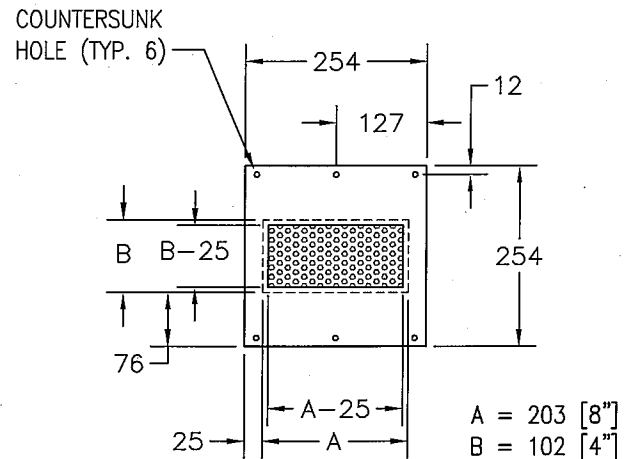
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APPENDIX B

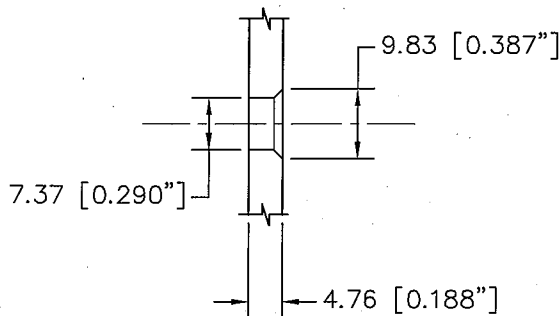
MECHANICAL DRAWINGS



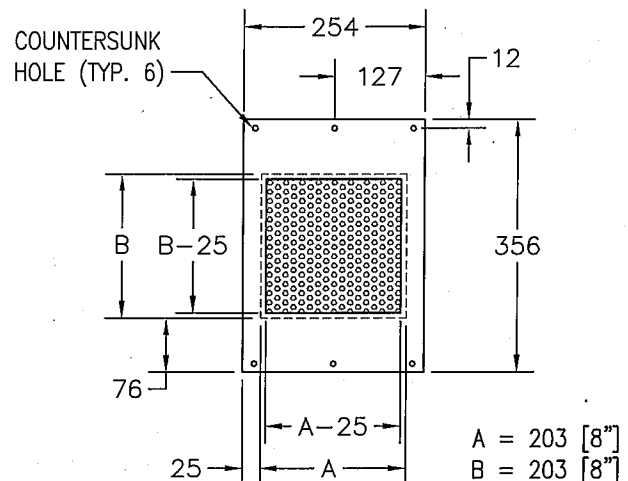
EXHAUST GRILLE (EG-S1.2)
1:10



EXHAUST GRILLE (EG-S1.1)
1:10



COUNTERSUNK HOLE
1:1



EXHAUST GRILLE (EG-S1.3)
1:10

DRAWING NOTES:

- 1 NOMINAL SIZE = A x B
NOMINAL PERFORATED AREA = (A - 25) x (B - 25)
CUSTOM FLANGE DIMENSIONS TO SUIT SITE CONDITION.
- 2 CONTRACTOR SHALL VERIFY SITE CONDITION ROOM BY ROOM AND CONFIRM GRILLE SIZES, INCLUDING FLANGE DIMENSIONS, PRIOR TO ORDERING GRILLES. THREE CUSTOM SIZES ARE SHOWN (EG-S1.1, EG-S1.2, EG-S1.3), BUT CONTRACTOR SHALL ALLOW UP TO 5 CUSTOM SIZES.
- 3 SIX (6) COUNTERSINK SCREW HOLES IN FACE FLANGE FOR FASTENING GRILLE TO EXISTING HOLLOW BLOCK WALL, USING HILTI KWIK-CON II+ 316-114 TFH, 3/16" ANCHOR, TAPERED FLAT HEAD W/ T-25 TORX, (OR EQUAL BY TAPCON). USE DRILL BIT APPROVED BY MANUFACTURER TO SUIT ANCHOR SIZE AND WALL CONSTRUCTION. INSTALL IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.



Public Works and
Government Services
Canada
Pacific Region

Travaux publics et
Services gouvernementaux
Canada
Région du Pacifique

Drawing title:
Titre du dessin:

DETAIL

scale:
échelle:

AS NOTED

date:

2017.04.12

revisions:

designed by:
conçu par:

M. NG

drawn by:
dessiné par:

M. NG

reviewed by:

—

approved by:
approuvé par:

—

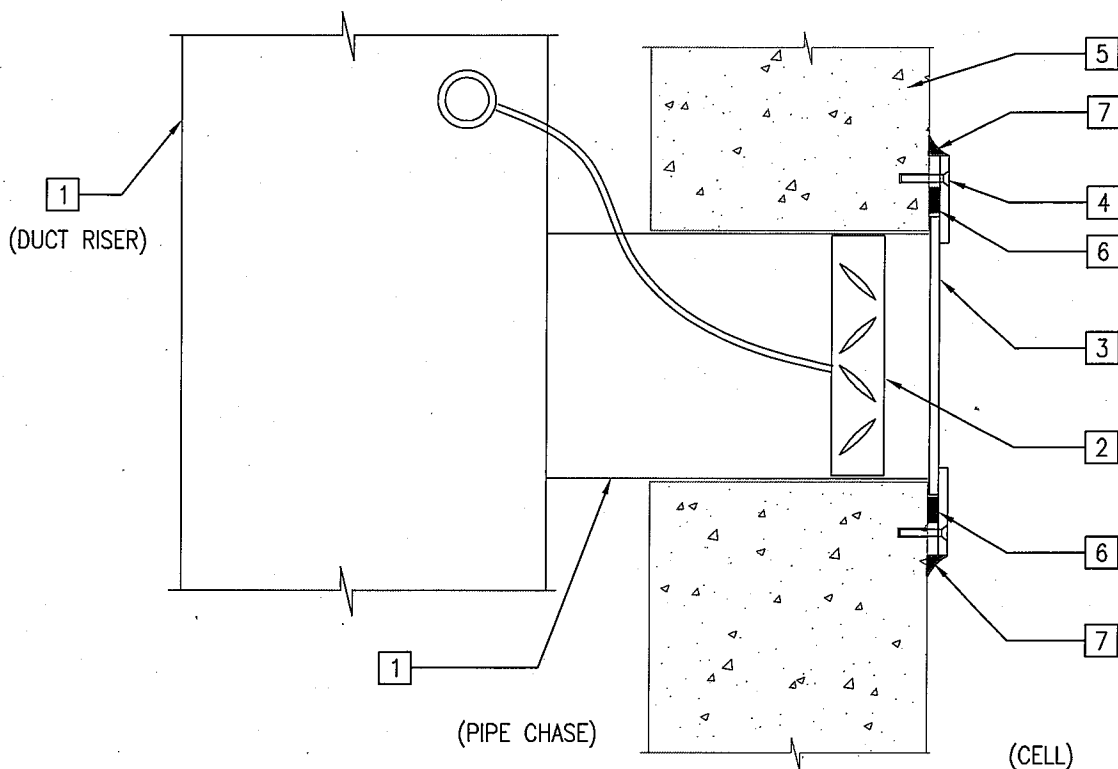
project no:
no. du projet:

R.082477.001

dwg. no.
dessin no.

MSK-1

MISSION MEDIUM INSTITUTION
LIVING UNITS 1 TO 5
CELL VENTILATION UPGRADE
8751 STAVE LAKE ST, MISSION, BC




EXHAUST GRILLE DETAIL

N.T.S.

DRAWING NOTES:

- 1 EXISTING DUCT.
- 2 PROVIDE NEW OPPOSED BLADE DAMPER FOR BALANCING C/W YOUNG REGULATOR AND BOWDEN CABLE. INSTALL YOUNG REGULATOR IN PIPE CHASE.
- 3 REPLACE EXHAUST GRILLE WITH NEW. SEE LINE DRAWINGS (APPENDIX A) FOR GRILLE SCHEDULE AND SKETCH MSK-1 FOR GRILLE SIZES.
- 4 COUNTERSUNK HOLE AND ANCHORS (TYP. 6). AFTER INSTALLATION OF ANCHOR SCREWS, APPLY TWO (2) COATS OF SECURITY CAULKING OVER SCREW HEADS TO PREVENT TAMPERING.
- 5 EXISTING HOLLOW BLOCK WALL.
- 6 APPLY CONTACT ADHESIVE BETWEEN THE GRILLE AND WALL.
- 7 APPLY SECURITY CAULKING ALONG THE EDGE OF GRILLE (FULL PERIMETER). MAKE GOOD FINISH.

 Public Works and Government Services Canada Travaux publics et Services gouvernementaux Canada Pacific Region Région du Pacifique	Drawing title: DETAIL Titre du dessin:		designed by: M. NG conçu par:
	scale: AS NOTED échelle:		drawn by: M. NG dessiné par:
MISSION MEDIUM INSTITUTION LIVING UNITS 1 TO 5 CELL VENTILATION UPGRADE 8751 STAVE LAKE ST, MISSION, BC	date: 2017.04.12		reviewed by: —
	revisions: —		approved by: — approuvé par:
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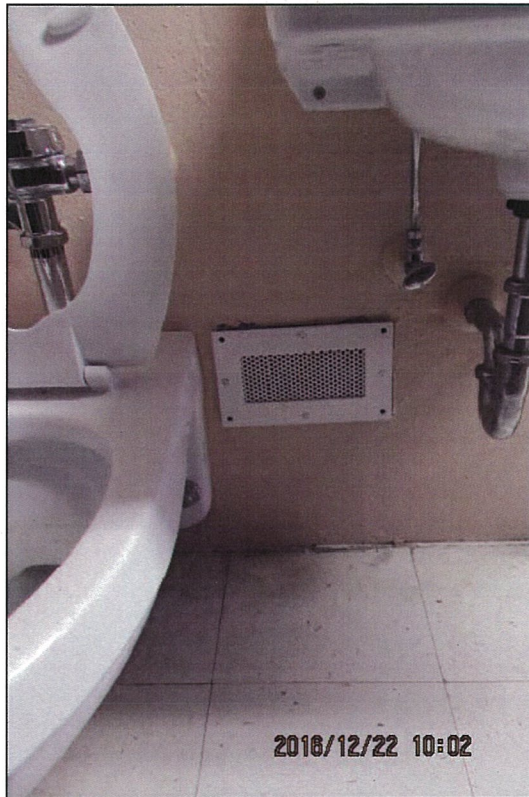


PHOTO #1 - LU-5, CELL N1

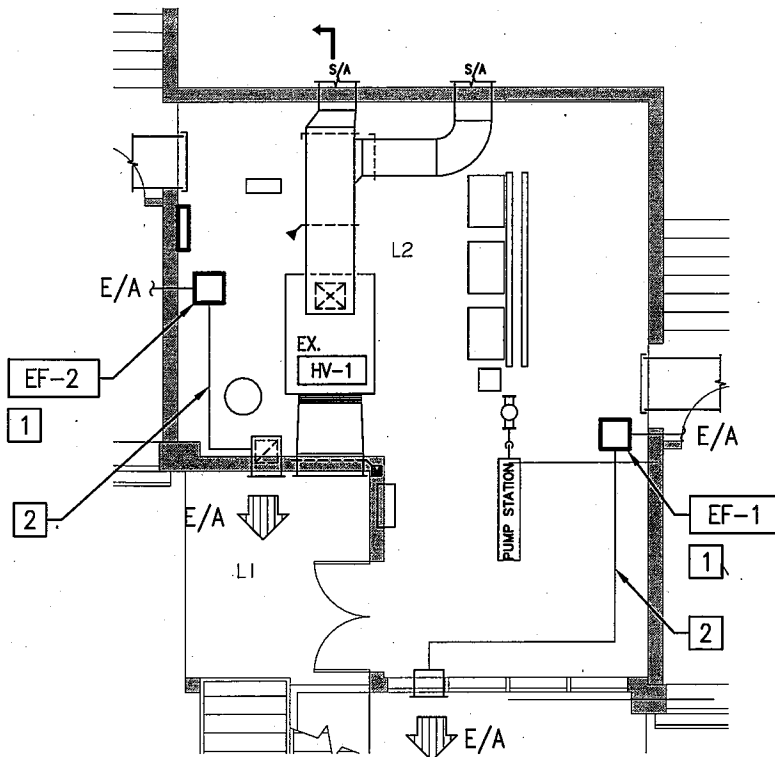


PHOTO #2 - LU-5 ANNEX, TYP. CELL

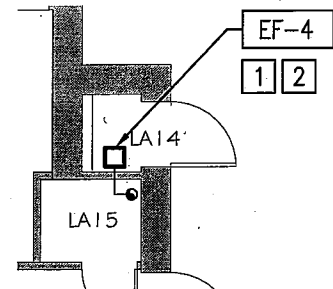


PHOTO #3 - LU-2, CELL N20

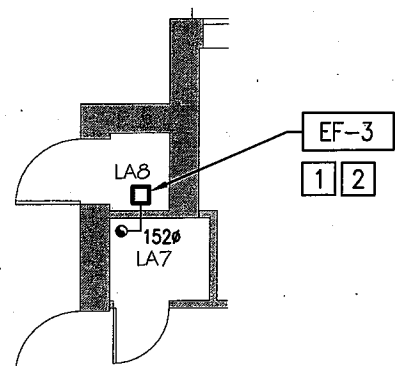
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	revisions: —		approved by: — approuvé par:	
			project no: R.082477.001 no. du projet:	dwg. no. MSK-3 dessin no.



PARTIAL LOWER FLOOR PLAN
1:100



PARTIAL UPPER FLOOR PLAN
1:100



PARTIAL UPPER FLOOR PLAN
1:100

DRAWING NOTES:

- 1 REMOVE EXISTING EXHAUST FAN WITH REPLACE WITH NEW AS SCHEDULED. PROVIDE FLEXIBLE DUCT CONNECTORS AT FAN INLET AND OUTLET. RECONNECT EX. DUCTWORK AND PROVIDE DUCT TRANSITIONS. REPLACE EXISTING DUCTWORK AND PROVIDE DUCT TRANSITION TO RECONNECT EXISTING DUCTWORK. COORDINATE WITH DIVISION 26 FOR DISCONNECT/RE-CONNECT POWER. SUPPORT AND SEISMIC RESTRAINTS PER SPECIFICATIONS.
- 2 EXISTING EXHAUST AIR SYSTEM WITHIN MECHANICAL ROOM TO BE CLEANED. SEE SPECIFICATIONS.

GENERAL NOTES:

1. READ IN CONJUNCTION WITH LINE DRAWINGS IN APPENDIX A.
2. TYPICAL FOR ALL FIVE (5) LIVING UNITS.



Public Works and
Government Services
Canada
Pacific Region

Travaux publics et
Services gouvernementaux
Canada
Région du Pacifique

Drawing title:
Titre du dessin:

PARTIAL FLOOR PLANS

scale:
échelle:

AS NOTED

date:

2017.04.12

revisions:

—

designed by:
conçu par:

M. NG

drawn by:
dessiné par:

M. NG

reviewed by:

—

approved by:
approuvé par:

—

project no:
no. du projet:

R.082477.001

dwg. no.
dessin no.

MSK-4

**MISSION MEDIUM INSTITUTION
LIVING UNITS 1 TO 5
CELL VENTILATION UPGRADE
8751 STAVE LAKE ST, MISSION, BC**

APPENDIX C

HAZMAT REPORT

Public Works and Government Services Canada

Hazardous Materials Assessment for the Mission
Medium Institution Living Units Buildings
(LU1 – LU5)

8751 Stave Lake Street,
Mission, British Columbia

November 21, 2016

702358-018

A large, solid red geometric shape, resembling a stylized triangle or a section of a larger triangle, is positioned in the bottom right corner of the page. It is composed of two overlapping triangular areas, creating a complex, angular form. A thin white line runs diagonally across the shape, and a horizontal white line intersects it near the bottom.

HAZARDOUS MATERIALS ASSESSMENT FOR THE MISSION MEDIUM INSTITUTION – LIVING
UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia



Paul Smith, B.Sc., IHT
Senior Industrial Hygienist



Wayne J. Cormack, M.Eng., CIH
Senior Consultant

**HAZARDOUS
MATERIALS
ASSESSMENT FOR
THE MISSION MEDIUM
INSTITUTION LIVING
UNITS BUILDINGS (LU1
– LU5)**

8751 Stave Lake Street,
Mission, British Columbia

Prepared for:

Ms. Sherry Steele
Public Works and Government Services
Canada

Environmental Services
401 – 1230 Government Street
Victoria, British Columbia
V8W 3X4

Prepared by:

Arcadis Canada Inc.
121 Granton Drive, Suite 12
Richmond Hill, Ontario L4B 3N4
Tel 905 882 5984
Fax 905 882 8962

Our Ref.:

702358-018

Date:

November 21, 2016

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HAZARDOUS MATERIALS ASSESSMENT FOR THE MISSION MEDIUM INSTITUTION – LIVING
UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia

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HAZARDOUS MATERIALS ASSESSMENT FOR THE MISSION MEDIUM INSTITUTION – LIVING
UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia

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APPENDICES

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B	Laboratory Reports
C	Photographs

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Public Works and Government Services Canada (PWGSC) Pacific Region, on behalf of Correctional Service Canada (CSC), to conduct a hazardous materials assessment in designated areas of the Mission Medium Institution Living Units Buildings (LU1 – LU5), located at 8751 Stave Lake Street, Mission, BC.

According to information provided by PWGSC, the work in each of the Living Units Building will include:

- replacement of 46 exhaust grills in the cells (36 grills in the original construction, 10 grills in the annex) with new frames and grills; and
- replacement of exhaust fans in the main and partial mechanical rooms (one main and two partial mechanical rooms).

Floor plans are provided in Appendix A.

The survey was undertaken to report on the presence or suspected presence of readily observable hazardous materials.

1.1 Scope of Work

The scope of work for our investigation included:

- review of existing information provided by PWGSC;
- conducting a hazardous building materials assessment of the five Living Units Buildings (including but not limited to assessment of asbestos-containing materials, lead, mould, mercury, PCB-containing equipment, rodent droppings and silica);
- obtaining representative bulk samples of materials which could contain asbestos, and paint chip samples;
- laboratory analyses of bulk samples for asbestos content and analysis of paint chip samples for lead content; and
- preparation of a report outlining the findings of the investigation.

Mr. Kenny Luong visited the site on October 18 and 19, 2016 to conduct the hazardous materials survey.

2 BACKGROUND INFORMATION ON HAZARDOUS MATERIALS

Canada Labour Code

Requirements related to disclosing the presence of hazardous substances (including designated substances) in federal government buildings are specified in Part II of the Canada Labour Code, sections 124(1)y and 125(1)Z.14, which state that employers shall:

- “ensure that the activities of every person granted access to the work place do not endanger the health and safety of employees [Section y]; and
- take all reasonable care to ensure that all of the persons granted access to the workplace, other than the employer’s employees, are informed of every known or foreseeable health or safety hazard to which they are likely to be exposed in the workplace. [Section Z.14]”.

When construction or redevelopment work is undertaken by a company whose primary activity is construction or redevelopment work at the site of a federally-regulated employer, the provincial health and safety laws apply. The British Columbia Workers Compensation Act and Occupational Health and Safety Regulations (B.C. Reg. 296/97) would therefore apply to any construction work undertaken at the subject site.

2.1 Asbestos

Asbestos has been widely used in buildings, both in friable applications (materials which can be crumbled, pulverized or powdered by hand pressure, when dry) such as pipe and tank insulation, sprayed-on fireproofing and acoustic texture material and in non-friable manufactured products such as floor tile, gaskets, cement board and so on. The use of asbestos in friable applications was curtailed around the mid-1970s. The use of asbestos in certain non-friable materials continued beyond the mid-1970s.

Control of exposure to asbestos is governed in British Columbia by B.C. Reg. 296/97 – Occupational Health and Safety Regulations. The WorkSafe BC publication *Safe Work Practices for Handling Asbestos* provides additional guidance.

B.C. Reg. 296/97 states that “asbestos-containing material” means the following:

- (a) a manufactured article or other material, other than vermiculite insulation, that would be determined to contain at least 0.5% asbestos if tested in accordance with one of the prescribed methods.
- (b) vermiculite insulation that would be determined to contain any asbestos if tested in accordance with the prescribed EPA method.

B.C. Reg. 296/97 prescribes certain requirements for asbestos management in buildings.

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UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia

For on-going asbestos management in buildings, employers are required to:

- develop and implement an exposure control plan if a worker is or may be exposed to potentially harmful levels of asbestos;
- prepare an inventory (i.e., asbestos survey report) of all asbestos-containing materials in the workplace; keep the inventory at the workplace and keep the inventory current;
- ensure that a risk assessment is conducted by qualified person on asbestos-containing material identified in the inventory, with due regard for the condition of the material, its' friability, accessibility and likelihood of damage, and the potential for fibre release and exposure of workers;
- ensure that before a work activity that involves working with or in proximity to asbestos-containing material begins, the work activity is assessed by a qualified person and classified as a low, moderate or high risk activity;
- ensure that all friable asbestos-containing materials in the workplace are controlled by removal, enclosure or encapsulation so as to prevent the release of airborne asbestos fibre;
- prohibit any work that would disturb asbestos-containing material unless necessary precautions have been taken to protect workers;
- ensure that procedures for handling or using asbestos-containing material prevent or minimize the release of airborne asbestos fibres;
- ensure that the procedures for control, handling or use of asbestos are in accordance with procedures acceptable to the board;
- provide training for staff who are at risk of exposure to asbestos;

"Waste asbestos" is classified as a "hazardous waste" and is defined in the British Columbia Hazardous Waste Regulation (B.C. Reg. 63/88) as "a waste containing friable asbestos fibres or asbestos dust in a concentration greater than 1% by weight". Section 40, Part 6 of the regulation provides requirements for management of asbestos waste.

2.2 Lead

Lead is a heavy metal that can be found in construction materials such as paints, coatings, mortar, concrete, pipes, solder, packings, sheet metal, caulking, glazed ceramic products and cable splices. Lead has been used historically in exterior and interior paints.

B.C. Reg. 296/97 prescribes specific requirements for control of workplace exposure to lead. Employers are responsible for developing and implementing an exposure control plan if workers are or may be exposed to lead. The WorkSafe BC publication "Lead-Containing Paints and Coatings, Preventing Exposure in the Construction Industry" provides guidance in the measures and procedures that should be followed when handling lead-containing paints and coatings during construction projects and states the following:

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- *“Information from the U.S. Occupational Safety and Health Administration (OSHA) suggests that the improper removal of lead paint containing 600 mg/kg lead results in airborne lead concentrations that exceed half of the exposure limit. This would trigger the requirement for an Exposure Control Plan (ECP) and safe work procedures.*
- *Lead concentrations as low as 90 mg/kg may present a risk to pregnant women and children. Any risk assessment should include for the presence of high risk individuals within the workplace.”*

The *Surface Coating Materials Regulations* made under the *Hazardous Products Act* (SOR/2005-109) sets a maximum concentration of total lead of 90 mg/kg (0.009 percent or 90 parts per million) for surface coating materials, including paints, effective 21 October 2010. This criterion level applies to the sale and importation of new surface coating materials.

In addition, under the *Hazardous Waste Regulation* (B.C. Reg. 63/88, including amendments up to B.C. Reg. 63/2009, April 1, 2009), identified lead-based paints (LBPs) must also undergo Toxicity Characteristic Leachate Properties (TCLP) testing to determine disposal procedures. The acceptable TCLP limit for disposal of LBPs is less than 5 milligrams per litre (mg/L). If an identified LBP exhibits a TCLP result of less than 5 mg/L, the paint is not considered a hazardous material and may be disposed as construction waste.

The National Plumbing Code allowed lead as an acceptable material for pipes until 1975 and in solder until 1986.

2.3 Mercury

Mercury has been used in electrical equipment such as alkaline batteries, fluorescent light bulbs (lamps), high intensity discharge (HID) lights (mercury vapour, high pressure sodium and metal halide), “silent switches” and in instruments such as thermometers, manometers and barometers, pressure gauges, float and level switches and flow meters. Mercury-containing lamps, the bulk of which are 1.22 m (four foot) fluorescent lamps contain between 7 and 40 mg of mercury each. Mercury compounds have also been used historically as additives in latex paint to protect the paint from mildew and bacteria during production and storage.

The intentional addition of mercury to Canadian-produced consumer paints for interior use was prohibited in 1991. Mercury may have remained in paints after 1991, however, as a result of impurities in the paint ingredients or cross-contamination due to other manufacturing processes. The *Surface Coating Materials Regulations* made under the *Hazardous Products Act* set a maximum total mercury concentration of 10 mg/kg (0.001 percent) for surface coating materials (including paint). This criterion level applies to the sale and importation of new surface coating materials.

Mercury-containing thermostats and silent light switches are mercury tilt switches which are small tubes with electrical contacts at one end of the tube. A mercury tilt switch is usually present when no switch is visible. Mercury switches often have the word “TOP” stamped on the upper end of the switch, which is visible after removing the cover plate. If mercury switches are to be removed, the entire switch should be removed and placed into a suitable container for storage and disposal.

HAZARDOUS MATERIALS ASSESSMENT FOR THE MISSION MEDIUM INSTITUTION – LIVING UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia

Waste light tubes generated during renovations or building demolition and waste mercury from equipment must either be recycled or disposed of in accordance with the requirements of B.C. Reg. 63/88 – *Hazardous Waste Regulation*.

Waste mercury is classified as “leachable toxic waste” if the extraction criterion value prescribed in Table 1 of Schedule 4 of the regulation is exceeded. Waste mercury from mercury switches or gauges should be properly collected and shipped to a recycling facility or disposed of as a hazardous waste. Removal of mercury-containing equipment (e.g., switches, gauges, controls, etc.) should be carried out in a manner which prevents spillage and exposure to workers.

2.4 Silica

Silica exists in several forms of which crystalline silica is of most concern with respect to potential worker exposures. Quartz is the most abundant type of crystalline silica. Some commonly used construction materials containing silica include brick, refractory brick, concrete, concrete block, cement, mortar, rock and stone, sand, fill dirt, topsoil and asphalt containing rock or stone.

Employers in British Columbia are required to develop an exposure control plan (ECP) when workers are or may be exposed to airborne silica dust in excess of 50 percent of the exposure limit. The WorkSafe BC guidance document “Developing a Silica Exposure Control Plan” provides information on each of the required elements of an ECP, including safe work procedures for controlling exposure to silica during construction activities.

2.5 PCBs

In most institutional and commercial facilities and in smaller industrial facilities, the primary source of equipment potentially containing PCBs is fluorescent and H.I.D. light ballasts. Small transformers may also be present. In larger industrial facilities, larger transformers and switch gear containing, or potentially containing, PCBs may also be present.

PCBs were also commonly added to industrial paints from the 1940s to the late 1970s. PCBs were added directly to the paint mixture to act as a fungicide, to increase durability and flexibility, to improve resistance to fires and to increase moisture resistance. The use of PCBs in new products was banned in Canada in the 1970s. PCB amended paints were used in speciality industrial/institutional applications prior to the 1970s including government buildings and equipment such as industrial plants, radar sites, ships as well as non-government rail cars, ships, grain bins, automobiles and appliances.

Removal of in-service equipment containing PCBs, such as fluorescent light ballasts, capacitors and transformers, is subject to the requirements of the federal *PCB Regulations*.

The PCB Regulations, which came into force on 5 September 2008, were made under the *Canadian Environmental Protection Act*, 1999 (CEPA 1999) with the objective of addressing the risks posed by the use, storage and release to the environment of PCBs, and to accelerate their destruction. The PCB Regulations set different end-of-use deadlines for equipment containing PCBs at various concentration levels.

The Regulations Amending the PCB Regulations and Repealing the Federal Mobile PCB Treatment and Destruction Regulations were published on 23 April 2014, in the Canada Gazette, Part II, and came into force on 1 January 2015. The most notable part of the amendments is the addition of an end-of-use deadline date of 31 December 2025 for specific electrical equipment located at electrical generation, transmission and distribution facilities.

“PCB wastes” are defined in B.C. Reg. 63/88 – *Hazardous Waste Regulation* as *PCB liquid, PCB solid and PCB equipment that have been taken out of service for the purpose of treatment, recycling, reuse or disposal or for the purpose of storage prior to treatment, recycling, reuse or disposal*. “PCB liquid” means any liquid containing more than 50 parts per million by weight of chlorobiphenyls. “PCB solid” means any material or substance other than PCB liquid that contains or is contaminated with chlorobiphenyls at a concentration greater than 50 parts per million by weight of chlorobiphenyls. “PCB equipment” means a manufactured item that contains or is contaminated with PCB liquids or PCB solids and includes transformers, capacitors and containers.

2.6 Rodent Droppings

According to the Health Canada (in collaboration with the Public Health Agency of Canada) article “*It’s Your Health – Hantaviruses*”, dated August 2009, Hantaviruses are found in the droppings, urine, and saliva of infected rodents and humans can contact the virus from breathing in airborne particles or from being bitten. In Canada, a hantavirus capable of causing disease in humans – named Sin Nombre virus – has been identified in deer mice. Although the risk in Canada is low, when it happens, the disease can be very severe.

Exposure to hantaviruses can cause a rare, but often fatal, disease called Hantavirus pulmonary syndrome (HPS). The earliest documented case of HPS in Canada was contracted in Alberta in 1989. Since then, there have been over 70 confirmed cases. Most of the cases occurred in western Canada (Manitoba, Saskatchewan, Alberta and British Columbia), except for one case in Quebec.

Hantavirus is typically transmitted by breathing particles in air from the droppings, urine and saliva of infected rodents. However, there have been a small number of reported cases of HPS believed to have been contracted through rodent bites.

2.7 Mould

Moulds are forms of fungi that are found everywhere both indoors and outdoors all year round. Outdoors, moulds live in the soil, on plants and on dead and decaying matter. More than 1000 different kinds of indoor moulds have been found in buildings. Moulds spread and reproduce by making spores, which are all small and light-weight, able to travel through air, capable of resisting dry, adverse environmental conditions, and hence capable of surviving a long time. Moulds need moisture and nutrients to grow and their growth is stimulated by warm, damp and humid conditions.

Recommended work practices are outlined in the following document:

- *Mould Guidelines for the Canadian Construction Industry*. Standard Construction Document CCA 82 2004. Canadian Construction Association.

3 METHODOLOGY

3.1 Asbestos

Bulk sampling and analysis was performed in general accordance with the requirements specified in B.C. Reg. 296/97 and in the WorkSafe BC publication *Safe Work Practices for Handling Asbestos*.

Determination of the locations of asbestos-containing materials was made based on the results of bulk sample analyses, visual observations and physical characteristics of the applications as well as our knowledge of the uses of asbestos in building materials.

Analysis of bulk samples was performed following EPA Method 600/R-93/116 in conformity with the requirements specified in B.C. Reg. 296/97.

3.2 Lead

Samples of select, representative paint applications collected during the course of the site inspection were forwarded to the Maxxam Analytical Inc. laboratory in Mississauga, Ontario for analysis of lead content.

3.3 Mercury

The presence of equipment which may contain mercury, such as fluorescent light tubes, thermometers, gauges, etc. observed during the course of our site inspection was recorded.

3.4 Silica

The presence of silica-containing materials observed during the course of our site inspection was documented. Silica is known to be a constituent of brick, concrete, cement, etc. Sampling and laboratory analysis are not required to make this determination.

3.5 PCBs

The presence or absence of fluorescent lights was documented during the course of our survey to determine whether there were any of the T12 type which may therefore contain PCB ballasts.

3.6 Rodent Droppings

The presence of rodent droppings in all accessible areas was recorded during the site inspections by Arcadis staff.

3.7 Mould

The presence of any “suspect” mould observed during the course of our site inspection was documented. “Suspect” mould is typically a coloured, textured substance or discolouration or staining on a building material surface which, based on our experience, may be mould growth. The adjective “suspect” is used where the presence of mould has not been confirmed by laboratory analysis.

4 RESULTS AND DISCUSSION

4.1 Asbestos

All mechanical rooms in each of the five Living Units were inspected. Grills were inspected in approximately 15 cells in each Living Unit to get a good representation of the cells. All areas, including the cells and mechanical rooms appeared to have been built at the same time and were of similar construction.

The cell room numbers are indicated by either an “N” or an “S” before the number (ie., N7). The main mechanical room in each Living Unit is Room L2. The partial mechanical rooms also begin with the designation “L”.

During the course of our hazardous materials assessment, representative bulk samples of materials were collected by Arcadis staff. The samples were forwarded to EMSL Canada Inc. for asbestos analyses. EMSL holds a current Certificate of Accreditation for Bulk Asbestos Fibre Analysis under the Voluntary Accreditation Program (NVLAP). The results of the bulk sample analyses for asbestos content are provided in Table 4.1, and the laboratory report is provided in Appendix B.

Table 4.1
Summary of Results of Analyses of Bulk Samples for Asbestos Content
Mission Medium Institution – Living Units Buildings
October 2016

Sample No.	Location	Description	Asbestos Content
B1A	LU-3 – Room N7	masonry block mortar	None detected
B1B	LU-3 – Room N7	masonry block mortar	None detected
B1C	LU-3 – Room N7	masonry block mortar	None detected
B2A	LU-3 – Room S8	plaster	None detected
B2B	LU-3 – Room S8	plaster	None detected
B2C	LU-3 – Room S8	plaster	None detected
B3A	LU-3 – Room S8	masonry block mortar around grill	None detected
B3B	LU-3 – Room S8	masonry block mortar around grill	None detected
B3C	LU-3 – Room S8	masonry block mortar around grill	None detected
B4	LU-3 – Room S8	tape – outer wall of air duct	None detected
B5	LU-3 – Room S1	paper – outer edge of grill	None detected
B6A	LU-3 – Room L2	grey air duct mastic on corners	None detected
B6B	LU-3 – Room L3	grey air duct mastic on corners	None detected
B6C	LU-3 – Room L4	grey air duct mastic on corners	None detected
B7	LU-3 – Room LA14	grey air duct mastic on corners	None detected
B8	LU-1 – Room S8	masonry block mortar at grill	None detected

HAZARDOUS MATERIALS ASSESSMENT FOR THE MISSION MEDIUM INSTITUTION – LIVING
UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia

B9A	LU-1 – Room L2	grey air duct mastic on corners	None detected
B9B	LU-1 – Room LA8	grey air duct mastic on corners	None detected
B9C	LU-1 – Room LA14	grey air duct mastic on corners	None detected
B10A	LU-1 – Room LA8	masonry block mortar	None detected
B10B	LU-1 – Room LA8	masonry block mortar	None detected
B10C	LU-1 – Room LA8	masonry block mortar	None detected
B11A	LU-2 – Room L2	grey air duct mastic on corners	None detected
B11B	LU-2 – Room L8	grey air duct mastic on corners	None detected
B11C	LU-2 – Room LA14	grey air duct mastic on corners	None detected
B12A	LU-4 – Room L2	grey air duct mastic on corners	None detected
B12B	LU-4 – Room L8	grey air duct mastic on corners	None detected
B12C	LU-4 – Room LA14	grey air duct mastic on corners	None detected
B13A	LU-4 – Room N15	air vent plaster in front of grill	None detected
B13B	LU-4 – Room N15	air vent plaster in front of grill	None detected
B13C	LU-4 – Room N15	air vent plaster in front of grill	None detected
B14A	LU-5 – Room L2	grey air duct mastic on corners	None detected
B14B	LU-5 – Room L8	grey air duct mastic on corners	None detected
B14C	LU-5 – Room LA14	grey air duct mastic on corners	None detected

Not all of the grills could be opened/accessed for inspection, as they could not be removed. In some case, there were limited amounts of building materials that could be sampled at the grills (ie., tape and paper, plaster). In the case of the plaster, it appeared that this material had been applied around the grill to act as a sealant. It is recommended that additional samples of these materials, if present, be sampled at the time when the grills can be removed. The materials should be submitted for asbestos analysis.

Based on visual observations and results of laboratory analyses of samples collected by Arcadis, no asbestos-containing materials were found to be present in the study areas.

Floor plans of the Living Units Buildings are provided in Appendix A.

Asbestos may also be present in materials which were not sampled during the course of the asbestos survey carried out by Arcadis, including, but not limited to, components of electrical equipment (e.g. electric wiring insulation, non-metallic sheathed cable, electrical panel partitions, arc chutes, high-grade electrical paper, etc.) and/or in locations that are presently inaccessible (e.g., in pipe chases, behind walls). Asbestos may also be present in the form of vermiculite insulation in cavities in concrete or cement block walls (used as in-fill insulation). Confirmatory testing of any such materials could be undertaken as the need arises (i.e., at the time of renovations) or the materials can be assumed to contain asbestos based on findings in adjacent areas.

If any materials which may contain asbestos and which were not tested during the course of the hazardous materials survey are discovered during any renovation activities, or if any of the materials listed above are encountered, or may be affected by the renovation activities, the work shall not proceed until such time as the required notifications have been made and an appropriate course of action is determined.

HAZARDOUS MATERIALS ASSESSMENT FOR THE MISSION MEDIUM INSTITUTION – LIVING
UNITS BUILDINGS LU1 – LU5 - 8751 Stave Lake Street, Mission, British Columbia

4.2 Lead

Six samples of the predominant paints were collected by Arcadis during the course of the investigation. The samples were submitted to EMSL Canada Inc. for analysis of lead content. The results of the analyses are presented in Table 4.2, and the laboratory report is provided in Appendix B.

Lead was detected at levels below the WorkSafe BC guideline value of 600 mg/kg in all samples of paint.

The paint applications were noted to be generally in good condition at the time of the survey by Arcadis. Prior to any renovation work, the lead-containing paint should be handled following the measures and procedures outlined in the WorkSafe BC publication *Lead-Containing Paints and Coatings, Preventing Exposure in the Construction Industry*.

Table 4.2
Summary of Results of Analyses of Paint Samples for Lead Content
Mission Medium Institution – Living Units Buildings
October 2016

Sample No.	Location	Description	Condition	Lead Content (mg/kg)
L3	LU-3 – Room N21	peach wall paint	Good	<90
L9	LU-2 – Room S15	peach wall paint	Good	<90
L11	LU-2 – Room N9	purple wall paint	Good	<90
L16	LU-5 – Room N10	peach wall paint	Good	<90
L17	LU-5 – Room N23	grey wall paint	Good	160
L18	LU-5 – Room L2	white wall paint	Good	<90
L6	LU-1 – Room S1	blue wall paint	Good	<90
L7	LU-1 – Room N2	grey wall paint	Good	250
L12	LU-4 – Room S13	grey wall paint	Good	<90
L14	LU-4 – Room S22	dark blue wall paint	Good	<90

NOTES:

mg/kg = milligrams lead per kilogram paint.

< = less than.

1 mg/kg = 1 part per million (ppm).

4.3 Mercury

No mercury-containing thermostats were observed during the course of our site inspection. Fluorescent light tubes were observed throughout the study areas. Mercury should be assumed to be present in the light tubes.

4.4 Silica

Materials observed in the study areas which could contain silica included concrete, concrete block, mortar and plaster.

The WorkSafe BC guidance document Developing a Silica Exposure Control Plan, provides guidance in controlling exposure to silica dust during construction/renovation activities.

4.5 PCBs

Fluorescent lights used throughout the common areas of the Living Unit Buildings and cells were observed to be a combination of incandescent and compact fluorescent lights. The lights are not expected to be affected by the renovation project.

4.6 Rodent Droppings

Rodent droppings were observed throughout Rooms L8 and L14(exhaust fan rooms) in all five Living Units during the course of our site inspection. It appeared that these areas may have been used as nesting sites. No rodent carcasses were observed during the course of the site inspection.

4.7 Mould

No suspect mould was observed during the course of our site inspection.

5 RECOMMENDATIONS

We recommend the following on the basis of the findings of the hazardous material assessment outlined in this report:

1. Not all of the grills could be opened/accessed for inspection, as they could not be removed. In some case, there were limited amounts of building materials that could be sampled at the grills (ie., tape and paper, plaster). In the case of the plaster, it appeared that this material had been applied around the grill to act as a sealant. It is recommended that additional samples of these materials, if present, be sampled at the time when the grills can be removed. The materials should be submitted for asbestos analysis.
2. Prior to undertaking renovation activities:
 - develop a silica exposure control plan; and
 - Remove all rodent droppings in accordance with the Health Canada (in collaboration with the Public Health Agency of Canada) article "*It's Your Health – Hantaviruses*", dated August 2009. Measures include, for example:
 - The wearing of rubber or plastic gloves;
 - Spraying droppings with a general purpose household disinfectant or a mixture of bleach and water (1 part bleach, 9 parts water);
 - Ensure that the droppings are very wet, and letting the areas soak for 10 minutes;
 - Using a paper towel to wipe up the droppings, and disposing the paper towel immediately;
 - Washing gloves in disinfectant and hot soapy water before removing them, thoroughly washing your hands after removing the gloves; and
 - When cleaning contaminated areas in a confined space, consider wearing a high efficiency particulate air (HEPA) filtered respirator.

6 USE AND LIMITATIONS OF HAZARDOUS MATERIALS SURVEY REPORT

This report, prepared for Public Works and Government Services Canada, on behalf of Correctional Service Canada, does not provide certification or warranty, expressed or implied, that the investigation conducted by Arcadis identified all hazardous materials in the designated study areas of the Living Units Buildings. The work undertaken by Arcadis was directed to provide information on the presence of hazardous materials in building construction materials based on visual inspection of readily accessible areas of the building, and on the results of laboratory analysis of a limited number of bulk samples of material for asbestos content and laboratory analysis of a limited number of paint samples for lead content.

The material in this report reflects Arcadis' best judgment in light of the information available at the time of the investigation, which was performed on October 18 and 19, 2016.

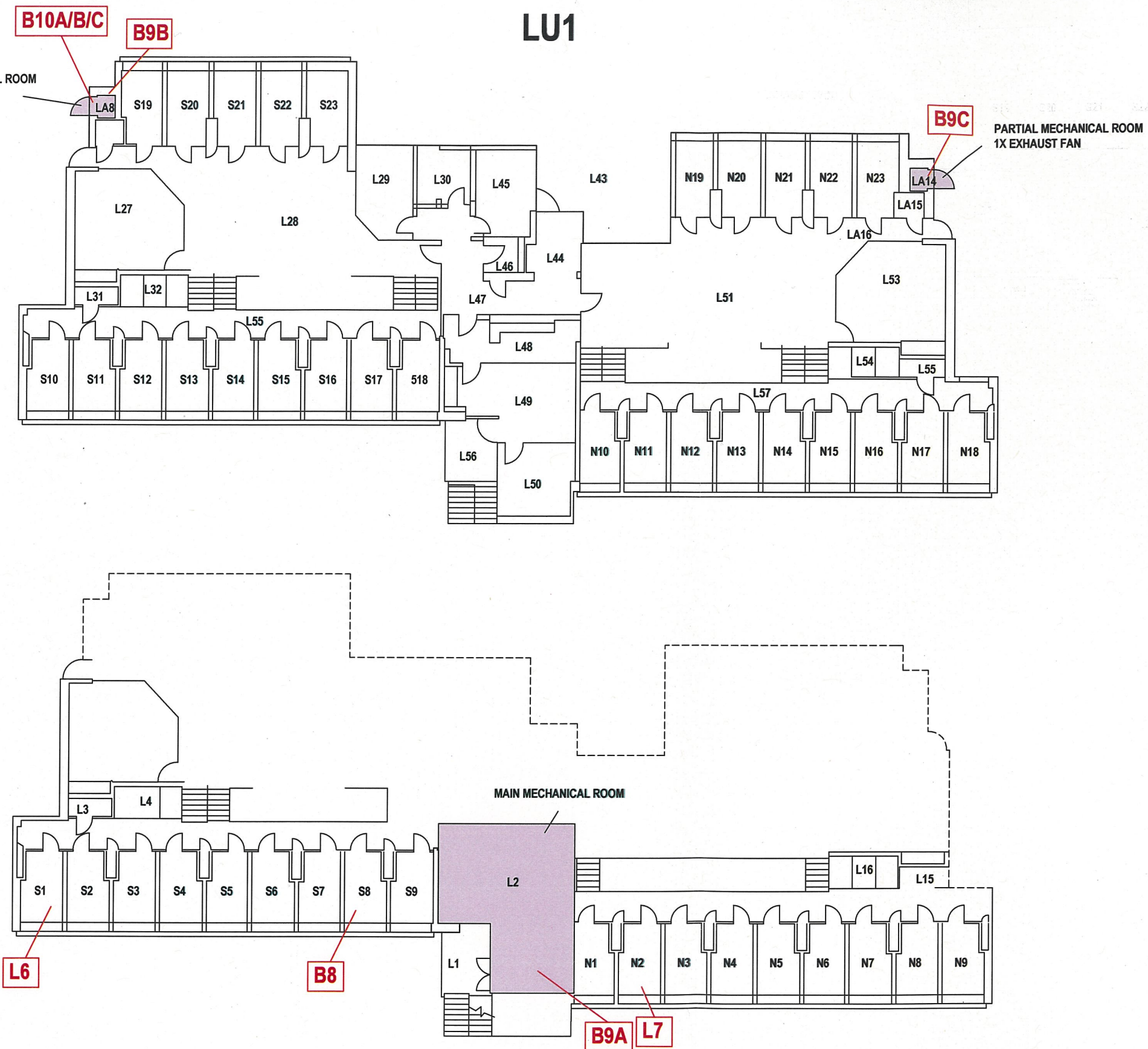
This report was prepared by Arcadis for Public Works and Government Services Canada, on behalf of Correctional Service Canada. Any use which any other party makes of the report, or reliance on, or decisions to be based on it, is the responsibility of such parties.

APPENDIX A

Floor Plans



1 Z:\WORK\Projects\702358 - Mission Institution\CAD\018018.dwg



LEGEND

B33 Sample Location

N.T.S

Title: **MISSION MEDIUM INSTITUTION
LIVING UNITS BUILDINGS (LU1 - LU5)**

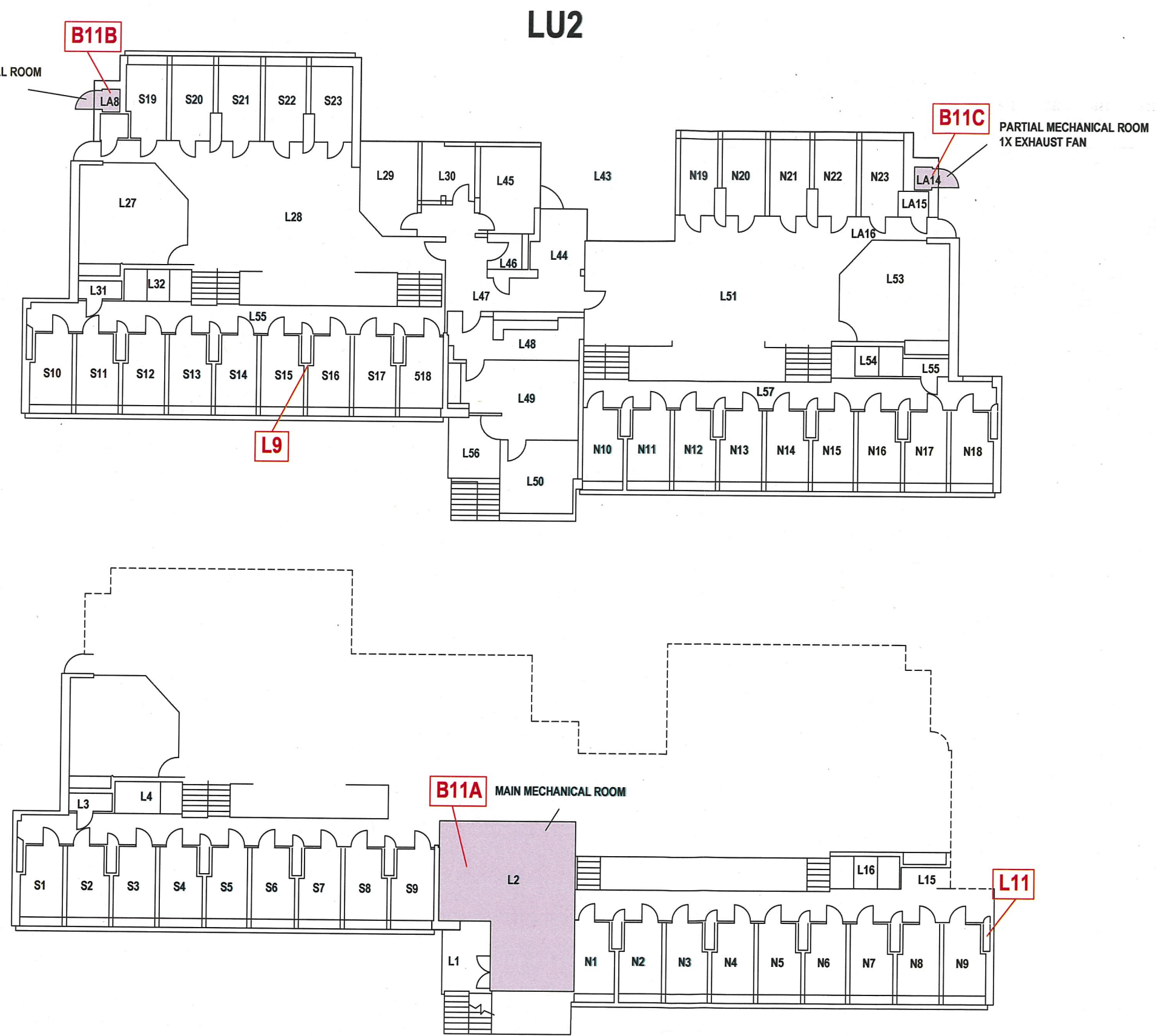
Project: **HAZARDOUS MATERIALS ASSESSMENT**

Client:  **PUBLIC WORKS AND
GOVERNMENT SERVICES
CANADA**

Project Number: 702358-018 Drawn By: CB Plot Size: 11X17" Date: **NOVEMBER 2016**

 **FIGURE 1**



1 (2) Z:\WORK\Projects\702358 - Mission Institution\CAD\018\018.dwg



LEGEND

B33 Sample Location

N.T.S

Title: MISSION MEDIUM INSTITUTION LIVING UNITS BUILDINGS (LU1 - LU5)			
Project: HAZARDOUS MATERIALS ASSESSMENT			
Client:  PUBLIC WORKS AND GOVERNMENT SERVICES CANADA		Date: NOVEMBER 2016	
Project Number: 702358-018	Drawn By: CB	Plot Size: 11X17"	
			FIGURE 1

LU3

PARTIAL MECHANICAL ROOM
1X EXHAUST FAN

PARTIAL MECHANICAL ROOM
1X EXHAUST FAN

MAIN MECHANICAL ROOM

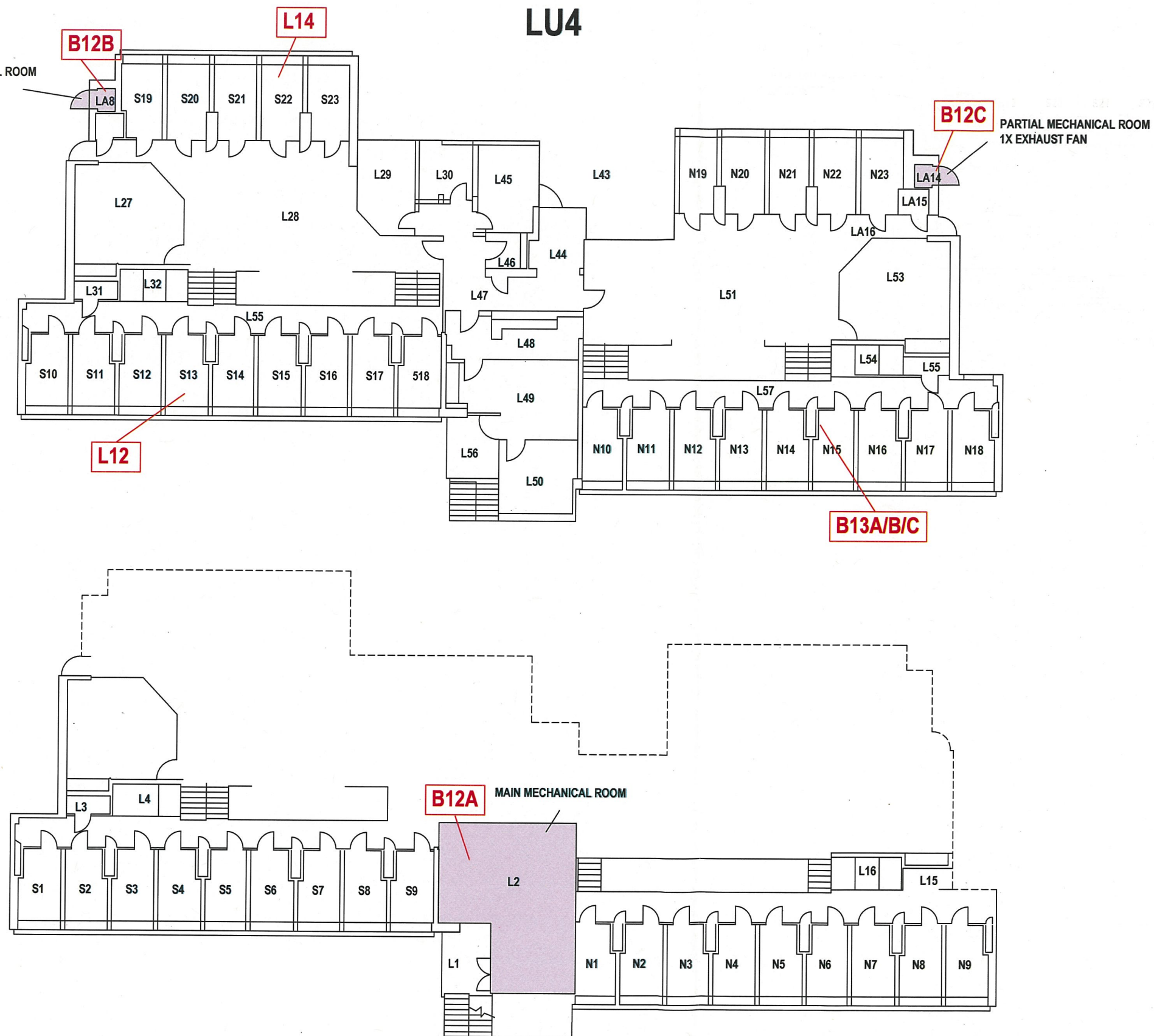
Rooms and Corridors labeled: S19, S20, S21, S22, S23, L27, L28, L29, L30, L43, L44, L45, L46, L47, L48, L49, L50, L51, L52, L53, L54, L55, N19, N20, N21, N22, N23, N10, N11, N12, N13, N14, N15, N16, N17, N18, S10, S11, S12, S13, S14, S15, S16, S17, S18, S1, S2, S3, S4, S5, S6, S7, S8, S9, L1, L2, L3, L4, L15, L16, N1, N2, N3, N4, N5, N6, N7, N8, N9.

Highlighted areas (Red boxes): B5, B6B, B6C, B3A/B/C, B4, B2A/B/C, B1A/B/C, B6A, L3, L7, B7.

N.T.S

FIGURE 1

1 (4) Z:\WORK\Projects\702358 - Mission Institution\CAD\018018.dwg



LEGEND

B33 Sample Location

N.T.S

Title: **MISSION MEDIUM INSTITUTION
LIVING UNITS BUILDINGS (LU1 - LU5)**

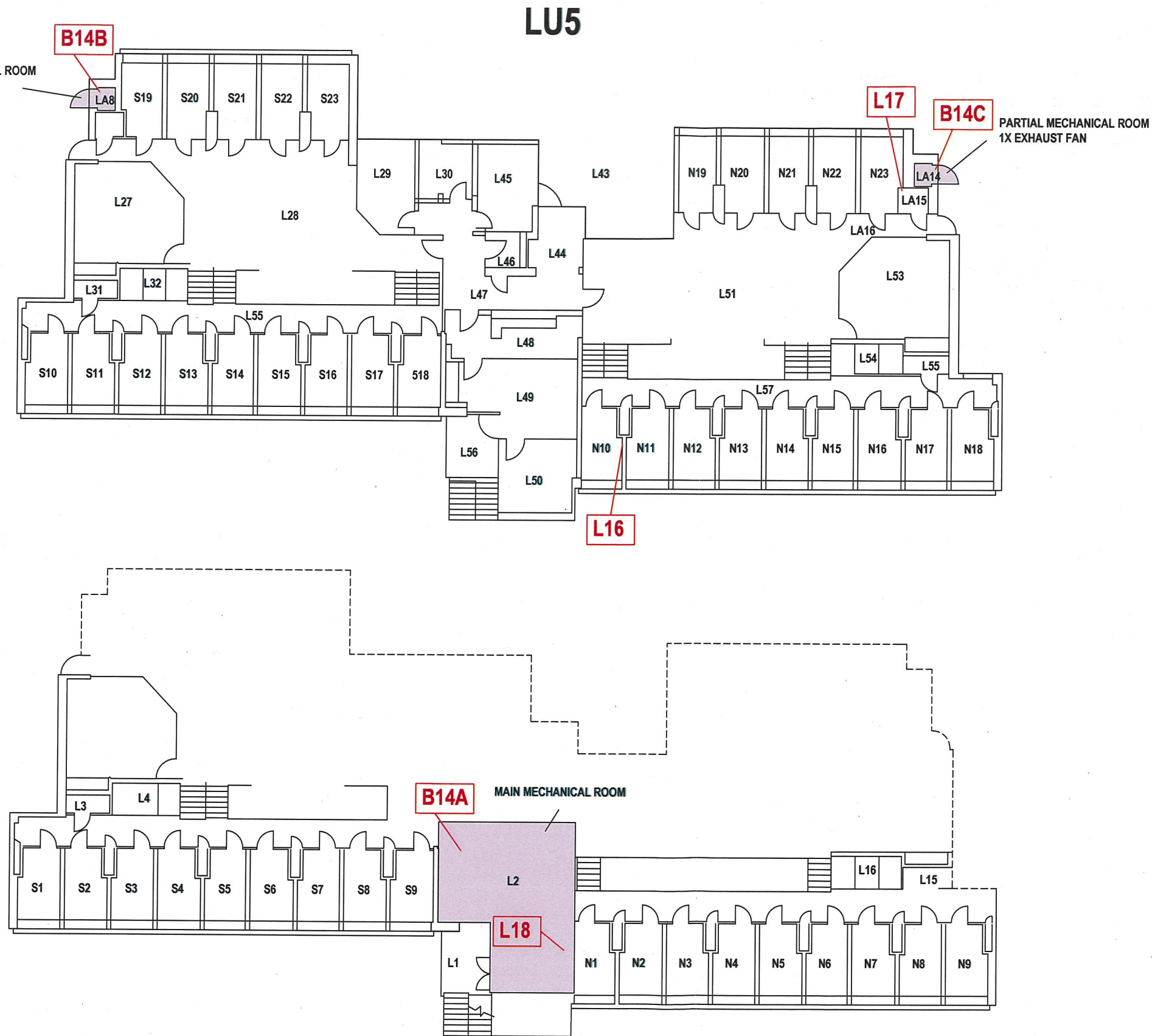
Project: **HAZARDOUS MATERIALS ASSESSMENT**

Client:  **PUBLIC WORKS AND
GOVERNMENT SERVICES
CANADA**

Project Number: 702358-018	Drawn By: CB	Plot Size: 11X17"	Date: NOVEMBER 2016
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 **ARCADIS**

FIGURE 1



LEGEND

B33 Sample Location

N.T.S

Title: **MISSION MEDIUM INSTITUTION
LIVING UNITS BUILDINGS (LU1 - LU5)**

Project: **HAZARDOUS MATERIALS ASSESSMENT**

Client:  **PUBLIC WORKS AND
GOVERNMENT SERVICES
CANADA**

Project Number: 702358-018 Drawn By: CB Plot Size: 11X17" Date: **NOVEMBER 2016**

 **ARCADIS**

FIGURE 1

APPENDIX B

Laboratory Reports



**EMSL Canada Inc.**

4506 Dawson Street Burnaby, BC V5C 4C1
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<http://www.EMSL.com> / vancouverlab@EMSL.com

EMSL Canada Order 691601428
Customer ID: 55DCSL97
Customer PO: 702358
Project ID:

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Proj: 702358

Phone: (905) 882-5984
Fax: (905) 882-8962
Collected:
Received: 10/27/2016
Analyzed: 11/02/2016

**Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British
Columbia Regulation 188/2011 via EPA 600/R-93/116 Method**

Client Sample ID: B1A **Lab Sample ID:** 691601428-0001
Sample Description: N7/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B1B **Lab Sample ID:** 691601428-0002
Sample Description: N7/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B1C **Lab Sample ID:** 691601428-0003
Sample Description: N7/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B2A **Lab Sample ID:** 691601428-0004
Sample Description: S8/PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	White	0%	100%	None Detected	

Client Sample ID: B2B **Lab Sample ID:** 691601428-0005
Sample Description: S8/PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	White	0%	100%	None Detected	

Client Sample ID: B2C **Lab Sample ID:** 691601428-0006
Sample Description: S8/PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	White	0%	100%	None Detected	

Client Sample ID: B3A **Lab Sample ID:** 691601428-0007
Sample Description: S8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

**EMSL Canada Inc.**

4506 Dawson Street Burnaby, BC V5C 4C1
Phone/Fax: 604-757-3158 / (604) 757-4731
<http://www.EMSL.com> / vancouverlab@EMSL.com

EMSL Canada Order 691601428
Customer ID: 55DCSL97
Customer PO: 702358
Project ID:

**Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British
Columbia Regulation 188/2011 via EPA 600/R-93/116 Method**

Client Sample ID: B3B **Lab Sample ID:** 691601428-0008

Sample Description: S8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B3C

Lab Sample ID: 691601428-0009

Sample Description: S8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B4

Lab Sample ID: 691601428-0010

Sample Description: S8/TAPE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Clear	0%	100%	None Detected	

Client Sample ID: B5

Lab Sample ID: 691601428-0011

Sample Description: S1/PAPER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	White	80%	20%	None Detected	

Client Sample ID: B6A

Lab Sample ID: 691601428-0012

Sample Description: L2/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B6B

Lab Sample ID: 691601428-0013

Sample Description: L3/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B6C

Lab Sample ID: 691601428-0014

Sample Description: L4/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B7

Lab Sample ID: 691601428-0015

Sample Description: LA4/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

**EMSL Canada Inc.**

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EMSL Canada Order 691601428
Customer ID: 55DCSL97
Customer PO: 702358
Project ID:

**Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British
Columbia Regulation 188/2011 via EPA 600/R-93/116 Method**

Client Sample ID: B8 **Lab Sample ID:** 691601428-0016

Sample Description: S8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B9A **Lab Sample ID:** 691601428-0017

Sample Description: L2/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B9B **Lab Sample ID:** 691601428-0018

Sample Description: LA8/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B9C **Lab Sample ID:** 691601428-0019

Sample Description: LA14/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B10A **Lab Sample ID:** 691601428-0020

Sample Description: LA8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B10B **Lab Sample ID:** 691601428-0021

Sample Description: LA8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B10C **Lab Sample ID:** 691601428-0022

Sample Description: LA8/BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B11A **Lab Sample ID:** 691601428-0023

Sample Description: L2/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

**EMSL Canada Inc.**

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

EMSL Canada Order 691601428
Customer ID: 55DCSL97
Customer PO: 702358
Project ID:

**Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British
Columbia Regulation 188/2011 via EPA 600/R-93/116 Method**

Client Sample ID: B11B **Lab Sample ID:** 691601428-0024

Sample Description: LA8/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B11C **Lab Sample ID:** 691601428-0025

Sample Description: LA14/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B12A **Lab Sample ID:** 691601428-0026

Sample Description: L2/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B12B **Lab Sample ID:** 691601428-0027

Sample Description: LA8/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B12C **Lab Sample ID:** 691601428-0028

Sample Description: LA14/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Client Sample ID: B13A **Lab Sample ID:** 691601428-0029

Sample Description: N15 AIR VENT/PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray/White	0%	100%	None Detected	

Client Sample ID: B13B **Lab Sample ID:** 691601428-0030

Sample Description: N15 AIR VENT/PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray/White	0%	100%	None Detected	

Client Sample ID: B13C **Lab Sample ID:** 691601428-0031

Sample Description: N15 AIR VENT/PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	White	0%	100%	None Detected	



EMSL Canada Inc.

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EMSL Canada Order 691601428
Customer ID: 55DCSL97
Customer PO: 702358
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: B14A

Lab Sample ID: 691601428-0032

Sample Description: L2/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B14B

Lab Sample ID: 691601428-0033

Sample Description: LA8/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/01/2016	Gray	0%	100%	None Detected	

Client Sample ID: B14C

Lab Sample ID: 691601428-0034

Sample Description: LA14/GREY AIR DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/02/2016	Gray	0%	100%	None Detected	

Analyst(s):

Kathleen Cruz PLM (24)
Nicole Yeo PLM (10)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 11/03/2016 09:33:13

**EMSL Canada Inc.**

2756 Slough Street, Mississauga, ON L9T 5N4

Phone/Fax: 289-997-4602 / (289) 997-4607

<http://www.EMSL.com>torontolab@emsl.com

EMSL Canada Or 551611605

CustomerID: 55DCSL97

CustomerPO: 702358

ProjectID:

Attn: **Paul Smith**
ARCADIS Canada Inc.
121 Granton Drive
Unit 12
Richmond Hill, ON L4B 3N4

Phone: (905) 882-5984
Fax: (905) 882-8962
Received: 10/28/16 11:05 AM
Collected:

Project: 702358

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
L3	551611605-0001 Site: N21 Desc: PEACH	11/2/2016		<90 mg/Kg
L9	551611605-0002 Site: S15 Desc: PEACH	11/2/2016		<90 mg/Kg
L11	551611605-0003 Site: N8 Desc: PURPLE	11/2/2016		<90 mg/Kg
L16	551611605-0004 Site: N10 Desc: PEACH	11/2/2016		<90 mg/Kg
L17	551611605-0005 Site: N23 Desc: GREY	11/2/2016		160 mg/Kg
L18	551611605-0006 Site: L2 Desc: WHITE	11/2/2016		<90 mg/Kg
L19	551611605-0007 Site: 224 Desc: WHITE	11/2/2016		410 mg/Kg
L20	551611605-0008 Site: AHU Desc: WHITE	11/2/2016		2100 mg/Kg

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 11/04/2016 08:23:23

**EMSL Canada Inc.**

2756 Slough Street, Mississauga, ON L9T 5N4

Phone/Fax: 289-997-4602 / (289) 997-4607

<http://www.EMSL.com>torontolab@emsl.com

EMSL Canada Or 551612011

CustomerID: 55DCSL97

CustomerPO: 702358

ProjectID:

Attn: **Paul Smith**
ARCADIS Canada Inc.
121 Granton Drive
Unit 12
Richmond Hill, ON L4B 3N4

Phone: (905) 882-5984
Fax: (905) 882-8962
Received: 11/07/16 11:08 PM
Collected: 10/19/2016

Project: 702358

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
L6	551612011-0001 Site: LU1-S1	10/19/2016	11/10/2016	<90 mg/Kg
L7	551612011-0002 Site: LU1-N2	10/19/2016	11/10/2016	250 mg/Kg
L12	551612011-0003 Site: LU4-S13	10/19/2016	11/10/2016	<90 mg/Kg
L14	551612011-0004 Site: LU4-S22	10/19/2016	11/10/2016	<90 mg/Kg

Rowena Fanto, Lead Supervisor
or other approved signatory

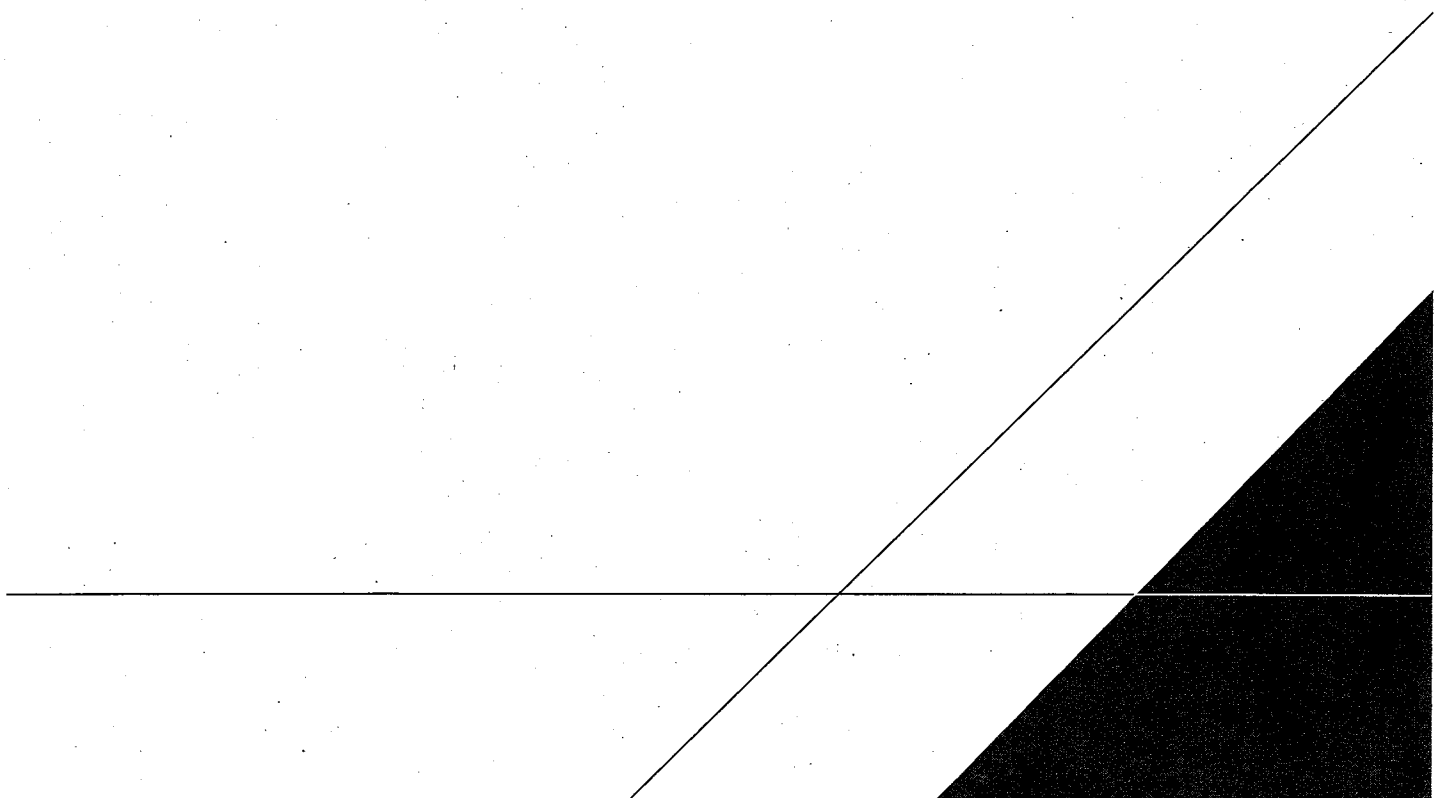
*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 11/14/2016 08:19:32

APPENDIX C

Photographs



Project Photographs



Photo: #1

Date:

October 18, 2016

Description:

Vent grill. Location of Samples B2A, B2B, B2C, B3A, B3B, B3C and B4

Location:

Living Unit LU-3, Room S8



Photo: #2

Date:

October 18, 2016

Description:

Location of Sample B5 (paper on outer edge of grill)

Location:

Living Unit LU-3, Room S1

Project Photographs



Photo: #3

Date:

October 18, 2016

Description:

Location of Sample L3

Location:

Living Unit LU-3, Room N21



Photo: #4

Date:

October 18, 2016

Description:

Location of Sample B6A

Location:

Living Unit LU-3, Room L2

Project Photographs



Photo: #5

Date:

October 18, 2016

Description:

Location of Sample B9A.

Location:

Living Unit LU-1, Room L2

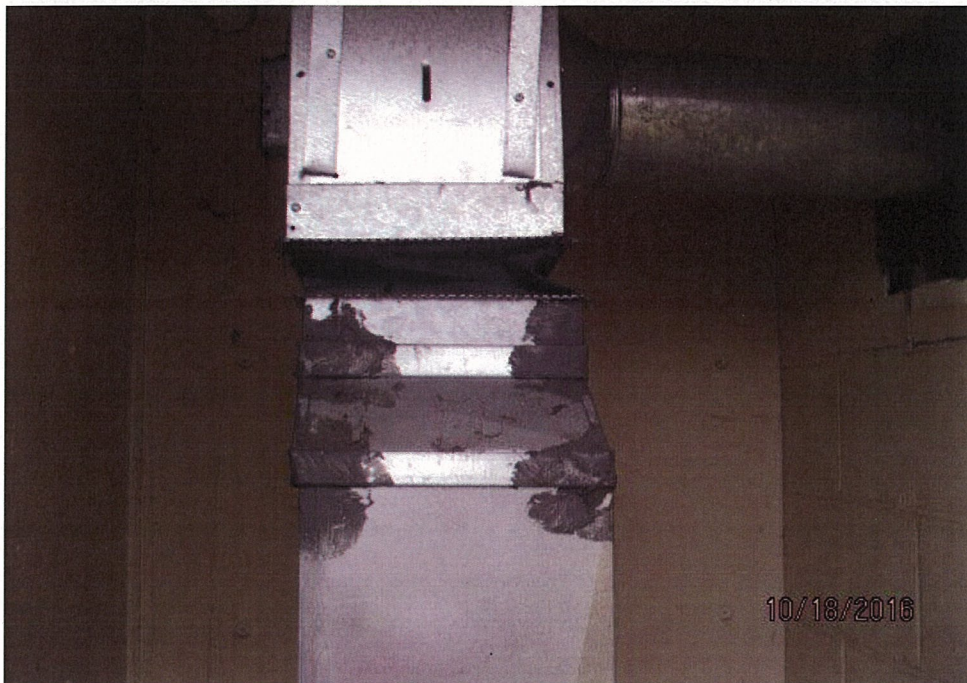


Photo: #6

Date:

October 18, 2016

Description:

Location of samples B9B,
B10A, B10B and B10C

Location:

Living Unit LU-1, Room LA8

Project Photographs



Photo: #7

Date:

October 18, 2016

Description:

Location of Samples B9B, B10A, B10B and B10C

Location:

Living Unit LU-1, Room LA8



Photo: #8

Date:

October 18, 2016

Description:

Location of Sample B9C

Location:

Living Unit LU-1, Room LA14

Project Photographs

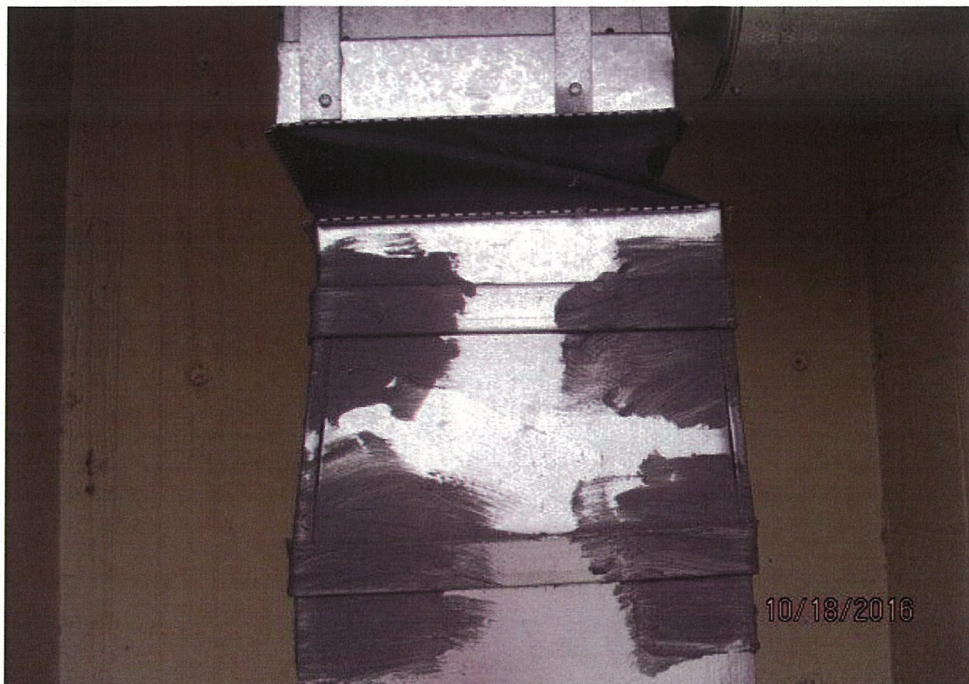


Photo: #9

Date:

October 18, 2016

Description:

Location of Sample B11B

Location:

Living Unit LU-2, Room LA8



Photo: #10

Date:

October 18, 2016

Description:

Location of Sample L9

Location:

Living Unit LU-2, Room S15

Project Photographs



Photo: #11

Date:

October 18, 2016

Description:

Location of Sample L11

Location:

Living Unit LU-2, Room N9



Photo: #12

Date:

October 18, 2016

Description:

Location of Samples B13A,
B13B and B13C

Location:

Living Unit LU-4, Room N15

Project Photographs

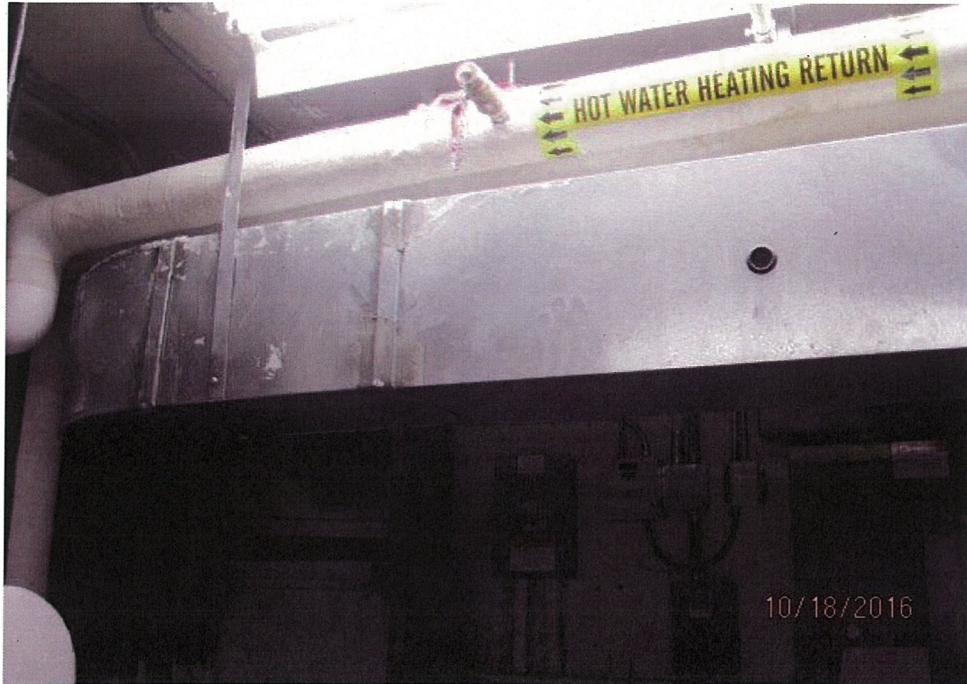


Photo: #13

Date:

October 18, 2016

Description:

Location of Samples B12A and B14A

Location:

Living Unit LU-4, Room L2



Photo: #14

Date:

October 18, 2016

Description:

Location of Samples B12B

Location:

Living Unit LU-4, Room L8

Project Photographs



Photo: #15

Date:
October 18, 2016

Description:
Location of Sample B12C

Location:
Living Unit LU-4, Room LA14

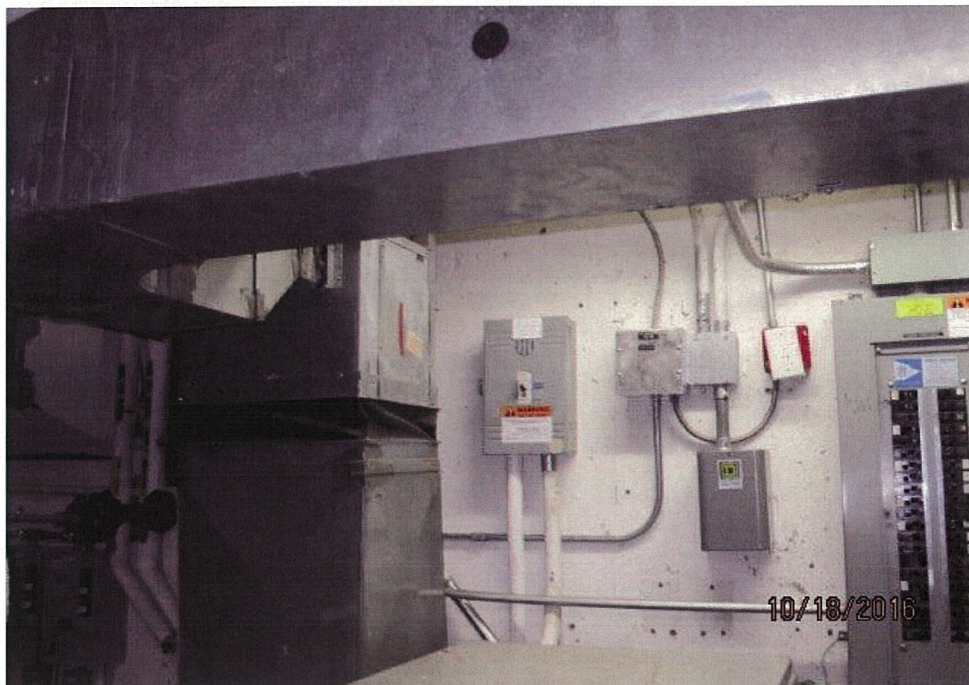


Photo: #16

Date:
October 18, 2016

Description:
Location of Samples B14A and
L18

Location:
Living Unit LU-5, Room L2

Project Photographs

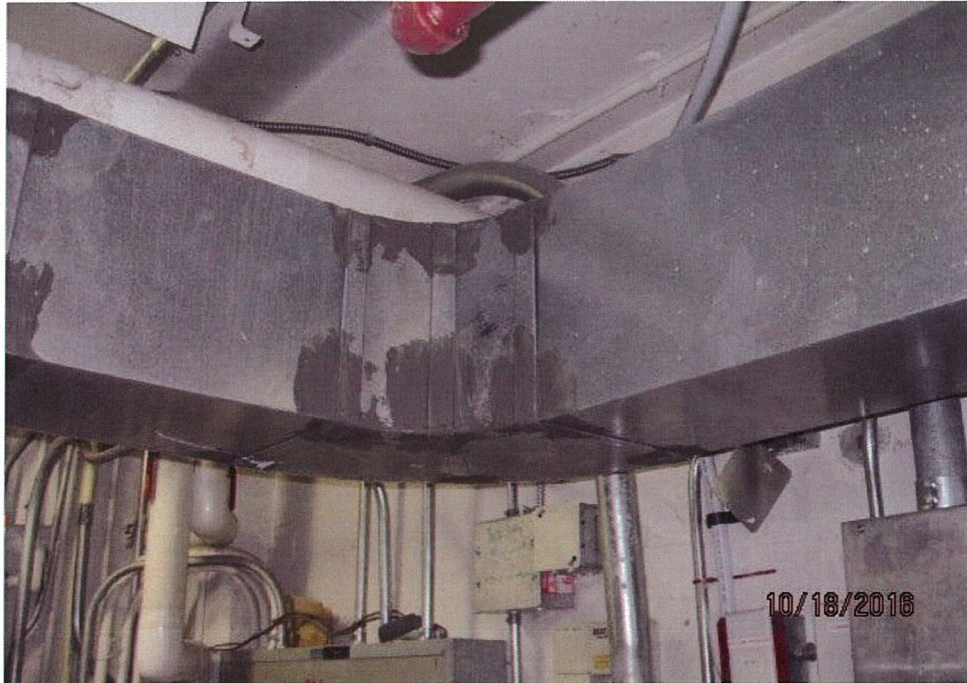


Photo: #17

Date:

October 18, 2016

Description:

Location of Samples B14A and L18

Location:

Living Unit LU-5, Room L2

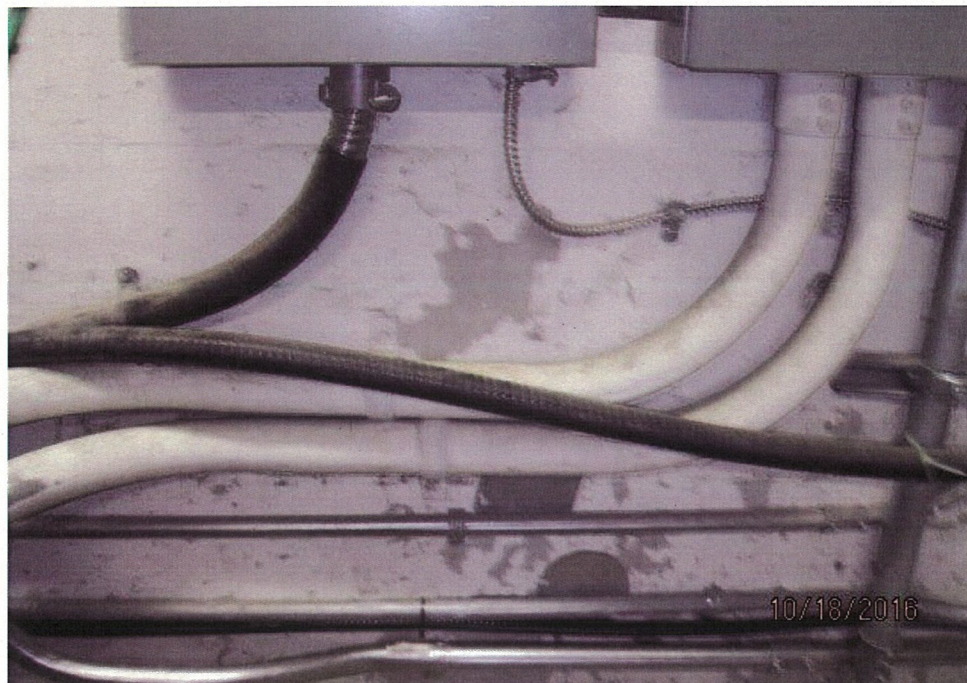


Photo: #18

Date:

October 18, 2016

Description:

Location of Sample L18, White wall paint

Location:

Living Unit LU-5, Room L2

Project Photographs



Photo: #19

Date:

October 18, 2016

Description:

Location of Sample L17

Location:

Living Unit LU-5, Room N23



Photo: #20

Date:

October 18, 2016

Description:

Location of Sample L6

Location:

Living Unit LU-1, Room S1

Project Photographs



Photo: #21

Date:
October 18, 2016

Description:
Location of Sample L7

Location:
Living Unit LU-1, Room N2



Photo: #22

Date:
October 18, 2016

Description:
Location of Sample L12

Location:
Living Unit LU-4, Room S13

Project Photographs

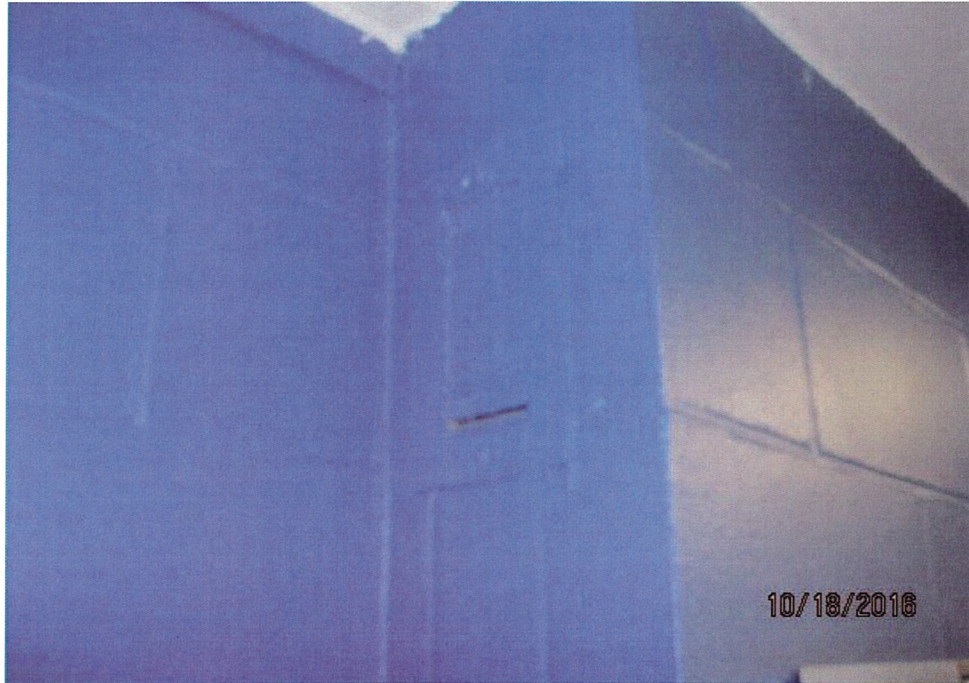


Photo: #23

Date:

October 18, 2016

Description:

Location of Sample L14

Location:

Living Unit LU-4, Room S22

Arcadis Canada Inc.

121 Granton Drive, Suite 12, Richmond Hill, Ontario L4B 3N4

Tel 905 882 5984

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