



FACILITIES MANAGEMENT

OPEN CALL FOR BIDS

FOR

**EN-123-21: Engineering Building,
Renovations to EN-4029**

Request for Open Call Number: **TFM-006-24**

Issued: March 4, 2024

Submission Deadline: **Thursday, March 21, 2024**
@ 3:00PM NST

REQUEST FOR OPEN CALL FOR BIDS INFORMATION SHEET

Request for Open Call			
Title:	EN-123-21: Engineering Building, Renovations to EN-4029		
Open Call #:	TFM-006-24	Issue Date:	March 4, 2024
Site Visit:	Location: Engineering Building, EN-4029		March 11, 2024 @ 9:00AM NST
Questions Deadline:	Eight (8) days prior to closing time, at 3:00pm (NST).	Closing Date & Time:	Thursday March 21, 2024 @ 3:00 pm NST
		Bid Submission Format:	opencalls@mun.ca
		Opening Date, Time & Location:	Thursday, March 21, 2024 @ 3:30 pm NST
			Via Conference line: 1-416-915-6530 (toll free) Access Code: 2773 450 4730 Attendee ID: Please press Pound(#)
Bids Irrevocable Period after Submission Deadline:			45 days (See section 1.6)
Bid Submission: Responses to this solicitation must be submitted by email to opencalls@mun.ca Email subject line must read: BID SUBMISSION: TFM-006-24 EN-123-21: Engineering Building, Renovations to EN-4029			

Inquiries and Communication

Inquiries and communication: Strategic Procurement Office, Memorial University of Newfoundland, opencalls@mun.ca. Inquiries accepted only via email. No phone calls will be accepted. **Please reference open call Title and Open Call # from above, ie: **TFM-006-24 EN-123-21: Engineering Building, Renovations to EN-4029** in subject line. Emails not containing this requirement information in the subject line will NOT receive a response.**

Bids submitted by fax, mail, courier, drop off or by any other means of delivery other than by email stated above shall not be accepted.

ABOUT MEMORIAL UNIVERSITY

As Newfoundland and Labrador's only university, Memorial has a special obligation to the people of this province. Established as a memorial to the Newfoundlanders who lost their lives on active service during the First and Second World Wars, Memorial University draws inspiration from these shattering sacrifices of the past as we help to build a better future for our province, our country and our world.

We are a multi-campus, multi-disciplinary, public university committed to excellence in teaching and learning, research and scholarship, and to public engagement and service. We strive to have national and global impact, while fulfilling our social mandate to provide access to university education for the people of the province and to contribute to the social, cultural, scientific and economic development of Newfoundland and Labrador and beyond.

The Memorial experience goes beyond academics; it invites a discovery of self, community and place. At Memorial, we celebrate our unique identity through the stories of our people – the work of scholars and educators, the ingenuity of students, the achievements of alumni – and the impact we collectively make in the province, the country and the world. Memorial is the natural place where people and ideas become.

Memorial University has more than 18,500 students and 3,600 faculty and staff spread across four campuses and nearly 100,000 alumni active throughout the world. From local endeavors to research projects of national importance, Memorial's impact is felt far and wide.

Mission, Vision and Values

Vision

Memorial University will be one of the most distinguished public universities in Canada and beyond, and will fulfill its special obligation to the people of Newfoundland and Labrador.

Mission

Memorial University is an inclusive community dedicated to innovation and excellence in teaching and learning, research, scholarship, creative activity, service and public engagement.

Memorial welcomes and supports students and scholars from all over the world and contributes knowledge and expertise locally, nationally and internationally.

Values

Excellence: Encouraging and promoting excellence through innovation and creativity, rigor and pragmatism.

Integrity: Being honest and ethical in all interactions, maintaining the highest ethical standards in teaching, research, public engagement and service.

Collegiality: Engaging others with respect, openness and trust in pursuit of a common purpose, having regard for individuals, ideals and the institution as a whole.

Inclusiveness and diversity: Embracing and acting on responsibility to guarantee diversity and equity.

Responsiveness: Being receptive to individuals and communities.

Accountability: Accepting responsibility for achievement of common goals and objectives.

Freedom and Discovery: Supporting the freedom to pursue knowledge that is based on individual and collective intelligence, curiosity, ingenuity and creativity.

Recognition: Acknowledging, tangibly, all aspects of university enterprise including teaching and learning, research, scholarship, creative activity and public engagement.

Responsibility to place: Valuing and fulfilling the special obligation to the people of Newfoundland and Labrador by supporting and building capacity for excellence that:

- addresses needs and opportunities for Newfoundland and Labrador;
- engages the university community on matters of national and international significance;
- produces and delivers academic programs of national and international calibre; and,
- Recognizes the dynamic opportunities presented by a multi-campus institution.

Responsibility to learners: Recognizing students as a first priority and providing the environment and support to ensure their academic and personal success.

Interdisciplinary collaboration: Supporting overarching themes in all pursuits that cut across academic units and address significant opportunities and challenges for which Memorial is particularly well positioned to build nationally and internationally recognized capacity.

Sustainability: Acting in a manner that is environmentally, economically and socially sustainable in administration, academic and research programs.

Memorial's exceptional staff and students contribute to the vitality and positive environment of the university through active community engagement. Memorial University has always been a publicly engaged institution. Since the founding of the University in 1949, the work of many of Memorial's students, faculty and staff has emphasized the importance of strong, sustained partnerships with members of the public of Newfoundland and Labrador and beyond.

Faculty and Staff

Memorial is one of the largest employers in the province, with approximately 3,600 faculty and staff. Memorial has been recognized as an Employer of Distinction by the Newfoundland and Labrador Employers' Council, which is reflective of its investment in comprehensive benefits, services such as childcare and recreation facilities, emphasis on work-life balance, and its vibrant work environment.

Governance and Administration

The management, administration and control of the property, revenue, business and affairs of the University are vested in a Board of Regents. The Board is appointed under the *Memorial University Act* and is responsible for the management, administration, and control of the property, revenue, business and affairs of the university. Matters of an academic character are in general charge of the Senate of the University.

For more information on Memorial University of Newfoundland, please visit:
Memorial's home page: <http://www.mun.ca/>

Territory Acknowledgements at Memorial:

We acknowledge that the lands on which Memorial University's Campus are situated are in the traditional territories of diverse Indigenous groups and we acknowledge with respect the diverse histories and cultures of the Beothuk, *Mi'kmaq*, *Innu*, and *Inuit of this province*.

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**SPECIFICATIONS AND DRAWINGS
LOCATED AT THE END OF THIS DOCUMENT**

APPENDIX B – SUBMISSION FORM

1. Bidder Information

Please fill out the following form, naming one person to be the bidder's contact for the Open Call process and for any clarifications or communication that might be necessary.	
Full Legal Name of Bidder:	
Any Other Relevant Name under which Bidder Carries on Business:	
Street Address:	
City, Province/State:	
Postal Code:	
Phone Number:	
Fax Number:	
Company Website (if any):	
Bidder Contact Name and Title:	
Bidder Contact Phone:	
Bidder Contact Fax:	
Bidder Contact Email:	

2. Offer

The bidder has carefully examined the Open Call documents and has a clear and comprehensive knowledge of the Deliverables required under the Open Call. By submitting a bid, the bidder agrees and consents to the terms, conditions and provisions of the Open Call, including the Form of Agreement, and offers to provide the Deliverables in accordance therewith at the rates set out in the completed Pricing Form (Appendix C1 and/or C2 and/or C3).

3. Rates

The bidder has submitted its rates in accordance with the instructions in the Open Call and in the Pricing Form (Appendix C1 and/or C2 and/or C3). The bidder confirms that it has factored all of the provisions of Appendix A, including insurance and indemnity requirements, into its pricing assumptions and calculations.

4. Addenda

- 4.1** The bidder is deemed to have read and accepted all addenda issued by the Owner. The onus is on bidders to make any necessary amendments to their bids based on the addenda. The bidder is required to confirm that it has received all addenda by listing the addenda numbers in table below: **(Listing of individually the numbers of each Addendum received in the blank space)**

NOTE: FAILURE TO COMPLETE “TABLE: ADDENDA RECEIVED” LOCATED BELOW SHALL RESULT IN BID DISQUALIFICATION:

TABLE 1.10: ADDENDA RECEIVED

Bidders who fail to complete the above table will be deemed to have not received all posted addenda and shall be deemed **non-compliant**.

5. No Prohibited Conduct

The bidder declares that it has not engaged in any conduct prohibited by this Open Call.

6. Disclosure of Information

The bidder hereby agrees that any information provided in this bid, even if it is identified as being supplied in confidence, may be disclosed where required by law or by order of a court or tribunal. The bidder hereby consents to the disclosure, on a confidential basis, of this bid by the Owner to the advisers retained by the Owner to advise or assist with the Open Call process, including with respect to the evaluation of this bid.

7. Bid Irrevocable

The bidder agrees that its tender shall be irrevocable for a period of **45** days running from the moment that the Submission Deadline passes.

8. Execution of Agreement

The bidder agrees that in the event its bid is selected by the Owner, in whole or in part, it will finalize and execute the Agreement in the form set out in Appendix A (or in a form mutually acceptable to the parties) to this Open Call in accordance with the terms of this Open Call . Failure to submit this signature section will render the proposal **NON-COMPLIANT** and the proposal will be disqualified.

BIDDER SIGNATURE FORM:

BIDDERS MUST COMPLETE THE BIDDER SIGNATURE FORM. ANY BIDS RECEIVED WITHOUT THE BIDDER CONTACT FORM COMPLETED WILL BE DEEMED NON- COMPLIANT

(See Part 1 section 1.8 for Electronic Signature acceptance)

Signature of Witness

Signature of Bidder Representative

Name of Witness

Name of Bidder Representative

Title of Bidder Representative

Date

I have the authority to bind the bidder.

**IN SIGNING THIS PAGE AND
SUBMITTING YOUR PROPOSAL, THE
PROONENT ACKNOWLEDGES
HAVING READ, UNDERSTOOD AND
AGREED TO THE TERMS AND
CONDITIONS OF THIS DOCUMENT**

APPENDIX C1 – PRICING FORM

1. INSTRUCTIONS ON HOW TO COMPLETE THE PRICING FORM

- Rates must be provided in Canadian Dollars
- Rates quoted by the bidder must be all-inclusive and must include all labor and material costs, all travel and carriage costs, all insurance costs, all costs of delivery to the Owner, all costs of installation and set-up, including any pre-delivery inspection charges, and all other overhead, including any fees or other charges required by law
- Owner: Having carefully examined the site and all conditions affecting the proposed work as well as the Bid Documents including the Drawings and Specifications, all Addenda and the Instructions to bidders, I/We, the undersigned, hereby offer to furnish all necessary labour, materials, superintendence, plant, tools, equipment, etc., required to complete all work requisite and necessary for the proper execution of this Contract, expeditiously and in the satisfactory manner and accept in full payment therefore a stipulated sum of:

	Contract Bid HST Excluded	
A: Subtotal		HST EXCLUDED
B: Sum of Allowances (Section 01 21 00)	\$8,695.65	HST EXCLUDED
C: Total: \$(A+B)		HST EXCLUDED

I/We agree to commence work within two (2) weeks after the acceptance of my/our Bid and complete the work in _____ weeks from the acceptance of the Bid and to coordinate the scheduling of our work with that of all Subcontractors working on the Project. The time of completion indicated herein is required and will be a significant factor in assessing bids.

2. THE DELIVERABLES:

EN-123-21: Engineering Building, Renovations to EN-4029
as per specifications listed in Appendix A

3. MANDATORY SUBMISSION REQUIREMENTS

(a) Submission Form (Appendix B)

Each bid must include a Submission Form (Appendix B) completed and signed by an authorized representative of the bidder.

(b) Each bid must include Pricing Form (Appendix C1) as per instructions on form.

(c) Where Appendix C2 and C3 are required, they must be included in bid submission.

APPENDIX C2 – UNIT RATES

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APPENDIX C3- FURNITURE BIDDING TABLE

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APPENDIX D- LIST OF SUBCONTRACTORS

Herewith is the list of Subcontractors, Suppliers and/or Manufacturers referred to in Section no. **5.1 of Part 5 of the Open Call and Acceptance Form**. The Subcontractors and Suppliers whose bids have been used in the preparation of this Bid must be listed in full including work to be done by own forces (B.O.F.). By Own Forces will be considered valid and satisfactory only if, prior to award, the supplier provides three (3) current (< 3 years) references of satisfactory completion of trade work of similar **scale, scope and complexity** as that described within the Bid documents. Trade certifications may be requested in addition to the references above. The determination of suitability is entirely at the discretion of the owner and shall be based on submitted documentation. The owner may use their knowledge and understanding of experience and performance of the Contractor on past work in lieu of this submission. The list will be subject to the approval of the Owner.

NOTE: FAILURE TO COMPLETE THIS PORTION OF THE BID SUBMISSION SHALL RESULT IN DISQUALIFICATION.

The trades below, if listed, have been identified by the owner, however it is the Bidder's responsibility to identify all applicable subtrades.

TRADE/DIVISION	SUBCONTRACTOR - SUPPLIER - MANUFACTURER
Hazardous Materials Abatement	
Demolition	
Masonry	
Metal Stud & Gypsum Board	
Millwork	
Doors & Frames	
Flooring	
Plaster & Paint	
Furnishings	
Plumbing	
HVAC	
Controls	
Electrical	
Fire Alarm	
ADD TRADES AS REQUIRED	

APPENDIX E – PROJECT REFERENCE (ROOFING PROJECTS ONLY)
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DEPARTMENT OF FACILITIES MANAGEMENT

GENERAL CONDITIONS

AND

AGREEMENT BETWEEN OWNER AND CONTRACTOR

FOR

THE STIPULATED PRICE CONTRACT

May 2023

**GENERAL CONDITIONS AND AGREEMENT
BETWEEN OWNER AND CONTRACTOR FOR THE STIPULATED PRICE CONTRACT**

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1.0 GENERAL CONDITIONS

1.1.0 DEFINITIONS

1.1.1 Contract Documents

The Contract Documents consist of the Instructions to bidders, Executed Agreement between the Owner and the Contractor, General Conditions of Contract, Supplementary General Conditions of Contract, Special Conditions, Campus Safety and Health Regulation, Contractor Performance Evaluations, Specifications, Drawings and such other documents forming part of the open call, including all amendments thereto incorporated before their execution and subsequent amendments thereto made pursuant to the provisions of the Contract or agreed upon between the parties. The successful bid and any Addenda to the Specifications issued during the bidding period shall also form part of the Contract Documents.

1.1.2 Owner, Engineer/Architect, Contractor

The Owner, Engineer/Architect and Contractor are the persons, firms or corporation identified as such in the Agreement. The term Owner, Engineer/Architect and Contractor means the Owner, Engineer/Architect and Contractor or their authorized representatives as designated by each party in writing.

1.1.3 Subcontractors

A Subcontractor is a person, firm or corporation having a direct contract with the Contractor to perform a part or parts of the Work included in the Contract, or to supply products worked to a special design according to the Contract Documents, but does not include one who merely supplies products not so worked.

1.1.4 The Project

The Project is the total construction contemplated of which the Work performed under the Contract Documents may be the whole or a part.

1.1.5 The Work

The Work means the total construction and related services required by the Contract Documents.

1.1.6 Place of Work

The Place of Work is the designated site or location of the project of which the Work may be the whole or a part.

1.1.7 Products/Materials/Equipment

The term Products/Materials/Equipment means all materials, machinery, equipment and fixtures forming the Work as required by the Contract Documents but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work and normally referred to as construction machinery and equipment.

1.1.8 Other Contractor

The term Other Contractor means any persons, firm or corporation employed by or having a separate contract directly or indirectly with the Owner for Work other than that required by the Contract Documents.

1.1.9 Time

- a) The Contract Time is the time stated in the Open Call for Bid and Acceptance Form for substantial performance of the Work.
- b) The date of substantial performance of the Work is the date certified by the Engineer/Architect.
- c) The term day, as used in the Contract Documents, shall mean the calendar day.
- d) The term working day means any day observed by the construction industry in the area of the place of the Work.

1.1.10 Substantial Performance of the Work

A Contract shall be deemed to be substantially performed:

- a) When the Work or a substantial part thereof is ready for use or is being used for the purpose intended; and
- b) When the Work to be done under the Contract is capable of completion or correction at a cost of not more than:
 - (i) 3% (Three per centum) of the first two hundred and fifty thousand dollars (\$250,000) of the Contract Price;
 - (ii) 2% (Two per centum) of the next two hundred and fifty thousand dollars (\$250,000) of the Contract Price; and
 - (iii) 1% (One per centum) of the balance of the Contract Price.
- c) When the Work or a substantial part thereof is ready for use or is being used for the purpose intended and where the Work cannot be completed expeditiously for

reasons beyond the control of the Contractor, the value of the remaining Work to be completed shall be deducted from the Contract Price in determining substantial performance.

1.1.11 Total Performance of the Work

Total Performance of the Work shall mean when the entire Work except those items arising from the provision **2.26.0 WARRANTY** has been performed to the requirements of the Contract Documents and is so certified by the Engineer/Architect.

1.1.12 Changes in the Work

Changes in the Work means additions, deletions or other revisions to the Work within the general scope of Work as contemplated by the Contract Documents.

1.1.13 Extra Work

Extra Work means any additional work or service, the performance of which is beyond the scope of Work as contemplated by the Contract Documents.

2.2.0 DOCUMENTS

2.2.1 The Contract Documents shall be signed in triplicate by the Owner and the Contractor.

2.2.2 Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

2.2.3 In the event of conflicts between Contract Documents, the following shall apply:

- a) Documents of later date shall govern;
- b) Figured dimensions shown on the drawings shall govern even though they may differ from scaled dimensions on the same drawing;
- c) Drawings of larger scale shall govern over those of smaller scale of the same date;
- d) Specifications shall govern over drawings;
- e) Special Conditions shall govern over Specifications;
- f) The General Conditions of Contract shall govern over Specifications;
- g) Supplementary General Conditions shall govern over the General Conditions of the Contract;

h) The Executed Agreement between the Owner and the Contractor shall govern over all documents.

2.2.4 The Contractor will be provided, without charge, up to twelve (12) sets of Contract Documents or parts thereof as are reasonably necessary for the performance of the Work.

2.2.5 The Contractor shall keep a copy of all current Contract Documents and shop drawings on the site, in good order and available to the Engineer/Architect and or their representatives. This requirement shall not be deemed to include the executed Contract Documents.

2.2.6 Drawings, specifications, models and copies thereof furnished to the Contractor are to be used only with respect to the Work. Such documents and models are not to be otherwise used or revised in any manner without the written authorization of the Owner.

2.2.7 Models furnished by the Contractor at the Owner's expense are the property of the Owner.

2.3.0 ADDITIONAL INSTRUCTIONS AND SCHEDULE OF WORK

2.3.1 During the progress of the Work, the Engineer/Architect shall furnish to the Contractor such additional instructions as may be necessary to supplement the Contract Documents. All such instructions shall be consistent with the intent of the Contract Documents.

2.3.2 Additional instructions may include minor changes to the Work which affect neither the Contract Price nor the Contract Time.

2.3.3 Additional instructions may be in the form of drawings, samples, models or written instructions.

2.3.4 Additional instructions will be issued by the Engineer/Architect with reasonable promptness and in accordance with any schedule agreed upon for such instructions.

2.3.5 The Contractor shall prepare and update, as required, a construction schedule indicating the timing of major activities of the Work. The schedule shall be designed to conform with the Contract Time. The schedule shall be submitted to the Engineer/Architect within seven (7) days of the date of the Owner's letter of award. The contractor shall monitor the progress of the Work relative to the schedule and advise the Engineer/Architect of any revisions required as a result of delays, as provided for in **2.5.0 DELAYS**, and indicating what action will be taken to complete the Work within the Contract Time.

2.4.0 ENGINEER/ARCHITECT'S DECISIONS

- 2.4.1** The Engineer/Architect, in the first instance, shall decide on questions arising under the contract Documents and interpret the requirements therein. Such decisions shall be given in writing.
- 2.4.2** The Contractor shall notify the Engineer/Architect in writing within fourteen (14) days of receipt of a decision of the Engineer/Architect referred to in 2.4.1, should they hold that a decision by the Engineer/Architect is in error and/or at variance with the Contract Documents. Unless the Contractor fulfils this requirement, subsequent claims by them for extra compensation arising out of the decision will not be accepted.
- 2.4.3** If the question of error and/or variance is not resolved immediately, and the Engineer/Architect decides that the disputed work shall be carried out, the Contractor shall act according to the Engineer/Architect's written decision.

Any questions of change in Contract Price and/or extension of Contract Time due to such error and/or variance shall be decided as provided in **2.11.0 DISPUTES**.

2.5.0 DELAYS

- 2.5.1** If it can be clearly shown that the Contractor is delayed in the performance of the Work by any act or fault of the Owner, Engineer/Architect, then the Contract Time shall be extended for such reasonable time as the Engineer/Architect may decide in consultation with the Owner and the Contractor. The Contractor shall be entitled to be reimbursed for any costs incurred by them as a result of such a delay occasioned by the act or fault, provided that it can be clearly shown that the Contractor's forces cannot work efficiently elsewhere on the project and that the incurred cost is limited to that which could not reasonably have been avoided.
- 2.5.2** If the Contractor is delayed in the performance of the Work by a Stop Work Order issued by any court or other public authority and providing that such order was not issued as the result of any act or fault of the Contractor or of anyone employed by them directly or indirectly then the Contract Time shall be extended for such reasonable time as the Engineer/Architect may decide in consultation with the Contractor.
- 2.5.3** If the Contractor is delayed in the performance of the Work by civil disorders, labour disputes, strikes, lockouts, (including lockouts decreed or recommended for its members by a recognized Contractor's Association, of which the Contractor is a member) fire, unusual delay by common carriers or unavoidable casualties, or without limit to any of the foregoing, by any cause of any kind whatsoever beyond the Contractor's control, then the Contract Time shall be extended for such reasonable time as may be decided by the Engineer/Architect in consultation with the Owner and the Contractor, but in no case shall the extension of time be less than the time lost as the result of the event causing the delay, unless such shorter extension of time be agreed to by the Contractor.

2.5.4 No extension shall be made for delays unless written notice of claims is given to the Engineer/Architect within fourteen (14) days of its commencement, providing that in the case of the continuing cause of delay one notice shall be necessary.

2.5.5 If no schedule is provided under **2.3.0 ADDITIONAL INSTRUCTIONS AND SCHEDULE OF WORK**, no claim for delay will be considered because of failure to furnish instructions until fourteen (14) days after a demand for such instructions had been made and not then unless such claim is reasonable.

2.6.0 OWNER'S RIGHT TO PERFORM WORK, STOP WORK AND/OR TERMINATE CONTRACT

2.6.1 If the Contractor should be adjudged bankrupt or makes a general assignment for the benefit of creditors because of their insolvency or if a Receiver is appointed on account of their insolvency, the Owner may, without prejudice to any other right or remedy they may have, by giving the Contractor or Receiver or Trustee in Bankruptcy written notice, terminate the Contract. If a Performance Bond has been provided by the Contractor guaranteeing faithful performance of the Work, the Owner shall give written notice to the Surety invoking the terms of the bond.

2.6.2 The Owner may notify the Contractor in writing that they are in default of their contractual obligations, if the Contractor:

- a) Fails to proceed regularly and diligently with the Work; or
- b) Without reasonable cause wholly suspends the carrying out of the Work before the completion thereof; or
- c) Refuses or fails to supply sufficient, properly skilled workmen for proper workmanship, products or construction machinery and equipment for the scheduled performance of the Work within five (5) working days of receiving written notice from the Engineer/Architect except in those cases provided in **2.5.0 DELAYS**; or
- d) Fails to make payments due to their Subcontractors, their Suppliers for their workmen; or
- e) Persistently disregards laws or ordinances, or the Engineer/Architect's instructions; or
- f) Otherwise violates the provisions of their Contract to a substantial degree.

Such written notice by the Owner shall instruct the Contractor to correct the default within five (5) working days from the receipt of the written notice. If a Performance Bond has been provided by the Contractor, a copy of such written notice will be provided to the Surety.

- 2.6.3** If the correction of the default cannot be completed within the five (5) working days specified, the Contractor shall be considered to be in compliance with the Owner's instruction if they:
- a) Commence the correction of the default within the specified time; and
 - b) Provide the Owner with an acceptable schedule for such correction; and
 - c) Complete the correction in accordance with such schedule.
- 2.6.4** If the Contractor fails to correct the default within the time specified or subsequently agreed upon, the Owner may, without prejudice to any other right or remedy they may have:
- a) Correct such default and deduct the cost thereof as certified by the Engineer/Architect from any payment due under the Contract; or
 - b) Terminate the Contract by written notice to the Contractor. If a Performance Bond has been provided by the Contractor, the Owner will provide the Surety with a copy of such notice.
- 2.6.5** If the Owner terminates the Contract under the conditions set out above, they are entitled to:
- a) Take possession of the premises and products and utilize the temporary buildings, plants, tools, construction machinery and equipment, goods and materials, intended for, delivered to and placed on or adjacent to the Work and may complete the Work by whatever method they may deem expedient but without undue delay or expense;
 - b) Withhold any further payments to the Contractor until the Work is finished;
 - c) Upon total performance of the Work, charge the Contractor the amount by which the full cost of finishing the Work as certified by the Engineer/Architect including compensation to the Engineer/Architect for their additional services and a reasonable allowance to cover the cost of any corrections required by **2.26.0 WARRANTY** exceeds the unpaid balance of the Contract Price; or if such cost of finishing the Work is less than the unpaid balance of the Contract Price, pay the Contractor the difference;
 - d) On expiry of the warranty period, charge the Contractor the amount by which the cost of corrections under **2.26.0 WARRANTY** exceeds the allowance provided for such corrections, or if the cost of such corrections is less than the allowance, pay the Contractor the difference;

e) Invoke the terms of the Performance Bond if such Bond has been provided under the Contract.

2.6.6 The Contractor's obligation under the Contract as to the performance of the Work up to the time of termination will remain in force after such termination.

2.7.0 CONTRACTOR'S RIGHT TO STOP WORK AND/OR TERMINATE CONTRACT

2.7.1 If the Owner should be adjudged bankrupt or makes a general assignment for the benefit of creditors or if a Receiver is appointed on account of their insolvency, the Contractor may, without prejudice to any other right or remedy they may have, by giving the Owner written notice, terminate the Contract.

2.7.2 If the Work should be stopped or otherwise delayed for a period of thirty (30) days or more under an order of any court or other public authority and providing that such order was not issued as the result of any act or fault of the Contractor or of anyone directly or indirectly employed by him, the Contractor may, without prejudice to any other right or remedy they may have, by giving the Owner fifteen (15) days' written notice, terminate the Contract.

2.7.3 The Contractor may notify the Owner in writing that the Owner is in default of their contractual obligations if:

- a) The Engineer/Architect fails to issue a certificate in accordance with **2.16.0 CERTIFICATES AND PAYMENTS;**
- b) The Owner fails to pay the Contractor when due any amount certified by the Engineer/Architect and verified by the audit of the Owner;
- c) The Owner violates the provisions of the Contract to a substantial degree.

Such written notice shall advise the Owner that if such default is not corrected within fifteen (15) days from the receipt of the written notice, the Contractor may, without prejudice to any other right or remedy they may have, stop the Work and/or terminate the Contract.

2.7.4 If the Contractor terminates the Contract under the conditions set out above, they shall be entitled to be paid for all work performed including reasonable overhead and profit and for any loss sustained upon products, construction machinery and equipment and other damages as the Contractor may have sustained as a result of the termination of the Contract.

2.8.0 OTHER CONTRACTORS

- 2.8.1** The Owner reserves the right to let separate contracts in connection with the project of which the Work is part or do certain work by their own forces.
- 2.8.2** The Owner shall, in such cases, coordinate the Work and insurance coverage of other Contractors as it affects the Work of this Contract.
- 2.8.3** The Contractor shall coordinate their work with that of other Contractors and connect as specified or shown in the Contract Documents. Any change in the costs incurred by the Contractor in the planning and performance of such work which was not shown or included in the Contract Documents as of the date of signing the Contract, shall be evaluated as provided under **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK** and authorized as provided in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK**.
- 2.8.4** The Contractor shall report to the Engineer/Architect any apparent deficiencies in other Contractor's work which would affect this Contract immediately as they come to their attention and shall confirm such report in writing. Failure by the Contractor to so report shall invalidate any claims against the Owner by reason of the deficiencies of other Contractor's work except as to those of which they were not reasonably aware.

2.9.0 ASSIGNMENT

- 2.9.1** The Contractor shall not assign the Contract or any part thereof or any benefit or interest therein or thereunder without the written consent of the Owner.

2.10.0 SUBCONTRACTORS

- 2.10.1** The Contractor agrees to preserve and protect the rights of the Owner under the Contract with respect to any work to be performed under subcontract. The Contractor shall:
- a) Require their Subcontractors to perform their work in accordance with and subject to the terms and conditions of the Contract Documents; and
 - b) Be fully responsible to the Owner for acts and omissions of their Subcontractors and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by them.

The Contractor, therefore, agrees that they will incorporate all the terms and conditions of the Contract Documents into all Subcontractor Agreements they enter into with their Subcontractors.

- 2.10.2** The Contractor shall employ those Subcontractors proposed by them in writing and accepted by the Owner prior to the signing of the Contract for such portions of the Work as may be designated in the bidding requirements.
- 2.10.3** The Owner may, for reasonable cause, object to the use of a proposed Subcontractor and require the Contractor to employ one of the other Subcontractors.
- 2.10.4** In the event that the Owner requires a change from any proposed Subcontractor, the Contract price shall be adjusted by the difference in cost occasioned by such required change.
- 2.10.5** The Contractor shall not be required to employ as a Subcontractor any person or firm to whom they may reasonably object.
- 2.10.6** The Engineer/Architect may, upon reasonable request and at their discretion, provide to a Subcontractor information as to the percentage of the Subcontractor's work which has been certified for payment.
- 2.10.7** Nothing contained in the Contract Documents shall create any contractual relationship between any Subcontractor and the Owner.
- 2.11.0 DISPUTES**
- 2.11.1** Differences between the parties to the Contract as to the interpretation, application or administration of this Contract or any failure to agree where agreement between the parties is called for, herein collectively called disputes, which are not resolved in the first instances by decision of the Engineer/Architect pursuant to the provisions of **2.4.0 ENGINEER/ARCHITECT'S DECISIONS** shall be settled in accordance with the requirement of the General Conditions.
- 2.11.2** The Claimant shall give written notice of such dispute to the other party no later than fourteen (14) days after the receipt of the Engineer/Architect's decisions given under **2.4.0 ENGINEER/ARCHITECT'S DECISIONS**. Such notice shall set forth particulars of the matters in dispute, the probable scope, extent and value of the dispute and relevant provisions of the Contract Documents. The other party shall reply to such notice no later than fourteen (14) days after they receive or are considered to have received it, setting out in such reply their grounds and other relevant provisions of the Contract Documents.
- 2.11.3** Pending settlement of the dispute, the Engineer/Architect will give such instructions as, in their opinion, are necessary for the proper performance of the Work or to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim they may have. If it is subsequently determined that such instructions were in error or at variance with the Contract Documents, the Owner shall pay the Contractor cost incurred by the Contractor in carrying out such instructions which they were

required to do beyond what the Contract Documents correctly understood and interpreted would have required them to do, including costs resulting from interruption of the Work.

2.11.4 It is agreed that no act by either party shall be construed as a renunciation or waiver of any of their rights or recourse, provided they have given the notices in accordance with Paragraph 2.11.2 and have carried out the instructions as provided in Paragraph 2.11.3.

2.11.5 If the dispute or claim cannot be resolved to the satisfaction of both parties, either party may refer the matter to such judicial tribunal as the circumstances require.

2.11.6 In recognition of the obligation of the Contractor to perform the disputed work as provided in Paragraph 2.11.3, it is agreed that settlement of dispute proceedings may be commenced immediately following the dispute in accordance with the foregoing settlement of dispute procedures.

2.12.0 INDEMNIFICATION

2.12.1 Except as provided in Paragraph 2.10.2, the Contractor shall be liable for and shall indemnify and hold harmless the Owner and the Engineer/Architect, their agents and employees from and against all claims, demands, losses, costs, damages, actions, suits or proceedings whatsoever arising under any statute or Common law.

a) In respect of personal injury to or the death of any person whomsoever arising out of or in the course of or caused by the carrying out of the Work; and

b) In respect of any injury or damage whatsoever to any property, real or personal or any chattel real, insofar as such injury or damage arises out of or in the course of or by reason of the carrying out of the Work.

2.12.2 The Contractor shall not be liable under Paragraph 2.12.1 if the injury, death, loss or damage is due to any act or neglect of the Owner or Engineer/Architect, their agents or employees.

2.13.0 CHANGES IN THE WORK AND EXTRA WORK

2.13.1 The Owner may, without invalidating the Contract, make changes by altering, adding to or deducting from the Work, with the Contract Price and the Contract Time being adjusted accordingly; and

2.13.2 No change in the Work shall be made without prior written order from the Owner, and no claim for an addition or deduction to the Contract Price or change in the Contract Time shall be valid unless so ordered and at the same time valued or agreed to be valued as provided in **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK**. Signed faxed copies are acceptable at the discretion of the Owner.

2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK

2.14.1 The value of any change shall be determined in one or more of the following methods:

- a) By estimate and acceptance in a lump sum;
- b) By unit prices subsequently agreed upon;
- c) By cost and a fixed or percentage fee.

In the case of changes in the Work valued as outlined in Paragraph 2.14.1(a) (as will be the usual case), the Contractor will submit an itemized estimate of all materials and labour (including Subcontractor's work) to complete the change.

In the case of changes in the Work as valued in Paragraph 2.14.1 (c), the Contractor shall submit detailed invoices, vouchers and time sheets for all materials and labour to complete the change.

The submissions in both cases shall be in the manner acceptable to the Engineer/Architect and will show separately the following percentages for overhead and profit:

- (i) Subcontractors shall include, in the breakdown, their 15 percent mark-up (10 percent of the estimated cost for the overhead and 5 percent for profit).
- (ii) The Contractor shall include, in the breakdown, the percentages as outlined in (i) for the overhead and profit on their portion of the Work.
- (iii) The Contractor shall add 10 percent to the Subcontractor's pricing for their own profit and overhead combined.

2.14.2 Notwithstanding the provisions of Paragraph 2.14.1, in case of changes in the Work, the amount charged for equipment rentals shall be that provided in the rental Contract, and no additional amount shall be paid as markup for overhead or profit for the Contractor or Subcontractor.

2.14.3 When a change in the Work is proposed or required, the Contractor shall present to the Engineer/Architect for approval their claim for the change in the Contract Price and/or change in the Contract Time in a form acceptable to the Engineer/Architect and including the appropriate documentation. The Engineer/Architect shall satisfy themselves as to the correctness of such claim, and when approved by the Owner, a change order will be issued to the Contractor to proceed with the change. The value of Work performed in the change shall be included for payment with the regular certificates for payment.

- 2.14.4** In the case of changes in the Work to be paid for under methods (b) and (c) of Paragraph 2.14.1, the form of presentation of costs and methods of measurement shall be agreed to by the Engineer/Architect and Contractor before proceeding with the change. The Contractor shall keep accurate records, as agreed upon, of quantities or costs and present an account of the cost of the change in the Work, together with vouchers where applicable.
- 2.14.5** If the method of valuation, measurement and the change in Contract Price and/or change in Contract Time cannot be promptly agreed upon, and the change is required to be proceeded with, then the valuation, measurement and the change in Contract Price and/or Contract Time will be subject to final determination in the manner set out in **2.11.0 DISPUTES**. In this case, the Engineer/Architect shall, with the consent of the Owner, issue a written authorization for the change setting out the method of valuation and, if by lump sum, their valuation of the change in Contract Price and/or Contract Time.
- 2.14.6** In the case of a dispute in the valuation of a change authorized in the Work and pending final determination of such value, the Engineer/Architect shall certify the value of the Work performed in accordance with their own evaluation of the change and include the amount with the regular certificates for payment. The Contractor shall keep accurate records of quantities and cost of such work.
- 2.14.7** It is intended in all matters referred to above that both the Engineer/Architect and Contractor shall act promptly.
- 2.14.8** Should the Owner direct the Contractor not to correct work that has been damaged or that was not performed in accordance with the Contract Document, an equitable deduction from the Contract amount by the Architect/Engineer shall be made to compensate the Owner for the uncorrected or uncompleted work.
- 2.14.9** Credits will be based on the net cost of material and labour or the net difference in the unit price quantities.
- 2.15.0 APPLICATION FOR PAYMENT**
- 2.15.1** Applications for payment on account may be made monthly as the Work progresses.
- 2.15.2** Applications for payment shall be made monthly on a date to be agreed upon between the Owner and the Contractor, and the amount claimed shall be for the value proportionate to the amount of the Contract, of the Work performed and products delivered to the site at that date.
- 2.15.3** The Contractor shall submit to the Engineer/Architect, before the first application for payment, a schedule of values of the various parts of the Work aggregating the total amount of the Contract Price and divided so as to facilitate evaluation of applications for payment.

- 2.15.4** This schedule shall be made out in such form and supported by such evidence as to its correctness as the Engineer/Architect may reasonably direct and, when approved by the Engineer/Architect, shall be used as the basis for application for payment.
- 2.15.5** When making application for payment, the Contractor shall submit a statement based upon this schedule. Claims for products delivered to the site but not yet incorporated into the Work shall be supported by such evidence as the Engineer/Architect may reasonably require to establish the value and delivery of the products.
- 2.15.6** With each monthly claim for payment, except the first, the Contractor shall submit a Statutory Declaration attesting that they have made all payments to Subcontractors, Suppliers, and workmen on behalf of whom amounts were included in the previous claim for payment.
- 2.15.7** Applications for release of holdback monies following the substantial performance of the Work and the application for final payment shall be made at the time in the manner set forth in **2.16.0 CERTIFICATES AND PAYMENTS**.
- 2.15.8** For all projects, it should be clearly understood that the University's policy is as follows:
- a) Each Progress Claim must be accompanied by a breakdown indicating amounts included for each Subcontractor;
 - b) When the University makes a Progress Payment, it is made in prorated amounts on behalf of those Subcontractors for whom amounts have been included in the corresponding Progress Claim;
 - c) The Contractor submitting the Progress Claim **must** make payment of the amounts included for the various Subcontractors to the various Subcontractors within ten (10) working days of issuance of the Progress Payment by the University.
 - d) Monthly payment amounts are not final or conclusive as to their value or quality of work performed and are subject to reopening and readjustment
- 2.15.9** Contractors not following the above procedures will be considered to be in default of their Contract, and the University may proceed in accordance with **Article 2.6.0 OWNER'S RIGHT TO PERFORM WORK, STOP WORK AND/OR TERMINATE CONTRACT** Subsection **2.6.2 (d)** of the General Conditions.

2.16.0 CERTIFICATES AND PAYMENTS

2.16.1 The Engineer/Architect shall, within ten (10) days of receipt of an application for payment from the Contractor submitted in accordance with **2.15.0 APPLICATION FOR PAYMENT**, issue a certificate for payment in the amount applied for or such amount as they shall determine to be properly due. If the Engineer/Architect amends the application, they shall promptly notify the Contractor in writing, giving their reason(s) for the amendment.

2.16.2 The Owner shall, within thirty (30) days of receipt and approval by the Owner of a certificate for payment from the Engineer/Architect, make payment to the Contractor on account.

2.16.3 Notwithstanding any other provisions of the Contract:

- a) Where legislation permits and where, upon application by the Contractor, the Engineer/Architect has certified that a Subcontract has been totally performed to their satisfaction prior to the Substantial Performance of this Contract, the Owner may, at their discretion, pay the Contractor the holdback retained for such Subcontractor on the day following the expiration of the Statutory Limitations Period stipulated in the Mechanic's Lien Act applicable to the place of the Work and subject to the following conditions:
 - (i) A copy of the Contract between the Subcontractor and the General Contractor must be submitted.
 - (ii) The Subcontract is completed without deficiencies.
 - (iii) The warranty for the Subcontract will not start until Substantial Performance of the General Contract.
 - (iv) The General Contractor provides an approved Statutory Declaration that all monies have been paid to the said Subcontractor.
 - (v) The General Contractor provides an approved Waiver of Lien from this Subcontractor.
 - (vi) The Contractor and the Subcontractor provide an approved Waiver of Claim for all work associated with this Subcontractor.
 - (vii) A certificate is issued by the Engineer/Architect indicating that the Subcontract has been totally completed to their satisfaction.
 - (viii) The Owner will, at that time, release the total amount specified on the Subcontractor's Contract.

- 2.16.4** Notwithstanding the provisions of Paragraph 16.3 (a) and notwithstanding the wording of such certificate, the Contractor shall ensure that such work is protected pending the Total Performance of the Contract and be responsible for the correction of any defects in it regardless of whether or not they were apparent when such certificates were issued.
- 2.16.5** The Engineer/Architect shall within ten (10) days of receipt of an application from the Contractor for a Certificate of Substantial Performance make an inspection and assessment of the Work to verify the validity of the application. The Engineer/Architect shall within seven (7) days of their inspection notify the Contractor of their approval or the reasons for their disapproval of the application. When the Engineer/Architect finds the Work to be substantially performed, they shall issue such a certificate. The date of this certificate shall be the date of Substantial Performance of the Contract. Immediately following the issuance of the Certificate of Substantial Performance, the Engineer/Architect, in consultation with the Contractor, shall establish a reasonable date for the Total Performance of the Contract.
- 2.16.6** Following the issuance of the Certificate of Substantial Performance and upon receipt from the Contractor of all documentation called for in the Contract Documents, the Engineer/Architect shall issue a Certificate for Payment of holdback monies, providing that no lien or privilege claims against the Work exists, that the Contractor has submitted to the Owner a sworn statement that all accounts for labour, Subcontracts, products, construction machinery and equipment and any other indebtedness which may have been incurred by the Contractor in the Substantial Performance of the Work and for which the Owner might in any way be held responsible, have been paid in full and that the Contractor has submitted to the Owner a waiver of all claims associated with this project except holdback monies properly retained. The holdback monies will become due and payable on the day following the expiration of the Statutory Limitation Period stipulated in the Mechanic's Lien Act applicable to the place of buildings. The Owner may retain out of such holdback monies any sum required by law to satisfy any liens against the Work or other monetary claims against the Contractor which may be enforceable against the Owner.
- 2.16.7** The Engineer/Architect shall, within ten (10) days of receipt of an application from the Contractor for payment upon Total Performance of the Contract, make an inspection and assessment of the Work to verify the validity of the application. The Engineer/Architect shall, within seven (7) days of their inspection, notify the Contractor of their approval or the reasons for their disapproval of the application. When the Engineer/Architect finds the Work to be totally performed to their satisfaction, they shall issue a Certificate of Total Performance and certify for payment the remaining monies due to the Contractor under the Contract, less any holdback monies which are required to be retained. The date of this certificate shall be the date of Total Performance of the Contract. The Owner shall, within thirty (30) days of issuance of such certificate, make payment to the Contractor in accordance with the provisions of the Contract.
- 2.16.8** The release of any remaining holdback monies shall become due and payable on the day following the expiration of the Statutory Limitation period stipulated in the

Mechanics' Lien Act of the place of building provided that no claims against the Work exists and that the Contractor has submitted to the Owner a sworn statement that all accounts for labour, Subcontractors, products, construction machinery and equipment and any other indebtedness which may have been incurred by the Contractor in the Total Performance of the Work and for which the Owner might in any way be held responsible have been paid in full, except holdback monies properly retained.

2.16.9 No certificate for payment, any payment made thereunder or any partial or entire use of occupancy of the Work by the Owner shall constitute an acceptance of any work or products not in accordance with the Contract Documents.

2.16.10 As of the date of Total Performance of the Work as set out in the Certificate of Total Performance of the Work, the Owner expressly waives and releases the Contractor from all claims against the Contractor including, without limitation, those that might arise from the negligence or breach of Contract by the Contractor except one or more of the following:

- a) Those made in writing prior to the date of the Total Performance of the Work and still unsettled;
- b) Those arising from the provisions of **2.12.0 INDEMNIFICATION** or **2.26.0 WARRANTY**;
- c) Those made in writing within a period of six (6) years from the date of Substantial Performance of the Work, as set out in the Certificate of Substantial Performance of the Work or within such shorter period as may be prescribed by any Limitation Statute of the Province of Newfoundland and Labrador and arising from any liability of the Contractor for damages resulting from their performance of the Contract with respect to substantial defects or deficiencies in the Work for which the Contractor is proven responsible.

As used herein, "substantial defects or deficiencies" means those defects or deficiencies in the Work which affect the Work to such an extent or in such manner that a significant part or the whole of the Work is unfit for the purpose intended by the Contract Documents.

2.16.11 As of the date of Total Performance of the Work, as set out in the Certificate of Total Performance of Work, the Contractor expressly waives and releases the Owner from all claims against the Owner including, without limitation, those that might arise from the negligence or breach of Contract by the Owner except those made in writing prior to the Contractor's application for payment upon Total Performance of the Work and still unsettled.

2.16.12 In the event of conflict between the provisions of the General Conditions and **2.24.0 DAMAGES AND MUTUAL RESPONSIBILITY**, the provisions of this General Condition shall govern.

2.16.13 The holdback to be used by the Engineer/Architect when issuing certificates of payment will be ten (10) percent of the value of the Work completed at the date of Contractor's claim.

2.16.14 Notwithstanding any other provision of this Contract, the Owner may:

- a) In the event of a claim by the Owner against the Contractor for damages arising out of the performance or non-performance of the Contract, withhold payment of any amount equal to the alleged damages until the liability for damages is established, and no amount of interest will be paid on amounts held under this Clause;
- b) Set-off amounts owing by the Contractor to the Owner;
- c) Following the issuance of the Certificate of Substantial Performance, withhold payment of an amount equal to twice the cost as estimated by the Engineer/Architect of remedying deficiencies until the issuance of a Certificate of Total Performance, and no amount of interest will be paid on amounts held under this Clause.

2.17.0 TAXES AND DUTIES

2.17.1 Unless otherwise stated in the Supplementary General Conditions, the Contractor shall pay all applicable government sales taxes, goods and services taxes, customs duties and excise taxes with respect to the Contract.

2.17.2 Any increase or decrease in costs to the Contractor due to changes in such taxes and duties after the date of the Agreement and up to the agreed date of completion shall increase or decrease the Contract Price accordingly. If the Owner so desires, the Contractor is to cooperate with the Engineer/Architect and Owner and permit access to books and records in order to establish the amount of such taxes involved.

2.17.3 The Contractor shall maintain full records of their estimates and of actual costs to them of the Work, together with all proper open calls, quotations, contracts, correspondence, invoices, receipts, payments to Subcontractors and Suppliers and vouchers relating thereto and shall make them available to audit and inspection by the Owner, the Auditor General for Newfoundland and Labrador or by persons acting on their behalf and shall furnish them with any information which they may require from time to time in connection with such records.

2.18.0 LAWS, NOTICES, PERMITS AND FEES

2.18.1 The laws of the Province of Newfoundland and Labrador shall govern the Work.

2.18.2 The Contractor shall obtain all permits, licenses and certificates and pay all fees required for the performance of the Work which are in force at the date of open call closing with the following exceptions:

- a) The Contractor shall obtain building permits for the Work but are not required to pay for said permits.
- b) The Contractor shall not include the obtaining of permanent easements or rights of servitude.

2.18.3 The Contractor shall give all required notices and comply with all laws, ordinances, rules, regulations, codes and order of all authorities having jurisdiction relating to the Work, to the preservation of the public health and construction safety which are or become in force during the performance of the Work.

2.18.4 The Contractor shall not be responsible for verifying that the Contract Documents are in compliance with the applicable laws, ordinances, rules, regulations and codes relating to the Work. If the Contract Documents are a variance therewith or changes which necessitate modifications to the Contract Documents are required by the authorities having jurisdiction subsequent to the Open call closing date, the Contractor shall notify the Engineer/Architect in writing requesting direction immediately when any such variance or change is observed by them. The Engineer/Architect will make the changes required to the Contract Documents, and the Contract Price and/or Contract Time shall be adjusted in accordance with **2.13.0 CHANGES IN THE WORK AND EXTRA WORK** and evaluated in accordance with **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK**.

2.18.5 If the Contractor fails to notify the Engineer/Architect in writing and obtain their direction as required in 2.18.4 and performs any work knowing it to be contrary to any laws, ordinances, rules, regulation, codes and orders of any authority having jurisdiction, they shall be responsible for and shall correct any violations thereof and shall bear all costs, expense and damages, attributable to their failure to comply with the provisions of such laws, ordinances, rules, regulations, codes and orders.

2.19.0 PATENT FEES

2.19.1 The Contractor shall pay all royalties and patent license fees required for the performance of the Contract and such royalties or fees shall be deemed to have been included in the Contract Price. They shall hold the Owner harmless from and against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the Contractor's performance of the Contract which are attributable to an infringement or an alleged infringement of any patent or invention by the Contractor or anyone for whose acts they may be liable.

2.19.2 The Owner shall hold the Contractor harmless against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the Contractor's performance of the Contract which are attributable to an infringement or an alleged

infringement of any patent or invention in executing anything for the purpose of the Contract, the model, plan or design of which was supplied to the Contractor by the Owner.

2.20.0 WORKERS' COMPENSATION

2.20.1 The Contractor shall be registered with and shall remain in good standing with the Workplace Health and Safety Compensation Commission during the term of their Contract.

2.20.2 At any time during the term of the Contract when requested by the Owner, the Contractor shall provide evidence of compliance by themselves and any or all of their Subcontractors.

2.21.0 LIABILITY INSURANCE

2.21.1 Comprehensive General Liability Insurance

- a) Without restricting the generality of **2.12.0 INDEMNIFICATION**, the Contractor shall provide and maintain, either by way of a separate policy or by an endorsement to their existing policy, Comprehensive General Liability Insurance acceptable to the Owner and subject to limits set out in detail below, inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof.
- b) The insurance shall be in the joint names of the Contractor and the Owner. It shall also cover as named Insureds all Subcontractors and anyone employed directly or indirectly by the Contractor or their Subcontractors to perform a part or parts of the Work but excluding Suppliers whose only function is to supply and/or transport products to the project site.
- c) The insurance shall also include as Named Insureds the architectural and engineering consultants of the Owner and Engineer/Architect.
- d) The insurance shall preclude subrogation claims by the Insurer against anyone insured thereunder.
- e) The Comprehensive General Liability Insurance will not be limited to, but shall include coverage for:
 - (i) Premises and Operations Liability
 - (ii) Products or Completed Operations Liability
 - (iii) Blanket Contractual Liability

- (iv) Cross Liability
- (v) Elevator and Hoist Liability
- (vi) Contingent Employer's Liability
- (vii) Personal Injury Liability arising out of false arrest, detention or imprisonment or malicious prosecution, libel, slander or defamation of character, invasion of privacy or wrongful entry
- (viii) Shoring, blasting, excavating, underpinning, demolition, pile driving and caisson work, work below ground surface, tunnelling and grading, as applicable
- (ix) Liability with respect to non-owned, licensed vehicles.

2.21.2 The Contractor shall provide and maintain liability insurance in respect of owned licensed vehicles subject to limits set out in detail in Article **2.21.0 LIABILITY INSURANCE** subsection **2.21.6**.

2.21.3 All liability insurance shall be maintained continuously until twelve (12) months after the date the Engineer/Architect issues a Certificate of Substantial Performance.

2.21.4 The Contractor shall provide the Owner with evidence of all liability insurance prior to the commencement of the Work and shall promptly provide the Owner with a certified true copy of each insurance policy.

2.21.5 All liability insurance policies shall contain an endorsement to provide all Named Insureds with prior notice of changes and cancellations. Such endorsements shall be in the following form:

"It is understood and agreed that the coverage provided by this policy will not be changed or amended in any way nor cancelled until thirty (30) days after written notice of such change or cancellation shall have been given to all Named Insureds."

2.21.6 The Contractor shall protect themselves and indemnify and save the Owner harmless from any and all claims which may arise from the Contractor's performance or failure of performance of the Contract and for this purpose shall, without restricting the generality of the foregoing, maintain insurance acceptable to the Owner to the following limits:

- a) Where the contract value exceed \$100,000 (inclusive of HST)
 - Comprehensive General Liability = \$3,000,000.00;
 - Standard Automobile Policy Liability = \$3,000,000.00.

- b) Where the contract value is less than \$100,000 (inclusive of HST)
- Comprehensive General Liability = \$2,000,000.00;
 - Standard Automobile Policy Liability = \$2,000,000.00.

Prior to the commencement of any work hereunder, the Contractor shall file with the Owner a copy of each insurance policy and certificate required.

2.22.0 PROPERTY INSURANCE

2.22.1 The Contractor shall provide and maintain property insurance acceptable to the Owner insuring the full value of the Work in the amount of the replacement cost or the Contract value, whichever is greater, and the full value as stated of products for incorporation into the Work. The insurance shall be in the joint names of the Contractor, the Owner, the Subcontractors as Unnamed Insured or, if they specifically request, as Named Insured. The policies shall preclude subrogation claims by the Insurer against anyone insured thereunder.

2.22.2 Such coverage shall be provided by EITHER an ALL RISKS Builders' Risk Policy OR by a combination of a Coverage and Malicious Damage Endorsements and a Builder's Risk Difference in Conditions Policy providing equivalent coverage of Piers, Wharves and Docks, Government Structures Policy.

2.22.3 The policies shall insure against all risks of direct loss or damage. Such coverage shall apply to:

- a) All products, labour and supplies of any nature whatsoever, the property of the Insureds or of others for which the Insureds may have assumed responsibility, to be used in or pertaining to the site preparations, demolition of existing structures, erections and/or fabrication and/or reconstruction and/or repair of the insured project, while on the site or in transit, subject to the exclusion of the property specified.
- b) The installation, testing and any subsequent use of machinery and equipment including boilers, pressure vessels or vessels under vacuum.
- c) Damage to the Work caused by an accident to and/or the explosion of any boiler(s) or pressure vessel(s) forming part of the Work.

Such coverage shall exclude construction machinery, equipment, temporary structural and other temporary facilities, tools and supplies used in the construction of the Work and which are not expendable under the Contract.

2.22.4 The Contractor shall provide the Owner with evidence of all insurance prior to the commencement of the Work and shall promptly provide the Owner with a certified true copy of each insurance policy.

Policies provided shall contain an endorsement to provide all Named Insureds with prior notice of changes and cancellations. Such endorsements shall be in the following form:

"It is understood and agreed that the coverage provided by this policy will not be changed or amended in any way or cancelled until thirty (30) days after written notice of such change or cancellation shall have been given to all Named Insureds."

2.22.5 All such insurance shall be maintained continuously until ten (10) days after the date the Engineer/Architect issues a certificate of Total Performance. All such insurance shall provide for the Owner to take occupancy of the Work or any part thereof during the terms of this insurance. Any increase in the cost of this insurance arising out of such occupancy shall be at the Owner's expense.

2.22.6 The policies shall provide that, in the event of a loss, payment for damage to the Work shall be made to the Owner and the Contractor as their respective interests may appear. Damage shall not affect the rights and obligations of either party under the Contract except that the Contractor shall be entitled to such reasonable extension of time for Substantial and Total Performance of the Work as the Engineer/Architect may decide.

2.22.7 The Contractor and/or their Subcontractors, as may be applicable, shall be responsible for any deductible amounts under the policies and for providing such additional insurance as may be required to protect the Insureds against loss on items excluded from the policies.

2.22.8 When this Contract pertains to a new building or structure with a total bid amount greater than \$25,000.00, the Contractor shall maintain All Risk Builder's Risk Insurance acceptable to the Owner in the joint names of the Owner and Contractor in the amount of 100 percent of the total value of the Work done and material delivered to the site and payable to the Owner and Contractor as their respective interest may appear.

2.23.0 PROTECTION OF WORK AND PROPERTY

2.23.1 The Contractor shall protect the property adjacent to the project site from damage as the result of their operations under the Contract.

2.23.2 The Contractor shall protect the Work and the Owner's property from damage and shall be responsible for any damage which may arise as the result of their operations under the Contract except damage which occurs as the result of:

- a) Errors in the Contract documents; and/or
- b) Acts or omissions by the Owner, their agents, employees or other Contractors.

2.23.3 Should the Contractor, in the performance of this Contract, damage the Work and/or Owner's property and/or property adjacent to the place of the Work, the Contractor shall be responsible for making good such damage at their own expense or pay all costs incurred by others in making good such damage.

2.23.4 Should any damage occur to the Work and/or Owner's property for which the Contractor is not responsible as provided in of **2.12.0 INDEMNIFICATION**, they shall make good such damage to the Work and, if the Owner so directs, to the Owner's property, and the contract Price and Contract Time shall be adjusted in accordance with in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK** and evaluated in accordance with in **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK**.

2.23.5 The Contractor shall be completely responsible for the safety of the Work as it applies to protection of the public and property and construction of the Work.

The codes that must be followed and enforced for safety are:

- a) The National Building Code, Part 8, Safety Measures at Construction and Demolition Sites (Latest Edition);
- b) Canadian Code for Construction Safety (Latest Edition) as issued by the Associate Committee of the National Building Code;
- c) The Occupational Health and Safety Act (1979) and Regulations.

2.23.6 Any person not following stipulated safety regulations shall be dismissed.

2.24.0 DAMAGES AND MUTUAL RESPONSIBILITY

2.24.1 If either party to this Contract should suffer damage in any manner because of any wrongful act or neglect of the other party or anyone employed by them then they shall be reimbursed by the other party for such damages. The party reimbursing the other party shall be subrogated to the rights of the other party in respect of such wrongful act or neglect if it be that of a third party.

2.24.2 Claims under this Contract shall be made in writing to the party liable within two (2) weeks after the first observance of such damage and may be adjusted by agreement or in the manner set out in **2.11.0 DISPUTES**.

2.24.3 If the Contractor has caused damage to any other Contractor on the Work, the Contractor agrees upon due notice to settle with such other Contractor by agreement or arbitration, if they will so settle. If such other Contractor sues the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor and may require the Contractor to defend the action at the Contractor's expense. If

any final order or judgment against the Owner arises therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

2.24.4 If the Contractor becomes liable to pay or satisfy any final order, judgment or award against the Owner then the Contractor, upon undertaking to indemnify the Owner against any and all liability for costs, shall have the right to appeal in the name of the Owner such final order or judgment to any and all courts of competent jurisdiction.

2.24.5 Should the Contractor fail to meet the date to substantially perform the Work, as indicated in the Agreement between the Owner and the Contractor, and is unable to provide justification acceptable to the Owner for the delay then the Contractor will be held liable for any liquidated damage amount indicated in **3.0 SUPPLEMENTARY GENERAL CONDITIONS** and may be held liable for payment to the Owner for other damages and losses suffered by the Owner as a result of the Contractor's delay including additional costs for Engineering/Architectural supervision.

2.25.0 BONDS

2.25.1 The Contractor shall promptly provide the Owner the surety bonds called for in the Open call Documents.

2.25.2 All such bonds shall be issued by a duly incorporated surety company approved by the Owner and authorized to transact a business or surety-ship in the Province of Newfoundland and Labrador.

2.25.3 If bonds are called for in the and Acceptance form, Instructions to Bidders or Supplementary General Conditions, the costs attributable to providing such bonds shall be included in the bid price.

2.25.4 Should the Owner require the provision of a bond or bonds by the Contractor other than those provided for under 2.25.3, the Contract Price shall be increased by all costs attributable to providing such bonds.

2.26.0 WARRANTY

2.26.1 The Contractor shall be responsible for the proper performance of the Work to the extent that the design and specifications permit such performance.

2.26.2 Subject to Paragraph 2.26.1, the Contractor agrees to correct promptly, at their own expense, defects or deficiencies in the Work which appear prior to and during the period of one (1) year from the date of Substantial Performance of the Work or such longer periods as may be specified for certain products or work.

2.26.3 The Contractor shall correct and/or pay for any damage to other work resulting from any corrections required under the conditions of Paragraph 2.26.2.

2.26.4 Neither the Engineer/Architect's final certificate nor payment thereunder shall relieve the Contractor from their responsibility hereunder.

2.26.5 The Owner and/or Engineer/Architect shall give the Contractor written notice of observed defects promptly.

2.27.0 CONTRACTOR'S RESPONSIBILITIES AND CONTROL OF THE WORK

2.27.1 The Contractor shall have complete control of the Work and shall effectively direct and supervise the Work so as to ensure conformance with the requirements of the Contract Documents. They shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all parts of the Work under the Contract.

2.27.2 The Contractor shall have the sole responsibility for the design, erection, operation, maintenance and removal of temporary structural and other temporary facilities and the design and execution of construction methods required in their use. The Contractor shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the Contract Documents and, in all cases, where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

2.27.3 Notwithstanding the provision of Paragraphs 2.27.1 and 2.27.2 above or any provisions to the contrary elsewhere in the Contract Documents where such Contract Documents include designs for temporary structural and other temporary facilities or specify a method of construction in whole or in part, such facilities and methods shall be deemed to comprise part of the overall design of the Work, and the Contractor shall not be held responsible for that part of the design or the specified method of construction. The Contractor shall, however, be responsible for the execution of such design or specified method of construction in the same manner that they are responsible for the execution of the Work.

2.27.4 The Contractor shall carefully examine the Contract Documents and shall promptly report to the Engineer/Architect any error, inconsistency or omission they may discover. The Contractor shall not be held liable for any damage resulting from any such errors, inconsistencies or omissions in the Contract Documents which they may discover, and they shall not proceed with the Work affected until they have received corrected or missing information from the Engineer/Architect.

2.28.0 PROJECT MANAGER AND SUPERINTENDENCE

2.28.1 The Contractor shall employ a competent Project Manager and necessary assistants who shall be in attendance at the Work site at all times while the Work is being performed.

- 2.28.2** The Project Manager shall be satisfactory to the Engineer/Architect and shall not be changed except for good reason and only then after consultation with an agreement by the Engineer/Architect.

The Project Manager shall have a minimum of ten (10) years' experience on construction projects of similar scale, complexity, type and value.

The project manager shall submit a resume and cover letter.

- 2.28.3** The Superintendent shall represent the Contractor at the place of work and instructions given to them by the Engineer/Architect shall be held to have been given to the Contractor. Important instructions shall be confirmed to the Contractor in writing, other instructions will be so confirmed if requested.

The superintendent shall have a minimum of ten (10) years' experience on construction projects of similar scale, complexity, type and value.

2.29.0 LABOUR AND PRODUCTS

- 2.29.1** Unless otherwise stipulated elsewhere in the Contract Documents, the Contractor shall provide and pay for all labour, products, tools, construction equipment and machinery, water, heat, light, power, transportation and other facilities and services necessary for the requirements of the Contract Documents.
- 2.29.2** All products provided shall be new unless otherwise specified in the Contract Documents. Any products which are not specified shall be of a quality best suited to the purpose required, and their use shall be subject to the approval of the Engineer/Architect.
- 2.29.3** In carrying out their duties under this Contract, the Contractor shall comply with all Provincial and Federal legislation respecting labour and the employment of labour, where applicable, including the Labour Standards Code and shall not operate in conflict with the Human Rights legislation. In the employment of labour, preference should be given to persons normally residing in Newfoundland and Labrador.
- 2.29.4** The Contractor and Subcontractors shall maintain and keep available for inspection by the Owner, a record of the names and addresses of all persons employed on the project.
- 2.29.5** The Contractor shall maintain good order and discipline among their employees engaged on the Work and shall employ on the Work only employees skilled in their various trades.
- 2.29.6** There shall be no discrimination in the selection of workers for employment on the project in respect to race, religion, views or political affiliation, and the office of the Canada Manpower will be used in the recruitment of workers wherever possible.

- 2.29.7** The Contractor shall pay fair wages and shall pay rates of wages and allowances to the various classes of labour not less favourable than those prevailing in the area where the Work is being performed.
- 2.29.8** The Contractor shall be aware that the majority of hourly-paid and maintenance workers employed within the University are unionized. It is of utmost importance that

any labour force used by the Contractor neither disrupts or be disrupted by any labour conditions existing on the University campus. Failure by the Contractor to familiarize themselves with labour conditions on Campus or disruptions to the Contractor's own labour force because of labour conditions on Campus will not relieve them of their obligations to furnish all labour and materials necessary to carry out the requirements of the Contract.

2.30.0 SUBSURFACE CONDITIONS

2.30.1 The Contractor shall promptly notify the Engineer/Architect in writing if, in their opinion, the subsurface conditions at the project site differ materially from that indicated or reasonably inferred from the Contract Documents.

2.30.2 After prompt investigation, should the Engineer/Architect determine that conditions do differ materially, they shall issue appropriate instructions for changes in the Work as provided for in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK**.

2.31.0 USE OF THE WORK

2.31.1 The Contractor shall confine their apparatus, the storage of products and the operations of their employees to limits indicated by laws, ordinances, permits or by instructions of the Engineer/Architect and shall not unreasonably encumber the premises with their products.

2.31.2 The Contractor shall not load or permit to be loaded any part of the Work with a weight or force that will endanger its safety.

2.31.3 Unless otherwise provided, the Contractor shall, at their own expense and without expense to the Owner, make suitable provision to accommodate all traffic, either pedestrian or vehicular, over or around the project upon which work is being performed in a manner satisfactory to the Engineer/Architect.

2.31.4 The Contractor shall provide and maintain at their own expense such fences, barriers, signs, lights and watchmen as may be necessary to prevent avoidable accidents to University Users or to the public generally.

2.31.5 All work shall be executed with the least possible interference with or disturbance to personnel and the Public. The Contractor shall cooperate with the person in charge of the premises. The Contractor shall ascertain from the Owner's representative the hours during which the work shall be performed, conform to the directions of the representative and to the directions of the said representative in determining the order in which the work shall be done.

2.31.6 The Contractor shall carry out all work required to maintain the building services and to provide necessary access for personnel and vehicles whenever new work affects occupied portions of the building.

2.31.7 Before final completion of the work, the Owner shall be entitled to make use of any portion of the work which is completed and fit for use for the installation of equipment, storage and furniture, supplies, etc., and for occupancy, if such can be arranged without interfering with the progress of the work.

2.32.0 CUTTING AND REMEDIAL WORK

2.32.1 The Contractor shall do all cutting and remedial work that may be required to make the several parts of the Work come together properly and shall coordinate the Work to ensure that this requirement is kept to a minimum.

2.32.2 Should the Owner, the Engineer/Architect, other contractors or anyone employed by them, be responsible for ill-timed work necessitating additional cutting and/or remedial work to be performed, it shall be valued as provided in **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK** and added to the Contract Price.

2.32.3 Cutting and remedial work shall be performed by specialists familiar with the materials affected and shall be performed in a manner to neither damage nor endanger any work.

2.33.0 INSPECTION OF WORK

2.33.1 The Owner, the Engineer/Architect and their authorized representatives shall have access to the Work for inspection wherever it is in preparation or progress. The Contractor shall cooperate to provide reasonable facilities for such access.

2.33.2 If parts of the Work are designated for special tests, inspections or approvals in the Contract Documents or by the Engineer/Architect's instructions or the laws or ordinances of the place of the Work, the Contractor shall give the Engineer/Architect timely notice requesting inspection. Inspection by the Engineer/Architect shall be made promptly. The Contractor shall arrange for inspections by other authorities and shall notify the Engineer/Architect with timely notice of the date and time.

2.33.3 If the Contractor covers or permits to be covered any of the Work that is designated for special tests, inspections or approvals, before such special tests, the Contractor shall, if so instructed by the Engineer/Architect, uncover the Work, have the inspection satisfactorily completed and make good the Work at their own expense.

2.33.4 The Engineer/Architect may order any part of the Work to be specifically examined, should they believe such work not to be in accordance with the requirements of the Contract Documents. If upon examination such work is found not to be in accordance with the requirements of the Contract Documents, the Contractor shall correct such work and pay the cost of examination and correction. If such work is found to be in accordance with the requirements of the Contract Documents, the Owner will pay the cost of examination and replacement.

2.33.5 The Contractors shall furnish promptly to the Engineer/Architect two (2) copies of all certificates and inspection reports relating to the Work.

2.34.0 ***REJECTED WORK***

2.34.1 Defective work, whether the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the Contractor and whether incorporated in the Work or not which has been rejected by the Engineer/Architect as failing to conform to the Contract Documents, shall be removed promptly from the premises by the Contractor and replaced and/or re-executed promptly in accordance with the Contract Documents at the Contractor's expense.

2.34.2 Other contractors' work destroyed or damaged by such removals or replacements shall be made good promptly at the Contractor's expense.

2.34.3 If, in the opinion of the Engineer/Architect, it is not expedient to correct defective work not done in accordance with the Contract Documents, the Owner may deduct from the Contract Price the difference in value between the Work as done and that called for by the Contract, the amount of which shall be determined in the first instance by the Engineer/Architect.

2.35.0 ***SHOP DRAWINGS AND SAMPLES***

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

2.35.2 The Contractor shall arrange for the preparation of clearly identified shop drawings as called for by the Contract Documents or as the Engineer/Architect may reasonably request.

2.35.3 Prior to submission to the Engineer/Architect, the Contractor shall review all shop drawings. By this review, the Contractor represents that they have determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, or will do so, and that they have checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents. The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

2.35.4 The Contractor shall submit shop drawings to the Engineer/Architect for their review with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the Work of other contractors. If either the Contractor or the Engineer/Architect so requests, they shall jointly prepare a schedule fixing the dates for submission and return of shop drawings. Shop drawings shall be submitted in the form

of reproducible transparencies or prints as the Engineer/Architect may direct. At the time of the submission, the Contractor shall notify the Engineer/Architect in writing of any deviations in the shop drawings from the requirements of the Contract Documents.

2.35.5 The Engineer/Architect will review and return shop drawings in accordance with any schedule agreed upon or otherwise with reasonable promptness so as to cause no delay. The Engineer/Architect's review will be for conformity to the design concept and for general arrangements only, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Contract Documents unless a deviation on the shop drawings has been approved in writing by the Engineers/Architects.

2.35.6 The Contractor shall make any changes in shop drawings which the Engineer/Architect may require consistent with the Contract Documents and resubmit, unless otherwise directed by the Engineer/Architect. When resubmitting, the Contractor shall notify the Engineer/Architect in writing of any deviations other than those requested by the Engineer/Architect.

2.35.7 The Contractor shall submit for the Engineer/Architect's approval such standard manufacturer's samples as the Engineer/Architect may reasonably require. Samples shall be labeled as to origin and intended use in the Work and shall conform to the requirements of the Contract Documents.

2.35.8 The Contractor shall provide samples of special products, assemblies or components when so specified. The cost of such samples not specified shall be authorized as an addition to the Contract Price as provided in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK**.

2.36.0 TESTS AND MIX DESIGNS

2.36.1 The Contractor shall furnish to the Engineer/Architect test results and mix designs as may be requested. The testing company must first be approved by the Engineer/Architect.

2.36.2 The cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by law, ordinances, rules and regulations relating to the Work and the preservation of public health, shall be authorized as an addition to the Contract Price as provided in **2.13.0 CHANGES IN THE WORK AND EXTRA WORK**.

2.37.0 MATERIALS AND SUBSTITUTIONS

2.37.1 Materials described and named in the specifications with "or approved equal" clause after the Manufacturer's name are so described as to the establish quality only, and substitutions of a similar materials may be made before the award of the Contract provided the Engineer/Architect's approval is obtained. Substitutions after the award

may be considered under special circumstances as indicated in Subsection 1.7.4 in the **INSTRUCTIONS TO Bidders**

2.37.2 Requests for substitutions must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples and other data to permit proper investigation of the substitutes proposed, together with any increase or decrease in price.

2.37.3 Whenever a substitute is proposed for approval, the Contractor shall guarantee that such proposed substitute will not adversely affect the space requirements allocated on the drawings for the material specified, and they shall agree to bear any additional expense incurred due to their use of the proposed substitute.

2.37.4 The Engineer/Architect may accept or reject any or all of the proposed substitutions as they see fit, and their decision on a question of equality shall be final.

2.38.0 TIME OF ESSENCE AND SCHEDULE

2.38.1 Time is of the essence of the Contract.

2.39.0 CASH ALLOWANCE

2.39.1 The Contract Price includes cash allowances, if any, stated in the Contract Documents.

2.39.2 Cash allowances, unless otherwise specified, cover the entire cost to the Contractor of services, products, construction machinery and equipment, freight, unloading, handling, storage, installation and other authorized expenses incurred in performing the Work stipulated under the cash allowances. This also includes the Contractors overhead and profit in connection with such cash allowance.

2.39.3 The cash allowance shall not include HST.

2.39.4 Where costs under a cash allowance exceed the amount of the allowance, the Contractor shall be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in **2.14.0 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK.**

2.39.5 The Contract Price shall be adjusted by written order to provide for any excess or deficit to each cash allowance.

2.39.6 Progress payments on account of Work authorized under cash allowance shall be included in the Engineer/Architect's monthly certificates for payment.

2.39.7 A schedule shall be prepared jointly by the Engineer/Architect and Contractor to show the items called for under Cash Allowances. They must be authorized by the Owner for ordering purposes so that the progress of the Work will not be delayed.

2.40.0 CLEANUP AND FINAL CLEANING OF THE WORK

2.40.1 The Contractor shall maintain the Work in a tidy condition and free from the accumulation of waste products and debris, other than that caused by the Owner, other contractors or their employees.

2.40.2 When the Work is substantially performed, the Contractor shall remove their surplus products, tools, construction machinery and equipment not required for the performance of the remaining Work. They shall also remove waste products and debris, other than that caused by the Owner, other contractors or their employees, and leave the Work clean and suitable for occupancy by the Owner, unless otherwise specified.

2.40.3 When the Work is totally performed, the Contractor shall remove their surplus products, tools, construction machinery and equipment. They shall also remove waste products and debris other than that caused by the Owner, other contractors or their employees.

3.0 SUPPLEMENTARY GENERAL CONDITIONS

SUPPLEMENTARY GENERAL CONDITIONS

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4.0 SPECIAL CONDITIONS

4.1.0 LAYOUT OF WORK

- 4.1.1** Other than the original lot lines and a bench mark, both shown on the drawings, establish and maintain all grades, lines, levels and well-built batter boards at all corners of the building. As work progresses, lay out on the forms or rough flooring the exact location of all partitions as a guide to all trades.
- 4.1.2** Verify all grades, lines, levels and dimensions as shown on the drawings and report any errors or inconsistencies in the above to the Engineer/Architect before commencing Work.

4.2.0 JOB SIGN

- 4.2.1** At the start of the job, erect two painted signs as detailed and where located by the Engineer/Architect. This will be the only sign or advertisement permitted on the site unless instructed otherwise by the Engineer/Architect.
- 4.2.2** The signs shall be 8'0" x 8'0" plywood, properly supported. It shall be painted and shall show the names of the building, Owner, Prime Consultant, Major Subconsultants, Contractor and Major Subcontractors. A drawing of the signs to be erected will be supplied by the Engineer/Architect.

4.3.0 TEMPORARY OFFICES AND SHEDS

- 4.3.1** Construct and maintain, until completion of the Contract temporary offices and storage sheds in approved locations on site for the use of staff.
- 4.3.2** Buildings shall be of weatherproof wood stud and plywood construction completely equipped with adequate lighting, heating and ventilation, and in addition, the Contractor's office shall be fully furnished with desks, plan tables, storage cabinets, file drawers, chairs, stools and plan racks.
- 4.3.3** Provide storage sheds for small tools, equipment, perishable materials, etc., as necessary. All buildings shall be equipped with windows for natural light and doors properly fitted and equipped with locks.
- 4.3.4** Maintain offices and storage sheds in good condition to the approval of the Engineer/Architect from start of Work until final completion of Work or, when directed by the Engineer/Architect, remove offices and sheds from the site and leave areas free of debris and waste materials and in a clean and tidy condition.
- 4.3.5** Offices and storage sheds required by Trade Contractors, such as mechanical and electrical, shall be provided by the trade requiring them.

4.3.6 Provide an office approximately 120 square feet for the absolute use of the Owner or their representative(s). It shall be properly fitted and furnished with light, heat, telephone, lock and key, shelving, table and chairs and plan rack. The building shall be removed from the site at the completion of the Work.

4.4.0 **TEMPORARY SERVICES**

4.4.1 Light and Power

Furnish all temporary light and power required to provide such intensity of light and sufficient power as necessary for the Work to be carried out under the best conditions. Obtain and pay for all permits and inspection tests required by Provincial and/or Municipal authorities. Pay all charges and maintain fixtures and equipment in good working order. **This shall include electric heat.**

4.4.2 Telephone

Install and pay for the operation of one job telephone and one telephone for the use of the Engineer/Architect for the duration of the Contract. Subcontractors requiring individual telephones shall have them installed at their expense. Long distance calls will be at the expense of the party making the calls.

4.4.3 Toilets

At the start of operations, provide and maintain in sanitary condition sufficient temporary toilets and washing facilities for the use of personnel on the job. Conform to requirements of the Department of Health and other authorities having jurisdiction. Supply adequate quantities of disinfectant and toilet paper. When building toilets and washing facilities are operable, they may be used under the same conditions as the temporary toilets with the latter being removed, leaving all surfaces and areas hygienically clean and in immaculate condition.

4.4.4 Heat

Provide and maintain in good condition a temporary heating system for use when the building is closed in until the project has been handed over to the Owner. Pay for fuel and maintenance of the system. Maintain temperatures at a minimum of 50° F, (higher if required for special trades). Heating equipment not adequately protected or operated in conditions other than those intended by the manufacturer shall be regarded as temporary. Remove all such equipment and replace with new permanent equipment.

When ready for operation, the permanent heating equipment may be used for temporary heating purposes, subject to the conditions of the Mechanical Division of the specifications. Protect all permanent heating equipment used for temporary heating purposes. Provide satisfactory site conditions for the proper operation of this equipment.

4.4.5 Water Supply

Provide in two convenient locations outside the building line a fresh water supply for the use of all trades.

Where connection cannot be made to an existing water supply, provide adequate size tanks and keep them filled for use of all trades.

4.5.0 PLANT AND MACHINERY

4.5.1 Provide all framework, scaffolding, ladders, cranes, derricks, planks, screens, gantries, tarpaulins, tools, equipment and machinery for the proper execution of the Work. Scaffolding shall be erected without damage of the structure or the finishes, be removed to suit the installation of work of other trades and be promptly removed at completion.

4.5.2 Where it is the normal practice for the trade to provide its own scaffolding, it shall be included in the Subcontract.

4.6.0 PROTECTION OF PUBLIC AND WORKMEN

4.6.1 Part 8 of the National Building Code of Canada, latest edition, shall apply to this project in its entirety. This covers fencing, barricades, Fire protection, excavation, use of streets or public property, control of vehicular traffic and mechanical methods of demolition.

4.6.2 The latest edition of Canadian Construction Safety Code shall also apply to all phases of this project.

4.6.3 The Workers' Compensation Board Regulations shall also apply to all phases of this project.

4.7.0 CONSTRUCTION SCHEDULE

4.7.1 The Contractor shall, within seven (7) days after the Contract is awarded, prepare for the use of the Engineer/Architect and Owner, a construction schedule. It shall indicate as closely as possible the starting and completion dates for the major sections of the Work, together with the Subcontractors' names.

4.7.2 With each monthly progress claim, submit one (1) copy of the original construction schedule marked in red to show the actual construction progress on the date of the submission of the claim.

Weekly schedule updates shall be provided.

Provide updated construction schedule demoting the original.

4.8.0 PROGRESS PHOTOGRAPHS

4.8.1 Submit with monthly progress claim digital progress photographs taken from points designated by the Engineer/Architect. In the lower right-hand corner of the prints show the date and name of the project.

4.9.0 OPERATIONS AND MAINTENANCE DATA

4.9.1 On completion of the project, submit to the Engineer/Architect two (2) copies of Operations and Maintenance Data and one (1) electronic copy as original editable format.

- a) Bind data in vinyl hard covered, 3-ring, loose-leaf binder for 215 x 280 mm size paper.
- b) Enclose title sheet, labelled "Operation and Maintenance Data", project number, project name, date and list of contents.
- c) Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- d) Provide electronic document in CD or DVD as original editable file format or, at the direction of the Owner, pdf format.

4.9.2 Include the following information plus data specified in Division 15 and 16:

- a) Maintenance instruction for finished surface and materials.
- b) Copy of hardware schedules.
- c) Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size capacity and serial number.
- d) Names, addresses, phone and fax numbers of Subcontractors and Suppliers.
- e) Guarantees, warranties and bonds showing:
 - (i) Name and address of project;
 - (ii) Guarantee commencement date (date of Final Certification of Completion).
 - (iii) Duration of guarantee.

(iv) Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.

(v) Signature and Seal of Contractor.

f) Additional materials used in project listed under various sections showing name of manufacturer and source of supply.

4.9.3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturer's literature.

4.9.4 The final certificate will not be issued until the data books have been received and approved by the Engineer/Architect.

4.10.0 COORDINATION OF WORK

4.10.1 The Contractor will coordinate the Work of their Subcontractors and provide necessary instructions and scheduling so as to permit continuous progress in the Work by all trades. They will coordinate work between the Subcontractors on the site to ensure that anchor bolts, plates, attachments, etc., are provided and set in place in a timely manner. They will lay out partitions and assist Subcontractors in establishing the actual location of the fixtures, pipes, outlets, duct conduit, etc., so as to limit the interference of one trade with another. Locations shown on the drawings are approximate. If interference problems are encountered which cannot be resolved on the site, advise the Engineer/Architect before proceeding with the Work. Conceal all mechanical and electrical work unless otherwise indicated.

4.11.0 TRAFFIC MAINTENANCE

4.11.1 Do not close or obstruct streets, sidewalks, driveways, etc., without permission from authorities having jurisdiction. Do not place or store materials in street, sidewalks, parking areas, etc., unless so authorized.

4.12.0 FIRE PROTECTION

4.12.1 Fire protection measures shall include:

- a) An adequate fire alarm signal, the use of fire resistant tarpaulins, the daily inspection of temporary heating system by competent staff and regular fire patrol;
- b) All temporary wiring shall be done by electricians qualified under the applicable local regulations;
- c) Supply and maintenance of fifteen (15) pounds dry chemicals and/or five (5) gallons soda-acid fire extinguishers in such locations that no working crew has to

travel more than fifty (50) feet to an extinguisher station. In any case, there shall be not less than one (1) fully charged extinguisher(s) at the job at any time.

4.13.0 JOB MEETINGS

4.13.1 Where the value of the contract exceeds \$100,000 (HST included) job meetings shall occur at definitely prescribed times (minimum once a month), which will be determined after commencement of work, the Contractor shall organize job meetings and send out notices stating time and place to the Owner's representative, the Engineer/Architect, Subconsultants, to all Subcontractors and to other persons whose presences are required at the meetings. They shall take note of all persons attending these meetings and shall, within one (1) week after each job meeting, submit to the Owner, the Engineer/Architect, the Subconsultants and others present, minutes of the meeting which must show any major decisions made and any instructions or information required.

4.13.2 Where the value of the contract is less than \$100,000 (HST included) job meetings shall occur at the discretion of the University Project Coordinator but shall not occur fewer than once per month.

4.14.0 AS-BUILT DRAWINGS

4.14.1 The Engineer/Architect will issue to the Contractor three (3) sets of prints of architectural, mechanical and electrical drawings for the sole purpose of providing "as-built" drawings. The Contractor shall pass these to the relevant Subcontractor who shall keep two (2) sets in their office and one (1) set on the job. As changes occur, the Subcontractor shall make them on the field set. Upon completion of the project, the Subcontractor shall accurately transfer all changes to the two (2) office sets in red ink and pass them to the Engineer/Architect, through the Contractor, for approval. If they are not approved, the Subcontractor shall prepare new sets for resubmission (purchasing additional white prints for this purpose).

4.14.2 As-built drawings shall be white prints and shall indicate all changes in Architectural, Mechanical and Electrical work, including any changes in location of piping, ducts, panels, etc.

4.14.3 Provide electronic as-builts in CD or DVD as original editable file format or, at the direction of the Owner, pdf format.

4.14.4 The Certificate of Total Performance will not be issued until such drawings have been received and approved.

4.15.0 COMPLETION TIME

4.15.1 The project shall be ready for the use and occupancy by the Owner within the time stated in the **Open Call and Acceptance Form.**

4.15.2 Prior to the acceptance by the Owner of the Substantial Performance, the Contractor and the Owner shall sign a list of deficiencies as prepared by the Engineer/Architect for prompt correction and/or completion.

4.16.0 CLOSE DOWN OF WORK

4.16.1 Should the Work be closed down for any cause, the Contractor shall assume all responsibility for its proper protection during such period. They must protect all foundation work and other work liable to be damaged.

4.17.0 BROKEN GLASS

4.17.1 The Contractor shall be held responsible for any damaged, broken or scratched glass and at completion shall replace all such glass at no additional cost to the Owner.

4.18.0 HOARDING

4.18.1 Before starting excavating, construct and thereafter maintain all necessary hoarding required by Municipal or Provincial regulations or by other authorities having jurisdiction.

4.19.0 COMMISSIONING

4.19.1 The Contractor is responsible for commissioning the Work to ensure that the various parts are operating in a manner as intended by the Contract Documents. Even through individual components and/or parts of the Work may have been tested and approved prior to the substantial completion, the Contractor must coordinate a final commissioning of the complete Work, including at the place of the Work all their major Subcontractors and Suppliers. The final commissioning will be carried out by the appropriate trades working together in a complementary manner such that the successful operation of the whole Work is completed properly to the satisfaction of the Engineer/Architect. The Substantial Performance Certificate will not be issued until the final commissioning of the Work has been successfully completed.

4.20.0 FINAL CLEAN-UP

4.20.1 At the end of the job, thoroughly clean the building of all rubbish and surplus materials.

4.20.2 Make good all damaged areas in the building caused as a result of the Work of this Contract.

4.20.3 Do final cleaning, waxing and polishing of resilient flooring.

5.0 CAMPUS SAFETY AND HEALTH REGULATIONS

Maintaining a healthy and safe environment for all members of the campus community, as well as visitors, is a priority with the University. This involves a commitment from all sectors of the campus community and extends to outside agencies having occasion to come on campus to conduct business.

The following regulations will apply to all work undertaken by contractors and service personnel on any University property.

5.1.0 REGULATIONS, CODES AND STANDARDS

Contractors shall be familiar with and abide by provisions of various safety codes and standards applicable to the work performed and should refer to Article **23. PROTECTION OF WORK AND PROPERTY** in the **General Conditions**.

In particular, strict adherence shall be required to the Provincial Occupational Health and Safety Act and Regulations and the National Building Code of Canada, Part 8.

5.2.0 GENERAL SAFETY REGULATIONS

- a) Contractors/service agencies shall ensure that members of the campus community are not endangered by any work or process in which they may be engaged. Work areas shall be adequately barricaded, and if dust or fumes are generated, suitable enclosures shall be installed to contain such emissions.
- b) No material shall be stored in such a way as to obstruct walkways or represent a danger to pedestrian traffic.
- c) Adequate protection shall be provided to prevent the possibility of materials falling from scaffolding or elevated areas. Areas where materials are being loaded or offloaded shall be barricaded or otherwise protected to prevent unauthorized entry. Where necessary, appropriate warning signs shall be posted.
- d) The work areas must be kept reasonably clean and free from debris which could constitute a fire hazard. Care must be taken to ensure that the work process does not activate fire alarm detection devices. (Generation of dust and fumes can activate smoke detectors causing a false alarm).
- e) Due consideration shall be given to fire safety in buildings. Flammable materials must be kept away from sources of ignition. No work involving the use of open flame devices must be undertaken around flammable solvents or gases.
- f) Do not alter or disturb any materials believed to contain asbestos materials (unless this is a duly authorized part of the project). Should suspect materials be encountered, consult with University officials before proceeding.

- g) Material Safety Data Sheets shall be procured for any hazardous product used on campus. Such sheets shall be made readily available for consultation as required under the Workplace Hazardous Materials Information System.

NOTE: The above regulations are not to be considered all inclusive and are considered to be complementary to the safety requirements outlined in the agreement between the Owner and the Contractor/Service Agency. Certain conditions and circumstances may require adherence to additional safety regulations.

As a general requirement, contract/service personnel are expected to conduct all work on campus in a professional and safe manner and to give priority to the welfare of members of the campus community.

6.0 CONTRACTOR PERFORMANCE EVALUATION

- 6.1.0 The purpose of this process is to maintain an acceptable level of performance with external contractors carrying out work for the Department of Facilities Management.
- 6.2.0 A record of the performance of external contractors will be maintained to identify the following:
- a) Those contractors who by virtue of satisfactory performance will continue to be eligible to submit bids for work at the University;
 - b) Those contractors whose performance is considered unsatisfactory and will be advised of the need to improve performance to remain eligible to submit bids for work at the University;
 - c) Those contractors whose record of unsatisfactory performance will render them ineligible to submit bids for work at the University.
- 6.3.0 Contractors' performance will be evaluated on a points rating system relative to quality of work performed, timeliness in completing work and management/administration of contracts/work and safety parameters.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Types of items described in this Section:
- B. Types of items described in this Section:
 - 1. Work Covered By the Contract Documents.
 - 2. Type of Contract.
 - 3. Work Phases.
 - 4. Work Under Other Contracts.
 - 5. Products Ordered In Advance.
 - 6. Owner-Furnished Products.
 - 7. Use of Premises.
 - 8. Owner's Occupancy Requirements.
 - 9. Work Restrictions.
 - 10. Interpretation Of Documents
 - 11. Specification Formats and Conventions.
 - 12. Project Management and Coordination.
 - 13. Construction Progress Documentation.
 - 14. Photographic Documentation.
 - 15. Substitution Procedures.
 - 16. Submittal Procedures.
 - 17. Environmental Procedures.
 - 18. Wildlife Protection.
 - 19. Quality Requirements.
 - 20. Regulatory Requirements.
 - 21. Temporary Facilities and Control.
 - 22. Temporary Barriers and Enclosures.
 - 23. Product Requirements.
 - 24. Execution.
 - 25. Construction Waste Management And Disposal.
 - 26. Closeout Procedures.
 - 27. List of Incomplete Items (Punch List)
 - 28. Operation and Maintenance Data.
 - 29. Project Record Documents.
 - 30. Demonstration and Training.
- C. Types of items you will not find described in this Section:
 - 1. Health and Safety Requirements

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: EN-123-21; Engineering Building, Renovations to EN-4029
 - 1. Project Location: Main Campus, Memorial University, St. John's, NL.

- B. Owner: Memorial University of Newfoundland & Labrador
1. Owner's Representative: Department of Facilities Management

- C. The Work consists of the following:
1. The Work includes renovations to existing classroom involving selective demolition and new construction including architectural, furniture, and associated electrical, plumbing, and ventilation work.

1.4 TYPE OF CONTRACT

- A. Project will be constructed under a single lump sum contract.

1.5 WORK PHASES

- A. The Work shall be conducted in one (1) phase in the following order, with each phase substantially complete before beginning the next phase:
1. Work shall be substantially complete and ready for occupancy on August 7, 2024.
2. Before commencing Work of each phase, submit a schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.6 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Preceding Work: Owner has awarded / will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
1. No preceding work planned.
- C. Concurrent Work: Owner has awarded / will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
1. Work associated with Facilities Management trade shop support and Information Technology Services.
- D. Future Work: Owner has awarded / will award separate contract(s) for the following additional work to be performed at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
1. No future work planned.

1.7 PRODUCTS ORDERED IN ADVANCE

- A. General: Owner has negotiated Purchase Orders with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Purchase Orders to Contractor. Costs for receiving, handling, storage if required, and installation of material and equipment are included in the Contract Sum.
1. Contractor's responsibilities are same as if Contractor had negotiated Purchase Orders, including responsibility to renegotiate purchase and to execute final Purchase-Order agreements.
- B. List of Products Ordered in Advance:
1. None.

1.8 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
 2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
 3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
 6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
 7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Owner's Representative noting discrepancies or anticipated problems in use of product.
 8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
 9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
 10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
 11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.
- B. Owner-Furnished Products:
1. Owner supplied furnishings are included in this project as noted on drawings. Contractor to store and protect owner supplied furnishings on site for duration of project.

1.9 USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- C. Use of Site: Limit use of premises to areas under construction. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
 2. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Use of Existing Building: If the work involves construction in an existing building, maintain the existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.10 OWNER'S OCCUPANCY REQUIREMENTS

- A. **Partial Owner Occupancy:** Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. **Owner Occupancy of Completed Areas of Construction:** Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 2. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 3. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.11 WORK RESTRICTIONS

- A. **On-Site Work Hours:** Work shall be generally performed inside the existing building during normal business working hours, Monday through Friday, except otherwise indicated.
1. **Weekend Hours:** **When schedule requires. Contractor to notify Owner's representative 48hrs prior to scheduling.**
 2. **Early Morning Hours:** **When schedule of work requires and when nature of work produces excess noise not acceptable to owner. Contractor to notify Owner's representative 48hrs prior to scheduling.**
 3. **Hours for Utility Shutdowns:** **Provide owner 72 hours notice, work to occur before, or after normal working hours.**
 4. **Hours for Core Drilling and other noise generating activities:** **To be scheduled after regular work hours. Contractor to notify Owner's representative 48hrs prior to scheduling.**
- B. **Existing Utility Interruptions:** Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's Representative's written permission.
- C. No smoking is permitted on MUN Campus.

1.12 INTERPRETATION OF DOCUMENTS

- A. In the event of discrepancies or conflicts in interpreting the Plans (drawings) and Specifications,
1. Supplementary General Conditions take precedence over all other documents.
 2. General Conditions take precedence over drawings and specifications.
 3. Division 1 Sections take precedence over technical specification sections in other Divisions;
 4. Legends and schedules take precedence over drawings and Specifications, whether they are bound with the specifications or integral with the drawings;
 5. Specifications take precedence over all other drawings;

- B. Plans (drawings) and Specifications are complementary. When work is shown or mentioned on the drawings but is not indicated in the Specifications, or when work is indicated in the Specifications but is not shown or mentioned on the Drawings, it shall nevertheless be included in the Contract.

1.13 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's *MasterFormat* numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
- C. The words *shall*, *shall be*, or *shall comply with*, depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.14 PROJECT MANAGEMENT AND COORDINATION

- A. Coordination
 - 1. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
- B. Administrative and supervisory personnel
 - 1. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
 - 2. Maintain same superintendent on Project for duration of Project. Immediately notify Owner's Representative if superintendent should become unavailable to work and immediately replace with an alternate person acceptable to the Owner's Representative.
- C. Project meetings
 - 1. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 2. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Owner's Representative, within three days of the meeting.
 - 3. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

1.15 Requests For Interpretation (RFIs)

1. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 - a. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
2. Allow seven working days for Owner`s Representative's response for each RFI.
3. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Owner`s Representative in writing within 10 days of receipt of the RFI response.

1.16 CONSTRUCTION PROGRESS DOCUMENTATION

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.
 1. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 2. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
- B. Reports
 1. Daily Construction Reports: Prepare a daily construction report and submit to Owner`s Representative each week recording the following information concerning events at Project site:
 - a. List of subcontractors at Project site.
 - b. List of separate contractors at Project site.
 - c. Approximate count of personnel at Project site.
 - d. Equipment at Project site.
 - e. Material deliveries.
 - f. High and low temperatures and general weather conditions.
 - g. Accidents.
 - h. Meetings and significant decisions.
 - i. Unusual events.
 - j. Stoppages, delays, shortages, and losses.
 - k. Meter readings and similar recordings.
 - l. Emergency procedures.
 - m. Orders and requests of authorities having jurisdiction.
 - n. Change Orders received and implemented.
 - o. Construction Change Directives received and implemented.
 - p. Services connected and disconnected.
 - q. Equipment or system tests and start-ups.
 - r. Partial Completions and occupancies.
 - s. Substantial Completions authorized.
 2. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.17 PHOTOGRAPHIC DOCUMENTATION

- A. Preconstruction Photographs: Before starting construction take, digital photographs of Project site and surrounding areas, including existing items to remain during construction, from different vantage points.
- B. Periodic Construction Photographs: Take digital photographs weekly, with timing each month adjusted to coincide with the cut-off date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

- C. E-mail or otherwise submit photos to Owner's representative on monthly basis to coincide with the each Application for Payment.

1.18 SUBSTITUTION PROCEDURES

- A. Substitution Requests: Submit PDF copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of Owner's Representatives and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 - 2. Owner's Representative's Action: If necessary, Owner's Representative will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Owner's Representative will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Owner's Representative's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Owner's Representative does not issue a decision on use of a proposed substitution within time allocated.
- B. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- C. Substitutions for Convenience: Owner's Representative will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Owner's Representative.
 1. Conditions: Owner's Representative will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Owner's Representative will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.

1.19 SUBMITTAL PROCEDURES

- A. Contractor's Review
 1. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. **Mark with approval stamp before submitting to Owner's Representative.**
- B. Preferred Size for Paper Submittals
 1. Provide paper submittals on sheets no less than 8 ½ x 11" Whenever practical, provide paper submittals on sheet size not greater than 11 x 17". In all cases ease of readability of submittal content by Engineer shall take precedent over providing information on preferred sheet size.
- C. Submittal Procedures
 1. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - a. Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

2. Submit three paper copies of each submittal, unless otherwise indicated. The Owner's Representative will return no copies on any submittals but instead will e-mail a web link to a web site which will host PDFs of the reviewed documents.
3. Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner's Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - a. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner's Representative will advise Contractor when a submittal being processed must be delayed for coordination.
 - b. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - c. Sequential Review: Where sequential review of submittals by Owner's Representative's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
4. Owner's Representative will review each submittal, make marks to indicate corrections or modifications required, and return it. Owner's Representative will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
 - a. REVIEWED – NO COMMENTS
 - b. REVIEWED WITH COMMENTS. REVISE & RESUBMIT PRIOR TO START OF WROK.
 - c. REVIEWED WITH COMMENTS. PROCEED WITH WORK SUBJECT TO IMPLEMENTATION OF NOTED COMMENTS, REVISE AND RESUBMIT.
 - d. NOT ACCEPTED.

1.20 ENVIRONMENTAL PROCEDURES

A. Definitions

1. Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

B. Fires and burning of rubbish on site not permitted.

C. Store, handle, and dispose of hazardous materials in accordance with applicable federal and provincial laws, regulations, codes and guidelines. Store in location that will prevent spillage into the environment

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

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

E. Protect any trees and plants on site and adjacent properties that are in immediate area of construction.

1. Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
2. Restrict tree removal to areas indicated or designated by Owner's Representative.

F. Minimize stripping of topsoil and vegetation.

1.21 WILDLIFE PROTECTION

A. Should nests of migratory birds (Seagulls) be encountered during work, immediately notify Owner's Representative for directives to be followed.

1. Do not disturb nest site and neighbouring vegetation until nesting is completed.
2. Minimize work immediately adjacent to such areas until nesting is completed.
3. Protect these areas by following recommendations of Canadian Wildlife Service.

1.22 QUALITY REQUIREMENTS

A. Conflicting Requirements

1. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Owner's Representative for a decision before proceeding.
2. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Owner's Representative for a decision before proceeding.

B. Quality Control

1. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - a. Payment for these services will be made by the Owner.
 - b. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
2. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - a. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - b. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - c. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

1.23 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- B. Meet or exceed requirements of:
 1. Contract documents.
 2. Specified standards, codes, and referenced documents.

1.24 TEMPORARY FACILITIES AND CONTROLS

A. Temporary Utility Installation

1. General: Install temporary service or connect to existing service.
 - a. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Sanitary Facilities: If the Owner has existing toilet facilities these may be used as long as these facilities are kept cleaned and maintained in a condition acceptable to the Owner. Otherwise provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

3. Water Service: If the Owner has existing water service it may be used as long as it does not impact on the Owner's need. Otherwise install water service and distribution piping in sizes and pressures adequate for construction.
 4. Sewers and Drainage: Provide temporary utilities as required to remove effluent lawfully.
 5. Heating: Provide temporary heating as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 6. Ventilation and Humidity Control: Provide temporary ventilation as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 7. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - a. Install electric power service overhead, unless otherwise indicated.
 - b. If the Owner has an existing power source, the contractor may access it for temporary power provided it does not impact the Owner's needs.
 8. Lighting: Provide temporary lighting with local switching as required to provide adequate illumination for construction operations, observations, inspections, and traffic conditions.
 9. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
 10. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.
 11. Tree and Plant Protection: Install temporary fencing as required to protect trees and plants intended to remain. Install protection outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
 12. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner as required to prevent people and animals from easily entering site except by entrance gates.
- B. Operation, Termination, and Removal
1. Maintain facilities in good operating condition until removal.
 2. Remove each temporary facility when need for its service has ended.
- 1.25 TEMPORARY BARRIERS AND ENCLOSURES
- A. Hoarding
1. For work involving the excavation for new foundations or the erection of new structures outside of an enclosure, provide hoarding.
- B. Weather Enclosures
1. Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- C. Dust Tight Screens
1. Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- D. Protection Of Building Finishes
1. Provide protection for finished and partially finished building finishes and equipment during performance of work.

2. Provide necessary screens, covers, and hoardings.
3. Be responsible for damage incurred due to lack of or improper protection.

1.26 PRODUCT REQUIREMENTS

A. 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 Owner's Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Owner's Representative may establish course of action.

B. 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 Owner's 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.

C. Product Warranties

1. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

D. Product Selection Procedures

1. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1.27 EXECUTION

A. Materials

1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
2. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Owner's Representative for the visual and functional performance of in-place materials.

B. Construction Layout

1. Where work involves construction outside of an existing footprint, engage a land surveyor to lay out the Work using accepted surveying practices.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified location certificate showing dimensions, locations, angles, and elevations of construction and site work.

C. Installation

1. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - a. Make vertical work plumb and make horizontal work level.
 - b. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - c. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - d. Maintain minimum headroom clearance of 2440 mm in occupied spaces and in unoccupied spaces.
 2. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
 3. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - a. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner's Representative.
- D. Cutting And Patching
1. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - a. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
 2. Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
- E. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
- F. Progress Cleaning
1. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 2. Site: Maintain Project site free of waste materials and debris.
- G. Correction Of The Work
1. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 2. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
 3. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- H. Protection Of Installed Construction
1. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
 2. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
- 1.28 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
- A. Waste Reduction
1. Reduce construction waste during installation work. Undertake practices which will minimize waste and optimize full use of new materials on site, such as:
 - a. Use of a central cutting area to allow for easy access to off-cuts;
 - b. Use of off-cuts for blocking and bridging elsewhere.

- c. Use of effective and strategically placed facilities on site for storage and staging of left-over or partially cut materials (such as gypsum board, plywood, ceiling tiles, insulation etc...) to allow for easy incorporation into
 - B. Material Source Separation Process
 1. Perform demolition and removal of existing building components and equipment following a systematic deconstruction process.
 2. Separate materials and equipment at source, carefully dismantling, labelling and stockpiling alike items for the following purposes:
 - a. Reinstallation into the work where indicated.
 - b. Salvaging reusable items not needed in project which Contractor may sell to other parties. Sale of such items not permitted on site.
 - c. Sending as many items as possible to locally available recycling facility.
 - d. Segregating remaining waste and debris into various individual waste categories for disposal in a *non-mixed state* as recommended by waste processing/landfill sites.
 - C. Disposal Requirements
 1. Dispose of waste only at approved waste processing facility or landfill sites approved by authority having jurisdiction.
- 1.29 CLOSEOUT PROCEDURES
- A. Substantial Completion
 1. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - a. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - b. Advise Owner of pending insurance changeover requirements.
 - c. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - d. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - e. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - f. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - g. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - h. Complete start-up testing of systems.
 - i. Submit test/adjust/balance records.
 - j. Terminate and remove temporary facilities from Project site, along with mock-ups, construction tools, and similar elements.
 - k. Advise Owner of changeover in heat and other utilities.
 - l. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - m. Complete final cleaning requirements, including touch-up painting.
 - n. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 2. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner's Representative, that must be completed or corrected before certificate will be issued.

3. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- B. Final Completion
1. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - a. Submit a final Application for Payment according to the General Conditions.
 - b. Submit certified copy of Owner's Representative's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner's Representative. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - c. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - d. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 2. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner's Representative will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- C. Final Cleaning
1. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
 2. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
- 1.30 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Owner's Representative.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. Three paper copies of product schedule or list, unless otherwise indicated.
- 1.31 WARRANTIES
- A. Submittal Time: Submit written warranties on request of Owner's Representative for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215-by-280-mm paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title *WARRANTIES*, Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.32 OPERATION AND MAINTENANCE DATA

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- C. Manual Contents: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
- D. **Format: Submit operations and maintenance manuals in the following format:**
1. **PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Owner's Representative.**
 - a. **Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.**
 - b. **Enable inserted reviewer comments on draft submittals.**

1.33 PROJECT RECORD DOCUMENTS

- A. Record Drawings
1. Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 2. Mark Record Prints to show the actual installation where installation varies from that shown originally.
 3. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - a. Accurately record information in an understandable drawing technique.
 - b. Record data as soon as possible after obtaining it. Record and check the mark-up before enclosing concealed installations.
 4. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.

- i. Locations of concealed internal utilities.
- j. Changes made by Change Order or Change Directive.
- k. Changes made following Owner's Representative's written orders.
- l. Details not on the original Contract Drawings.
- m. Field records for variable and concealed conditions.
- n. Record information on the Work that is shown only schematically.
5. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
6. Mark record sets with erasable, red-coloured pencil. Use other colours to distinguish between changes for different categories of the Work at same location.
7. Mark important additional information that was either shown schematically or omitted from original Drawings.
8. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
9. Submit record drawings to Owner's Representative prior to requesting Substantial Completion inspection.

1.34 DEMONSTRATION AND TRAINING

- A. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of maintenance of each item of equipment.
- B. Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- C. Review contents of manual in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.
- E. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Administrative and procedural requirements governing allowances.
 - .1 Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.
 - .2 Types of allowances include the following:
 - .1 Revise list below to suit Project.
 - .2 Lump-sum allowances.
 - .3 Unit-cost allowances.
 - .4 Quantity allowances.
 - .5 Contingency allowances.
 - .6 Testing and inspecting allowances.
- .2 Types of items you will not find described in this Section:
 - .1 Procedures for using unit prices.
 - .2 Procedures governing the use of allowances for testing and inspecting.
 - .3 Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

- .1 At the earliest practical date after award of the Contract, advise Owner's Representative of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- .2 At Owner's Representative's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- .3 Purchase products and systems selected by Owner's Representative from the designated supplier.

1.4 SUBMITTALS

- .1 Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- .2 Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- .3 Submit time sheets and other documentation to show labour time and cost for installation of allowance items that include installation as part of the allowance.
- .4 Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- .1 Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 QUANTITY ALLOWANCES

- .1 Allowance shall include cost to Contractor of specific products and materials selected by Owner's Representative under allowance and shall include freight, and delivery to Project site.
- .2 Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labour, installation, overhead and profit, and similar costs related to products and materials selected by Owner's Representative under allowance shall be included as part of the Contract Sum and not part of the allowance.
- .3 Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - .1 If requested by Owner's Representative, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 CONTINGENCY ALLOWANCES

- .1 Use the contingency allowance only as directed by Owner's Representative for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- .2 Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.
- .3 Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- .4 At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.
- .5 The cash allowance shall not include HST.

1.8 TESTING AND INSPECTING ALLOWANCES

- .1 Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
- .2 The allowance does not include incidental labour required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labour to assist the testing agency shall be included in the Contract Sum.
- .3 At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

- .1 Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If

applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

- .1 Include installation costs in purchase amount only where indicated as part of the allowance.
 - .2 If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - .3 Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
-
- .2 Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labour, installation, overhead, and profit.
 - .1 Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - .2 No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- .1 Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- .1 Control Integration Allowance:
 - .1 Include a control integration allowance of \$2,173.91 for use according to Owner's instructions.
- .2 Lump-Sum Allowance:
 - .1 No Lump Sum Allowances apply to this Work.
- .3 Unit-Cost Allowance:
 - .1 No Unit Cost Allowances apply to this Work.
- .4 Contingency Allowance:
 - .1 Include a contingency allowance of \$6,521.74 for use according to Owner's instructions.
- .5 Testing and Inspection Allowance:
 - .1 No testing and Inspection Allowance apply to this Work.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Types of items described in this Section:
 - 1. Health and safety requirements for projects located in Newfoundland and Labrador.

1.3 REFERENCES

- A. Code and standards referenced in this section refer to the latest edition thereof.
- B. Canadian Standards Association (CSA)
 - 1. CSA S269.1 Falsework for Construction Purposes.
 - 2. CAN/CSA-Z259.1 Safety Belts and Lanyards.
 - 3. CAN/CSA-Z259.10 Full body Harnesses.
 - 4. CAN/CSA-Z259.11 Shock Absorbers for Personal Fall Arrest Systems.
 - 5. CAN/CSA-Z259.2, Fall Arresting Devices, Personnel Lowering Devices and Lifelines.
 - 6. FCC No. 301 Standard for Construction Operations.
 - 7. CSA Z275.2 Occupational Safety Code for Diving Operations.
 - 8. CSA Z275.4 Competency Standard for Divers Operations.
- C. FCC No. 302 Standard for Welding and Cutting.
- D. Transportation of Dangerous Goods Act Regulations.
- E. Newfoundland Occupational Health and Safety Act, Amended
- F. Consolidated Newfoundland and Regulations 1149 WMIS Regulations Under the Occupational Health and Safety Act
- G. Consolidated Newfoundland and Regulations 1165 Occupational Health and Safety Regulations under the Occupational Health and Safety Act.
- H. Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- I. National Building Code of Canada.

1.4 SUBMITTALS

- A. At least 10 (ten) working days prior to commencing any site work: submit to Owner's Representative copies of:
 - 1. A complete Site Specific Hazard Assessment and Safety Program Table of Contents.
 - 2. **Including requirements as outlined by the Department of Environmental Health & Safety, See APPENDIX A.**
- B. Acceptance of the Project Health and Safety Hazard Assessment and Management Plan and other submitted documents by the Owner's Representative shall only be viewed as acknowledgement that the contractor has submitted the required documentation under this specification section.
- C. Owner's Representative makes no representation and provides no warranty for the accuracy, completeness and legislative compliance of the Project Health and Safety Hazard Management Plan and other submitted documents by this acceptance.
- D. Responsibility for errors and omissions in the Project Health and Safety Hazard Assessment and Management Plan and other submitted documents is not relieved by acceptance by Owner's Representative.

1.5 OCCUPATIONAL HEALTH AND SAFETY (PROJECT HEALTH AND SAFETY HAZARD ASSESSMENT AND MANAGEMENT PLANS)

- A. Conduct operations in accordance with latest edition of the Newfoundland Occupational Health and Safety (OH&S) Act and Regulations.
- B. Prepare a detailed Project Health and Safety Hazard Assessment and Management Plan for the Owner. Assessment shall identify, evaluate and control job specific hazards and the necessary control measures to be implemented for managing hazards.
- C. Provide a copy of the Project Health and Safety Hazard Assessment and Management Plan upon request to Occupational Health and Safety Branch, Department of Labour, Province of Newfoundland and Labrador and the Owner.
- D. The written Health and Safety Hazard Assessment and Management Plan shall incorporate the following:
 - 1. A site-specific health and safety plan, refer to clause 1.6 Site-Specific Health and Safety Hazard Assessment and Management Plan of this section for requirements.
 - 2. An organizational structure which shall establish the specific chain of command and specify the overall responsibilities of contractor's employees at the work site.
 - 3. A comprehensive work plan which shall:
 - a. define work tasks and objectives of site activities/operations and the logistics and resources required to reach these tasks and objectives
 - b. establish personnel requirements for implementing the plan, and
 - c. establish site specific training and notification requirements and schedules.
 - 4. A personal protected equipment (PPE) Program which shall detail PPE:
 - a. Selection criteria based on site hazards.
 - b. Use, maintenance, inspection and storage requirements and procedures.

- c. Decontamination and disposal procedures.
 - d. Inspection procedures prior to during and after use, and other appropriate medical considerations.
 - e. Limitations during temperature extremes, heat stress and other appropriate medical consideration.
 5. An emergency response procedure, refer to Clause 1.7 Supervision and Emergency Response Procedure of this section for requirements.
 6. A hazard communication program for informing workers, visitors and individuals outside of the work area as required.
 7. A diving program which shall contain standard operating procedures to be followed in the diving operation.
 8. A health and safety training program.
 9. General safety rules.
 - E. Periodically review and modify as required each component of the Project Health and Safety Hazard Assessment and Management Plan when a new hazard is identified during completion of work and when an error or omission is identified in any part of the Project Health and Safety Hazard Assessment and Management Plan.
 - F. Implement all requirements of the Project Health and Safety Hazard Assessment and Management Plan.
 1. Ensure that every person entering the project site is informed of requirements under the Project Health and Safety Hazard Assessment and Management Plan.
 2. Take all necessary measures to immediately implement any engineering controls, administrative controls, personal protective equipment required or termination of work procedures to ensure compliance with the Project Health and Safety Hazard Assessment and Management Plan.
- 1.6 SITE SPECIFIC HEALTH AND SAFETY PLAN
- A. Prepare a detailed site Specific Project Health and Safety Plan which shall:
 1. Contain certain hazard assessment results.
 2. Identify engineering and administrative demonstrative controls (work-practices and procedures) to be implemented for managing identified and potential hazards, and comply with applicable federal and provincial legislation and more stringent requirements that have been specified in these specifications.
 - B. Review for completeness the hazard assessment results immediately prior to commencing work, when a new hazard is identified during completion of work and when an error or omission is identified.
 1. Be solely responsible for investigating, evaluation and managing any report of actual or potential hazards.
 2. Retain copies of all completed hazard assessments at the project site and make available to the Owner's Representative immediately upon request.
- 1.7 SUPERVISION AND EMERGENCY RESCUE PROCEDURE
- A. Carry out work under the direct supervision of competent persons responsible for safety by ensuring the work complies with the appropriate section of OH&S Act and Regulations
 - B. Assign a sufficient number of supervisory personnel to the work site.
 - C. Provide a suitable means of communications for workers required to work alone.

- D. Develop an emergency rescue plan for the job site and ensure that supervisors and workers are trained in the emergency rescue plan.
- E. The emergency response plan shall address, as a minimum:
1. Pre-emergency planning.
 2. Personnel roles, lines of authority and communication.
 3. Emergency recognition and prevention.
 4. Safe distances and places of refuge.
 5. Site security and control
 6. Evacuation routes and procedures
 7. Decontamination procedures which are not covered by the site specific safety and health plan.
 8. Emergency medical treatment and first aid.
 9. Emergency alarm, notification and response procedures including procedures for reporting incidents to local, provincial and federal government departments.
 10. PPE and emergency equipment.
 11. Procedures for handling emergency incidents.
 12. Site specific emergency response training requirements and schedules.
 13. For diving operation, include procedures for:
 - a. Managing deteriorating environmental conditions.
 - b. Managing unexpected weather or sea-state condition.
 - c. Evacuation of diver(s) under pressures greater than atmospheric pressure.
 - d. In-water emergency transfers.
 - e. Managing failing of equipment below the surface that impairs the ability of a diver to complete a dive.
 - f. Managing failure of any major component of diving plant or equipment.
 - g. Emergency signalling between divers involved in the diving program and between the diver(s) and the attendants using umbilical, tethers or other suitable methods.
 - h. Mobilizing stand-by divers.
 - i. Mobilizing crafts, stand-by boats and any other devices to be used for rescue.
 - j. Contacting evacuation, rescue, treatment facilities and medical services that will be used in the diving program.
 - k. Operation of emergency power and lighting facilities.
- F. The emergency response procedures shall be rehearsed regularly as part of the overall training program.
- G. Provide adequate first aid facilities for the jobsite and ensure that a minimum number of workers are trained in first aid in accordance with the First Aid Regulations.

1.8 CONTRACTORS SAFETY OFFICER

- A. The contractor's Safety Officer will be solely responsible for the implementation and monitoring of the Project Health and Safety Hazard Assessment and Management Plan, and will have the authority to implement health and safety changes as directed by the Owner's Representative. The Safety Officer shall have as a minimum:
1. Completed training in hazardous occurrence management and response/protocols.
 2. Completed training in the use, maintenance of fall protection systems.
 3. Completed training in the design and construction of scaffolding.
 4. Completed training in confined space entry protocols and techniques.
 5. Completed training in First Aid.

6. Have working knowledge of occupational safety and health regulations.
7. Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
8. Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
9. Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.9 HEALTH AND SAFETY COMMITTEE

- A. Establish an Occupational Health and Safety Committee where ten or more workers are employed on the job site as per the OH&S Act and Regulations. 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.
- C. Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 RESPONSIBILITY

- A. 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.
- B. 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.

1.11 UNFORESEEN HAZARDS

- A. Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Owner's Representative verbally and in writing.

1.12 INSTRUCTION AND TRAINING

- A. Workers shall not participate in or supervise any activity on the work site until they have been trained to a level required by this job function and responsibility. Training shall as a minimum thoroughly cover the following:
 1. Federal and Provincial Health and Safety Legislation requirements including roles and responsibilities of workers and person(s) responsible for implementing, monitoring and enforcing health and safety requirements.
 2. Safety and health hazards associated with working on a contaminated site including recognition of symptoms and signs which might indicate over exposure to hazards.
 3. Limitations, use, maintenance and disinfection-decontamination of personal protective equipment associated with completing work.
 4. Limitations, use, maintenance and care of engineering controls and equipment.

5. Limitations and use of emergency notifications and response equipment including emergency response protocol.
 6. Work practices and procedures to minimize the risk of an accident and hazardous occurrence from exposure to a hazard.
- B. Provide and maintain training of workers, as required, by Federal and Provincial legislation.
- C. Provide copies of all safety training certificates, upon request, to Owner's Representative for review, and to be maintained on the worker when they enter the work site.
- D. Authorized visitors shall not access the work site until they have been:
1. Notified of the names of persons responsible for implementing, monitoring and enforcing the Health and Safety Hazard Assessment and Management Plan.
 2. Briefed on safety and health hazards present on the site.
 3. Instructed in the proper use and limitations of personal protective equipment.
 4. Briefed as the emergency response protocol including notification and evacuation process.
 5. Informed of practices and procedures to minimize risks from hazards and applicable to activities performed by visitors.

1.13 CONSTRUCTION SAFETY MEASURES

- A. Observe construction safety measures of National Building Code, latest edition, Provincial Government, OH&S Act and Regulations, Workplace Health and Safety and Compensation Commission and Municipal Authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.
- B. Administer the project in a manner that will ensure, at all times, full compliance with Federal and Provincial Acts, regulations and applicable safety codes and the site Health and Safety Hazard Assessment and Management Plan.
- C. Provide Owner's Representative with copies of all orders, directions and any other documentation, issued by the Provincial Department of Government Services, Occupational Health and Safety branch immediately after receipt.

1.14 POSTING OF DOCUMENTS

- A. Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province and authority having jurisdiction, and in consultation with Owner's Representative.

1.15 HEALTH AND SAFETY MONITORING

- A. Periodic inspections of the contractor's work may be carried out by the Owner's Representative to maintain compliance with the Health and Safety Program. Inspections will include visual inspections as well as testing and sampling as required.
- B. The contractor shall be responsible for any and all costs associated with delays as a result of contractor's failure to comply with the requirements outlined in this section.

1.16 CORRECTION OF NON-COMPLIANCE

- A. Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner's Representative.
- B. Provide Owner's Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- C. Owner's Representative may stop work if non-compliance of health and safety regulations is not corrected.

1.17 WHMIS

- A. Ensure that all controlled products are in accordance with the Workplace Hazardous Materials Information System (WHMIS) Regulations and Chemical Substances of the OH&S Act and Regulations regarding use, handling, labelling, storage, and disposal of hazardous materials.
- B. Deliver copies of relevant (Material) Safety Data Sheets (SDS) to job site and the Owner's Representative. The SDS must be acceptable to Labour Canada and Health and Welfare Canada for all controlled products that will be used in the performance of this work.
- C. Train workers required to use or work in close proximity to controlled products as per OH&S Act and Regulations.
- D. Label controlled products at jobsite as per OH&S and Regulations.
- E. Provide appropriate emergency facilities as specified in the SDS where workers might be exposed to contact with chemicals, e.g. eye-wash facilities, emergency shower.
 - 1. Workers to be trained in use of such emergency equipment.
- F. Contractor shall provide appropriate personal protective equipment as specified in the SDS where workers are required to use controlled products.
 - 1. Properly fit workers for personal protective equipment
 - 2. Train workers in care, use and maintenance of personal protective equipment.
- G. No controlled products are to be brought on-site without prior approved SDS.
- H. The SDS are to remain on site at all times.

1.18 OVERLOADING

- A. Ensure no part of work or associated equipment is subjected to loading that will endanger its safety or will cause permanent deformation.

1.19 FALSEWORK

- A. Design and construct falsework in accordance with CSA S269.1.

1.20 SCAFFOLDING

- A. Design, erect and maintain scaffolding in accordance with CSA S269.2 and Sections 91-97 of the OH&S Act and Regulations.
- B. Ensure that fall-restraint or fall-arrest devices are used by all workers working at elevations greater than 3.05 metres above grade or floor level in accordance with CSA Z259.

1.21 PERSONAL PROTECTIVE EQUIPMENT

- A. Ensure workers on the jobsite use personal protective equipment appropriate to the hazards identified in the Hazard Assessment and Management Plan and those workers are trained in the proper care, use, and maintenance of such equipment.
- B. PPE selections shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, task-specific conditions, duration and hazards and potential hazards identified on site.
- C. Provide workers and visitors to the site with proper respiratory protection equipment.
 - 1. No work shall be performed in an area where an airborne contaminant exceeds one half ($\frac{1}{2}$) the IDLH concentration.
 - 2. Respiratory protection shall be provided in accordance with the requirements of the Occupational Health and Safety Branch, Department of Labour of the Province of Newfoundland and Labrador and these specifications.
 - 3. Establish, implement and maintain a respirator inspection and maintenance program.
 - 4. Copies of all respirator owners' maintenance manuals shall be kept at all times at the contractor's site office.
- D. Provide and maintain a supply of dermal protection equipment to allow visitors and all workers proper dermal protection.
 - 1. Dermal protection shall be sufficient to act as a protective barrier between the skin and an airborne contaminant or hazardous material. Dermal protection shall also be provided for all physical hazards.
 - 2. Dermal protection equipment shall not be used after exceeding 75% of the break through time. The break through time shall be based on the contaminant which requires the least amount of time to break through the protective equipment
 - 3. Copies of all dermal protection user specifications, owners and maintenance manuals shall be kept at all times at the contractor's site office.
 - 4. Establish, implement and maintain air inspection program to ensure proper dermal protection in accordance with CSA, NIOSH, U.S. EPA and manufacturer's requirements.
- E. Provide all workers and up to two (2) visitors to the site with proper hearing protection. Workers and visitors shall not be exposed to noise levels greater than 85 dB (A) over an eight hour shift without proper hearing protection.
- F. Provide all workers and up to two (2) visitors to the site with CSA approved eye protection sufficient to act as a protective barrier between the eye and airborne contaminants, hazardous materials and physical hazard.
- G. Provide workers and up to two (2) visitors to the site with CSA approved hard hats.

1.22 EXCAVATION SAFETY

- A. Protect excavations more than 1.25 metres deep against cave-ins or wall collapse by side wall sloping to the appropriate angle of repose, an engineered shoring/sheathing system or an approved trench box.
 - 1. Provide a ladder which can extend from the bottom of the excavation to at least 0.91 metres above the top of the excavation.
- B. Ensure that all excavations less than 1.25 metres deep are effectively protected when hazardous ground movement may be expected.
- C. Design trench boxes, certified by a registered Professional Engineer, and fabricated by a reputable manufacturer. Provide the manufacturer's Depth Certificate Statement permanently affixed. Use trench boxes in strict accordance with manufacturer's instructions and depth certification data.
- D. For excavations deeper than six (6) metres, provide a certificate from a registered Professional Engineer stating that the protection methods proposed have been properly designed in accordance with accepted engineering practice. The engineer's certificate shall verify that the trench boxes, if used, are properly designed and constructed to suit the depth and soil conditions.
 - 1. Ensure that the superintendent and every crew chief, foreperson and lead hand engaged in trenching operations or working in trenches have in his/her possession a copy of the Department of Labour's "Trench Excavation Safety Guide".

1.23 CONFINED SPACE WORK

- A. Comply with requirements of Canada Occupational Safety and Health Regulations, Part XI and Consolidated Regulations Newfoundland and Labrador (CRNL) OH&S 1165/96.
- B. Provide approved air monitoring equipment where workers are working in confined spaces and ensure any test equipment to be used is calibrated, in good working order and used by trained persons.
- C. Develop a confined space entry program specific to the nature of work performed and in accordance with OH&S Act and Regulations and ensure supervisors and workers are trained in the confined space entry program.
 - 1. Ensure that personal protective equipment and emergency rescue equipment appropriate to the nature of the work being performed is provided and used.
- D. Provide and maintain training of workers, as required by the Federal and Provincial Legislation.
- E. Provide Owner's Representative with a copy of an "Entry Permit" for each entry into the confined space to ensure compliance with Federal and Provincial Legislation.

1.24 HAZARDOUS MATERIALS

- A. Should material resembling hazardous materials (asbestos/mould) be encountered during the execution of work and notify Owner's Representative. Do not proceed until written instructions have been received from Owner's Representative.

- B. Unless otherwise noted, for hazardous materials abatement and repair, employ the services of a recognized Environmental Consultant to provide all air monitoring and testing services for regulatory requirements.

1.25 HEAVY EQUIPMENT

- A. Ensure mobile equipment used on jobsite is of the type specified in OH&S Act and Regulations fitted with a Roll Over Protective (ROP) Structure.
- B. Provide certificate of training in Power Line Hazards for operators of heavy equipment.
- C. Obtain written clearance from the power utility where equipment is used in close proximity to (within 5.5 metres) overhead or underground power lines.
- D. Equip cranes with:
 - 1. A mechanism which will effectively prevent the hook assembly from running into the top boom pulley.
 - 2. A legible load chart.
 - 3. A maintenance log book.

1.26 WORK STOPPAGE

- A. Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations of Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

APPENDIX "A" Contractor Safety Management Element – November 2018



Contractor Safety Management Element

November 2018

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1.0 Purpose

This element establishes the requirements for the administration and monitoring of contractor health and safety programs and activities at Memorial University. These measures shall ensure that contractors understand their collective responsibility with respect to the Occupational Health & Safety Act and Regulations, Memorial University policy and this element.

2.0 Scope

This procedure shall apply to all work done for Memorial University of Newfoundland with respect to the provision of services as outlined below. Memorial University reserves the right to exempt a Contractor from this element, in whole or in part, based upon an evaluation of the risk of the work being conducted. This evaluation must comply with the hazard identification and risk management element.

3.0 Definitions

Act: Newfoundland & Labrador Occupational Health & Safety Act, latest edition.

Contract: A documented agreement between Memorial University and a contractor.

Contractor: The principal contractor, person, partnership, or corporation bound to execute the work under the contract and defined as such in the agreement is responsible for the supervision of the work so as to ensure the work is carried out in accordance with the contract.

Project Management Team: The group assigned by the University to act on behalf of the owner with respect to the execution of Contractor work.

Principal Contractor: The person primarily responsible for the carrying out of a contract.

Regulations: Newfoundland & Labrador Occupational Health & Safety Regulations, latest edition.

Subcontractor: A person, firm or corporation having a direct contract with the Contractor or subcontractor(s) to perform a part or parts of the work included in the contract, or to supply products worked to a special design according to the contract documents, but does not include one who merely supplies products not so worked.

Owner: The Owner, Engineer/Architect are the persons, firms or corporation identified as such in the Contract. The term Owner, Engineer/Architect means, respectively, each of the Owner, Engineer/Architect and their authorized representatives as designated by each such party in writing.

Work: The services and job procedure completion that is described in the contract.

4.0 Roles and Responsibilities

4.1 Project Management Team

Will monitor the Contractor's performance for health and safety compliance. Monitoring activities may include but are not limited to:

- planned and unplanned workplace inspections;
- attendance of meetings;
- communications of safety related issues and topics, as deemed necessary;
- review of contractor records, inspections, work practices and documentation; and
- complete audits to verify that contractors and subcontractors are meeting their legislative, procedural and contractual responsibilities.

4.2 Contractors

Will comply with applicable Federal and Provincial legislation and applicable MUN safety procedures. Contractor responsibilities include but not limited to:

- report all incidents immediately to the required University project team followed by a written incident report within 24 hours;
- be responsible for the safety of subcontractors including those not under their employ;
- stop work if the conditions are such that work cannot be performed safely;
- perform evaluation, monitoring of the workplace to identify potential hazards and associated risks and ensure corrective actions are implemented;
- ensure daily task specific hazard assessments are completed; and
- maintain the accountability of persons responsible for the reporting and correction of hazards.

5.0 Procedure

5.1 Considerations prior to signing of contract

5.1.1 Prior to signing of contract, the preferred General Contractor shall provide proof of compliance with 5.2.1.

Within seven (7) calendar days after a pre-signing start up meeting the General Contractor shall provide proof of compliance of themselves and their subcontractors with 5.2.1 as well as provide the information requested in Section 5.2.2(a) (b).

5.2 Requirements

5.2.1 All Contractors, and their Subcontractors, shall be required to submit confirmation of a current third party occupational health and safety program certification (Letter of Assurance). These may include, but not be limited to, Certificate of Recognition (COR), OHSAS 18001, and CSAZ.1000.

5.2.2 Contractors shall also provide the following:

- (a) health and safety policy statement;
- (b) safety program table of contents; and
- (c) site hazard assessment;

The hazard assessment shall be updated by the General Contractor and re-submitted whenever the conditions, work practices or work forces change to the extent that new hazards can be identified.

5.2.3 In lieu of a Subcontractors 3rd party program, Contractors shall be required to integrate the Subcontractor(s) into the Contractors program and provide proof of same.

5.2.4 Memorial reserves the right to request and audit the full safety program of Contractors and Subcontractors and their associated documentation. This documentation may include, but not be limited to the following:

- (a) safety program and/or manual
- (b) applicable documented safe work practices;
- (c) inspection reports and schedules;
- (d) required employee safety training certifications and qualifications; and
- (e) updated list of OHS Committee and/or a worker health and safety representative, or workplace health and safety designate.

Request for submission shall be complied with within 7 calendar days of a written request from Memorial's Environmental Health and Safety unit.

5.2.5 Memorial reserves the right to:

- (1) Reject any Contractor that fails to meet the requirements or schedules outlined herein;
- (2) The University reserves the right to stop any work or portion of work where the risk presents an immediate danger.

5.3 Schedule of Submissions

5.3.1 General Contractors and their sub-contractors who have complied with 5.1.1 will be permitted to commence physical work on the site however no work shall be performed by the General Contractor, their sub-contractors until such a time as they comply with 5.1.1.



6.0 Post-Contract Evaluation

The Project Management Team will determine the extent of the evaluation of the Contractor's safety performance at the completion of the contract. This evaluation will be conducted by way of a standard contractor safety evaluation form and will be supported by objective evidence documented during the term of the Contract. The records of the evaluation must be retained with the project owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- .2 OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 General requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- .2 Types of items you will not find described in this Section:
 - .1 Commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.
 - .2 Commissioning process activities for building interiors construction, stairways, and finish systems and assemblies.
 - .3 Commissioning process activities for conveying systems, assemblies, equipment, and components.
 - .4 Commissioning process activities for fire-suppression systems, assemblies, equipment, and components.
 - .5 Commissioning process activities for plumbing systems, assemblies, equipment, and components.
 - .6 Commissioning process activities for HVAC systems, assemblies, equipment, and components.
 - .7 Commissioning process activities for integrated automation systems, assemblies, equipment, and components.
 - .8 Commissioning process activities for electrical systems, assemblies, equipment, and components.
 - .9 Commissioning process activities for communications systems, assemblies, equipment, and components.
 - .10 Commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

1.3 DEFINITIONS

- .1 BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- .2 Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- .3 CxA: Commissioning Authority.
- .4 OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- .5 Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean *as-built* systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

- .1 Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
 - .2 Members Appointed by Owner:
 - .1 CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
 - .2 Representatives of the facility user and operation and maintenance personnel.
 - .3 Owner's Representative and engineering design professionals.
- 1.5 OWNER'S RESPONSIBILITIES
- .1 Provide the OPR documentation to the CxA and Contractor for information and use.
 - .2 Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
 - .3 Provide the BoD documentation, prepared by Owner's Representative and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
- 1.6 CONTRACTOR'S RESPONSIBILITIES
- .1 Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
 - .1 Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - .2 Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 - .3 Attend commissioning team meetings held on a variable basis.
 - .4 Integrate and coordinate commissioning process activities with construction schedule.
 - .5 Review and accept construction checklists provided by the CxA.
 - .6 Complete paper construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
 - .7 Review and accept commissioning process test procedures provided by the Commissioning Authority.
 - .8 Complete commissioning process test procedures.
- 1.7 CxA'S RESPONSIBILITIES
- .1 Organize and lead the commissioning team.
 - .2 Provide commissioning plan.
 - .3 Convene commissioning team meetings.
 - .4 Provide Project-specific construction checklists and commissioning process test procedures.
 - .5 Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

- .6 Prepare and maintain the Issues Log.
- .7 Prepare and maintain completed construction checklist log.
- .8 Witness systems, assemblies, equipment, and component startup.
- .9 Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes a copy of:

.1 Asbestos and Lead Paint Building Materials Survey for: Engineering Building Memorial University of Newfoundland June 19, 2013

.2 This report was prepared primarily for the use of the Owner and the Design Team. The recommendations shall not be construed as a requirement of this Contract, unless also contained elsewhere in the Contract Documents.

.3 The report, by its nature, cannot reveal all conditions that exist or occur on the site. Undertake whatever precautionary measures as required by authorities having jurisdiction and whatever measures as you see prudent and appropriate to protect workers, building occupants, and the environment from hazardous materials.

.4 Should conditions be found to vary substantially from the report, changes in the design and construction of the Work may be made, with resulting credits or expenditures to the Contract Price accruing to the Owner.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION



**ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY FOR:
ENGINEERING BUILDING
MEMORIAL UNIVERSITY OF NEWFOUNDLAND**



Prepared for:
Memorial University of Newfoundland
St. John's, NL

Pinchin LeBlanc Environmental Ltd
Project No. 02-02-00900

June 19, 201

EXECUTIVE SUMMARY

Pinchin LeBlanc Environmental Limited. (Pinchin) was retained by Memorial University of Newfoundland to perform asbestos and lead paint surveys in selected buildings on the Memorial University of Newfoundland's St. John's, NL campus. A total of twenty-seven (27) buildings were surveyed for asbestos containing materials (ACM) and lead based paints (LBP). This report will provide the findings for the following location;

BUILDING DESCRIPTION: ENGINEERING BUILDING

BUILDING ADDRESS: MEMORIAL UNIVERSITY OF NL, ST. JOHN'S CAMPUS, NL

A summary of the findings for the Engineering Building (hereafter referred to as "Site Building") is provided. For specific recommendations regarding any hazardous materials listed the reader will refer to Sections 3 and 4 of this report:

1. Friable asbestos containing building materials were identified in the Site Building, specifically parging cement,
2. Non-friable materials with the potential to become friable during renovation and demolition activities were identified inside the Site Building, specifically drywall joint compound.
3. Non-friable asbestos-containing building materials were identified in the Site Building, specifically vinyl floor tiles, transite, incandescent heat shields, and tar mastic;
4. Paints containing greater than 600 mg/kg of lead were identified in the Site Building, specifically the cream paint as observed in EN1250, the green paint as observed in EN1035, and the green paint in EN 4013.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.

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1.0 INTRODUCTION

Pinchin LeBlanc Environmental Ltd. (Pinchin) was retained by Memorial University of Newfoundland to perform asbestos and lead paint surveys in selected buildings on the Memorial University of Newfoundland's St. John's, NL campus. A total of twenty-seven (27) buildings were surveyed for asbestos containing materials (ACM) and lead based paints (LBP). This report will provide the findings for the following location;

BUILDING DESCRIPTION: ENGINEERING BUILDING

BUILDING ADDRESS: MEMORIAL UNIVERSITY OF NL, ST. JOHN'S CAMPUS, NL

The report presents a detailed investigation of condition, quantity, location, access, and type of ACM and LBP present in the building. The Overview Report, provided under separate cover, provides detailed information regarding the survey methodology, sampling procedure, evaluation criteria, suspect materials and regulatory information.

Provincial regulations and guidelines distinguish between friable¹ and non-friable² materials. The asbestos building materials survey performed by Pinchin included a search for both friable and common non-friable ACM.

For reporting purposes, the survey will be divided into sections. The report is presented in this manner to accommodate ease in reading and to allow access to report information for specific areas or materials within the building. The report also addresses specific systems and products likely present in the building. The sections of the report are as follows:

- 2.0 Survey Information
- 3.0 ACM Survey Findings
- 4.0 LBP Survey Findings
- 5.0 Recommendations

1 The term friable is applied to a material that can be readily reduced to dust or powder by hand or moderate pressure. Friable ACM has a much greater potential to release airborne asbestos fibres when disturbed. The most common friable ACM used in the past are sprayed or trowelled materials (for fireproofing or thermal insulation), texture plaster (decorative or acoustic), and mechanical insulations.

2 Common non-friable ACM include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement pipe or board (transite), and asbestos textiles. Although a product may be considered non-friable when new, if the product releases fine dust due to deterioration or during removal, the free dust is considered friable. For example, most lay-in or glued on acoustic ceiling tiles release significant dust during removal of large quantities of these tiles.

2.0 SURVEY INFORMATION

The survey was conducted between July 27th and August 1st, 2012. The survey, collection of representative bulk samples, and recording of information was performed by Mr. Trent Hardy and Mr. Philip Lowery of Pinchin. All accessible areas of the building were inspected for the presence of asbestos containing materials (ACM) and lead based paints (LBP).

A total of eighty-three (83) representative bulk samples were collected for analysis for asbestos content and thirteen (13) bulk samples were collected for analysis of lead content.

3.0 ACM SURVEY FINDINGS

The ACM found during this survey are detailed in the location & data excel document provided to the client. The excel document serves as the clients active asbestos management plan. Quantities of materials identified, locations and friable or non-friable are also present in this excel file. Laboratory certificates for asbestos samples collected are presented in Appendix I and lead samples are presented in Appendix II. Sample location drawings are provided in Appendix III. A photographic record of the samples collected during the survey of the building is presented in Appendix IV. The following is summary of the findings for this building.

3.1 Sprayed or Trowelled Fireproofing and Thermal Insulation

Two (2) samples of spray applied fireproofing material were collected from above the ceiling in rooms EN 3034, and EN 1052. Analysis of the samples did not identify the presence of asbestos (reference samples 02-02-900-S080 and 02-02-900-S004).

3.2 Mechanical Insulation

Insulating cement, also referred to as “parging cement”, present on pipe elbows for and fittings was sampled in site building. Results from two (2) of the three (3) samples contain 25- 30% Chrysotile asbestos in (reference sample 02-02-900-S082 and 02-02-900-S008). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

The sample of tar mastic and paper sampled above ceiling in room EN 1053 contains 10% chrysotile asbestos (reference sample 02-02-900-S005). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

One (1) sample of the tar paper used on fibreglass insulation was collected from EN 1053. Analysis of the samples did not identify the presence of asbestos (reference sample 02-02-900-S038).

3.3 Acoustic Ceiling Tiles

Seven (7) samples were collected of acoustic ceiling tiles were observed in the site building. Analysis of the samples did not identify the presence of asbestos. A summary of the acoustic ceiling tiles samples collected are as follows:

- The 2"x2" acoustic ceiling tile distinguished with a pinhole and fleck pattern located in EN 2077 (reference sample 02-02-900-S048);
- The 2"x2" acoustic ceiling tile distinguished with a pinhole fleck pattern located in EN-1051A (reference sample 02-02-900-S007);
- The 2"x2" acoustic ceiling tile distinguished with a pinhole pattern located in EN 1056 (reference sample 02-02-900-S012);
- The 2"x2" acoustic ceiling tile distinguished with a plain pattern located in EN 1037 (reference sample 02-02-900-S040);
- The 2"x2" acoustic ceiling tile distinguished with a pinhole pattern located in EN 1052 (reference sample 02-02-900-S003);
- The 2"x2" acoustic ceiling tile distinguished with a pinhole and fleck pattern located in EN 1053 (reference sample 02-02-900-S010);and
- The 2"x2" acoustic ceiling tile distinguished with a pinhole and fissure pattern located in EN 1034B (reference sample 02-02-900-S029);

3.4 Drywall, Plaster, and Texture Finishes

Drywall was used as a wall and ceiling finish throughout the building. Until the early to mid-1980s, drywall joint compound may have contained chrysotile asbestos. Drywall joint compound is considered a non-friable material. Most buildings of this type undergo constant renovation, including the removal and replacement of drywall partitions. Therefore extensive sampling of drywall compound is necessary to come to a reasonable conclusion regarding the extent of asbestos. Furthermore, any attempt to distinguish and delineate all asbestos-containing drywall compounds from new non-asbestos drywall compound is often unachievable. Therefore, drywall joint compound was sampled at walls, which were believed to be original to try to define the presence of asbestos content in the original drywall compound.

Twenty (20) samples, in total, of drywall joint compound were collected in the site building. Results from ten (10) samples collected were determined to contain asbestos (reference samples 02-02-900-S024, 02-02-900-S043 02-02-900-S057 02-02-900-S058 02-02-900-S060 02-02-900-S068 02-02-900-S070 02-02-900-S072 02-02-900-S073 and 02-02-900-S074).

Plaster was used as a wall and ceiling finish in various locations in the Site Building. Until the early to mid-1980s, plaster may have contained chrysotile asbestos. Plaster is considered a potentially friable material. Most buildings of this type undergo constant renovation, including the removal and replacement of plaster. Moreover, the addition of asbestos to plaster compound was done at the site by the individual plasterer on an as needs basis. Therefore extensive sampling of plaster is necessary to come to a reasonable conclusion regarding the extent of asbestos. Furthermore, any attempt to distinguish and delineate all asbestos-containing plaster from new non-asbestos plaster is often unachievable. Therefore, plaster was sampled at walls which were believed to be original to try to define the presence of asbestos content in the original plaster.

Six (6) samples of plaster were collected throughout the site building. Analysis of the samples did not identify the presence of asbestos (reference samples 02-02-900-S079, 02-02-900-S078, 02-02-900-S05, 02-02-900-S075, 02-02-900-S076 and 02-02-900-S077).

Friable textured ceiling stucco was also observed on the ceilings of the stairwells of the site building. Samples of this material were collected from EN 2000 and EN 2001 and analysis of the samples did not identify the presence of asbestos (reference sample 02-02-900-S052 and 02-02-900-S054).

3.5 Vinyl Flooring Materials

3.5.1 Vinyl Floor Tiles Thirty (30) types of vinyl floor tiles were observed in the site building. Results from eleven (11) of the thirty (30) samples collected contain asbestos. For locations and conditions of this material at the time of the building survey refer to location & data excel document. A list of the visually different asbestos and non-asbestos vinyl floor tiles is provided below:

3.5.1.1 Asbestos Containing Vinyl Floor Tiles

Asbestos Floor Tile Summary Engineering Building			
Reference Sample	Description	Location	Asbestos (%)
02-02-900-S021	12"x12" vinyl floor tiles brown with abundant grey flecks	EN 1019A	3%
02-02-900-S035	12"x12" vinyl floor tiles brown with white and dark brown streaks	EN 1023F	3%
02-02-900-S033	12"x12" vinyl floor tiles green with brown and white streaks	EN 1026A	3%
02-02-900-S018	12"x12" vinyl floor tiles green with thick green streak	EN 1C01	3%
02-02-900-S050	12"x12" vinyl floor tiles grey with brown streaks	EN 2006	2%
02-02-900-S034	12"x12" vinyl floor tiles grey with dark grey streaks	EN 1023A	3%
02-02-900-S041	12"x12" vinyl floor tiles grey with dark grey streaks	EN 2024	3%
02-02-900-S023	12"x12" vinyl floor tiles light brown with brick red streak	EN 1019A	3%
02-02-900-S011	12"x12" vinyl floor tiles light brown with large white streaks	EN 1056	3%
02-02-900-S055	12"x12" vinyl floor tiles red with abundant white streaks	EN 2C01	3%
02-02-900-S013	12"x12" vinyl floor tiles very light brown with large brown streaks	EN 1061	3%
For additional locations of these materials at the time of the building survey refer to location & data excel document.			

3.5.1.2 Non Asbestos-Containing Vinyl Floor Tiles

Non-Asbestos Floor Tile Summary Engineering Building		
Reference Sample	Description	Location
02-02-900-S001	12"x12" Vinyl floor tiles greenish blue with large green and white streak	EN 1052
02-02-900-S042	12"x12" vinyl floor tiles grey with abundant white and dark grey flecks	EN 2020
02-02-900-S019	12"x12" vinyl floor tiles green with large white streaks	EN 1C01
02-02-900-S026	12"x12" vinyl floor tiles large brown and cream streaks	EN 1038F
02-02-900-S044	12"x12" vinyl floor tiles light yellow with dark yellow and white specks	EN 2048
02-02-900-S064	12"x12" vinyl floor tiles pale yellow with abundant yellow and white streak	EN 3000A
02-02-900-S036	12"x12" vinyl floor tiles white	EN 1023F
02-02-900-S022	12"x12" vinyl floor tiles white mottled brown	EN 1019A
02-02-900-S020	12"x12" vinyl floor tiles white with abundant grey flecks	EN 1015B
02-02-900-S006	12"x12" vinyl floor tiles white with black streaks	EN 1051A
02-02-900-S059	12"x12" vinyl floor tiles white with brown streak	EN 3057
02-02-900-S028	12"x12" vinyl floor tiles white with large brown flecks	EN 1010
02-02-900-S031	12"x12" vinyl floor tiles white with light blue streaks	EN 1035E
02-02-900-S046	12"x12" vinyl floor tiles, white with abundant grey flecks	EN 205C
02-02-900-S045	12"x12" vinyl floor tiles, white with yellow streak	EN 2050

Non-Asbestos Floor Tile Summary Engineering Building		
Reference Sample	Description	Location
02-02-900-S009	12"x12" vinyl; floor tiles blue with white streak	EN 1053
02-02-900-S017	12"x12" vinyl floor tiles aqua with white and green fleck	EN 1C01
02-02-900-S081	12"x12" vinyl floor tiles pebble stone pattern	
02-02-900-S083	12"x12" vinyl floor tiles orange with brown	EN2042
For additional locations of these materials at the time of the building survey refer to location & data excel document.		

3.5.2 Vinyl Sheet Flooring

Six (6) types of vinyl sheet flooring were observed in the site building. Analysis of the samples did not identify the presence of asbestos. A summary of the visually different asbestos containing vinyl sheet flooring is provided in the tables below:

3.5.2.1 Non-Asbestos Containing Vinyl Sheet Flooring

Non-Asbestos Containing Vinyl Sheet Flooring Engineering Building		
Sample Number	Description	Location
02-02-900-S069	Vinyl Sheet Flooring white with grey and brown mottles	EN 4029B
02-02-900-S039	Vinyl sheet flooring blue wave pattern	EN
02-02-900-S071	Vinyl sheet flooring brown stone pattern	EN 4004
02-02-900-S061	Vinyl sheet flooring dark blue	EN 3038
02-02-900-S066	Vinyl sheet flooring pale yellow with brown flecks	EN 2030

Non-Asbestos Containing Vinyl Sheet Flooring Engineering Building		
Sample Number	Description	Location
02-02-900-S065	Vinyl Sheet Flooring, dark grey flecks	EN 4028
For additional locations of these materials at the time of the building survey refer to location & data excel document.		

3.6 Asbestos Cement Products

One (1) sample of transite sheeting was collected inside the fume hood from EN 1020B and contains 20% chrysotile asbestos (reference sample 02-02-900-S025). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

The black phenolic lab bench also referred as “transite counter” was sampled in room EN 1001 and contains 15% amosite and 5% chrysotile asbestos (reference sample 02-02-900-S016). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

3.7 Vermiculite Insulation

No vermiculite containing products were observed. Visual observations were made above the ceiling and through any hatches.

3.8 Other Asbestos Containing Building Materials

One (1) sample of foil paper in the incandescent light fixture was collected from EN 4027 and contains 40% chrysotile asbestos (reference sample 02-02-900-S053). For locations and conditions of this material at the time of the building survey refer to location & data excel document.

One (1) sample of leveling compound on the ducts was collected from room EN 1049. Analysis of the sample did not identify the presence of asbestos (reference sample 02-02-900-S015).

One (1) sample of mastic compound on the ducts was collected from EN 3000A. Analysis of the samples did not identify the presence of asbestos (reference sample 02-02-900-S063).

4.0 LBP SURVEY FINDINGS

Analytical results indicate that three (3) of the samples collected of painted surfaces would be considered a risk to worker exposure during construction or renovation activities (with lead concentrations exceeding 0.06%). The cream paint as observed in EN 1250 (reference sample 02-02-900-L002) contains 0.26%, the green paint as observed in EN 10350 (reference sample 02-02-900-L013) contains 0.067% and the green paint in EN 4013 (reference sample 02-02-900-L012) contains 0.11% and the same paint colours located elsewhere, should be managed as lead-containing.

Results indicate that were detected, all other paint samples containing less than 0.06% lead.

All paints observed inside the Site Building were observed in GOOD condition.

5.0 RECOMMENDATIONS

Asbestos containing materials and lead based paints have been identified in the Site Building. Listed below are a series of general recommendations for the Site Building. Recommendations provided in the Overview Report may also be reviewed and applied to this building.

Friable ACMs

Friable asbestos containing materials identified inside the Site Building include: parging cement.

1. Type III (high risk) asbestos abatement procedures should be carried out for the scheduled removal of greater than 1 ft² of friable asbestos containing materials. Alternatively, Type II (moderate risk) glove bag abatement procedures may be applied where practical;
2. Type II (moderate risk) asbestos abatement procedures should be carried out for the scheduled repair or enclosure of friable ACMs or for the removal of less than 1ft² of material;

Potentially Friable Materials

Non-friable materials with the potential to become friable during renovation and demolition activities were identified inside the Site Building, specifically drywall joint compound

1. Under the NL guidance documents for moderate and low risk asbestos abatement procedures, quantities of these materials within an enclosure exceeding 100 ft² should be removed using Type III (high risk) asbestos abatement procedures. Quantities less than 100 ft² but exceeding 10ft² should be removed using Type II (moderate risk) asbestos abatement procedures, while

quantities less than 10 ft² should be removed using Type I (low risk) asbestos abatement procedures.

Non-Friable Materials

Non-friable asbestos containing materials identified inside the Site Building include: transite, tar mastic, and vinyl floor products.

1. Type I (low risk) asbestos abatement procedures should be carried out for the scheduled disturbance of any non-friable materials provided the materials can be removed intact, and without the use of powered hand tools.
2. Should the use of powered hand tools or excessive breakage of the materials become necessary, Type II (moderate risk) asbestos abatement procedures should be adopted.

Lead Based Paints

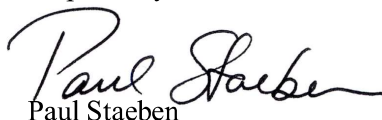
Do not grind, sand, torch or cut lead materials without using proper procedures, as material poses a health hazard if disturbed by these methods.

Any painted surfaces visually matching the identified paint colors should be managed as lead containing and necessary precautions (i.e.: worker protection) should be employed prior to the disturbance to these materials. Do not grind, sand, torch or cut lead materials without using proper procedures, as material poses a health hazard if disturbed by these methods.

Should there be any questions pertaining to the contents of this report, please do not hesitate to contact the undersigned at our office.

PINCHIN LEBLANC ENVIRONMENTAL LIMITED

Prepared by;



Paul Staeben

NL Vice President

pstaeben@pinchinleblanc.com

APPENDIX I

ASBESTOS ANALYTICAL REPORT



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns, NL A1B 4C3

Attn: Nicole Power

Lab Order ID: 1214573

Analysis ID: 1214573PLM

Date Received: 9/4/2012

Date Reported: 9/10/2012

Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S001 - A	12x12 VFT, greenish blue with large green and white streaks	None Detected		100% Other	Blue Non Fibrous Heterogeneous
1214573PLM_1	tile				Dissolved
02-02-900-S001 - B	12x12 VFT, greenish blue with large green and white streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_83	mastic				Dissolved
02-02-900-S002	Drywall joint compound	None Detected		100% Other	Tan Non Fibrous Homogeneous
1214573PLM_2					Crushed
02-02-900-S003	2x4 Acoustic ceiling tile pinhole pattern 2x4 Acoustic ceiling tile	None Detected	50% Cellulose 30% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_3					Crushed
02-02-900-S004	Spray insulation above ceiling	None Detected	60% Mineral Wool	40% Other	Gray Fibrous Heterogeneous
1214573PLM_4					Crushed
02-02-900-S005 - A	Tar paper and mastic	None Detected	95% Cellulose	5% Other	Brown Fibrous Heterogeneous
1214573PLM_5	tar paper				Teased
02-02-900-S005 - B	Tar paper and mastic	10% Chrysotile		90% Other	Black Non Fibrous Heterogeneous
1214573PLM_84	mastic				Dissolved
02-02-900-S006 - A	12x12 Vinyl floor tiles white with black streaks	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_6	tile				Dissolved

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency.

Dorlos Ammerman (116)

Analyst

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888

Nathaniel Durham, MS or Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



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Date Reported: 9/10/2012

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S006 - B	12x12 Vinyl floor tiles white with black streaks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_85	mastic				Dissolved
02-02-900-S007	2x2 Acoustic ceiling tile pinhole with fleck pattern	None Detected	40% Cellulose 40% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_7					Crushed
02-02-900-S008	Pipe elbow parging	30% Chrysotile		70% Other	Gray Fibrous Heterogeneous
1214573PLM_8					Teased
02-02-900-S009 - A	12x12 Vinyl; floor tiles blue with white streaks	None Detected		100% Other	Blue Non Fibrous Heterogeneous
1214573PLM_9	tile				Dissolved
02-02-900-S009 - B	12x12 Vinyl; floor tiles blue with white streaks	None Detected	5% Cellulose	95% Other	Black Non Fibrous Heterogeneous
1214573PLM_86	mastic				Dissolved
02-02-900-S010	2x4 Acoustic ceiling tile pinhole with fleck pattern	None Detected	50% Cellulose 30% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_10					Crushed
02-02-900-S011 - A	12x12 Vinyl floor tiles light brown with large white streaks	3% Chrysotile		97% Other	Brown Non Fibrous Heterogeneous
1214573PLM_11	tile				Dissolved
02-02-900-S011 - B	12x12 Vinyl floor tiles light brown with large white streaks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_87	mastic				Dissolved

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Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



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Project: 02-02-900

Date Reported: 9/10/2012

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				
02-02-900-S012	2x2 Acoustic ceiling tiles pinhole pattern	None Detected	40% Cellulose 40% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_12					Crushed
02-02-900-S013 - A	12x12 Vinyl floor tiles very light brown with large brown streaks	3% Chrysotile		97% Other	Tan Non Fibrous Heterogeneous
1214573PLM_13	tile				Dissolved
02-02-900-S013 - B	12x12 Vinyl floor tiles very light brown with large brown streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_88	mastic				Dissolved
02-02-900-S014	Drywall joint compound	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_14					Crushed
02-02-900-S015	Leveling compound above ceiling ductwork	None Detected	5% Cellulose	95% Other	White Non Fibrous Heterogeneous
1214573PLM_15					Crushed
02-02-900-S016	Counter top	15% Chrysotile 5% Amosite		80% Other	Black Fibrous Heterogeneous
1214573PLM_16					Crushed
02-02-900-S017 - A	12x12 Vinyl floor tiles aqua with white and green fleck	None Detected		100% Other	Blue Non Fibrous Heterogeneous
1214573PLM_17	tile				Dissolved
02-02-900-S017 - B	12x12 Vinyl floor tiles aqua with white and green fleck	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_89	mastic				Dissolved

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Dorlos Ammerman (116)

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Nathaniel Durham, MS or Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns, NL A1B 4C3

Attn: Nicole Power

Lab Order ID: 1214573

Analysis ID: 1214573PLM

Date Received: 9/4/2012

Date Reported: 9/10/2012

Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S018 - A	12x12 Vinyl floor tiles green with thick green streak	3% Chrysotile		97% Other	Red Non Fibrous Heterogeneous
1214573PLM_18	tile				Dissolved
02-02-900-S018 - B	12x12 Vinyl floor tiles green with thick green streak	None Detected	4% Cellulose	96% Other	White, Black Non Fibrous Heterogeneous
1214573PLM_90	mastic/leveling compound				Dissolved
02-02-900-S019 - A	12x12 Vinyl floor tiles green with large white streaks	None Detected		100% Other	Green Non Fibrous Heterogeneous
1214573PLM_19	tile				Dissolved
02-02-900-S019 - B	12x12 Vinyl floor tiles green with large white streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_91	mastic				Dissolved
02-02-900-S020 - A	12x12 Vinyl floor tiles white with abundant grey flecks	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_20	tile				Dissolved
02-02-900-S020 - B	12x12 Vinyl floor tiles white with abundant grey flecks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_92	mastic				Dissolved
02-02-900-S021 - A	12x12 Vinyl floor tiles brown with abundant grey flecks	3% Chrysotile		97% Other	Brown Non Fibrous Heterogeneous
1214573PLM_21	tile				Dissolved
02-02-900-S021 - B	12x12 Vinyl floor tiles brown with abundant grey flecks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_93	mastic				Dissolved

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Attn: Nicole Power

Lab Order ID: 1214573

Analysis ID: 1214573PLM

Date Received: 9/4/2012

Date Reported: 9/10/2012

Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S022 - A	12x12 Vinyl floor tiles white mottled brown	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_22	tile				Dissolved
02-02-900-S022 - B	12x12 Vinyl floor tiles white mottled brown	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_94	mastic				Dissolved
02-02-900-S023 - A	12x12 Vinyl floor tiles light brown with brick red streak	3% Chrysotile		97% Other	Tan Non Fibrous Heterogeneous
1214573PLM_23	tile				Dissolved
02-02-900-S023 - B	12x12 Vinyl floor tiles light brown with brick red streak	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_95	mastic				Dissolved
02-02-900-S024	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_24					Crushed
02-02-900-S025	Transite sheeting in fume hood	20% Chrysotile		80% Other	Gray Fibrous Heterogeneous
1214573PLM_25					Crushed
02-02-900-S026 - A	12x12 Vinyl floor tiles large brown and cream streaks	None Detected	3% Cellulose	97% Other	Cream Non Fibrous Heterogeneous
1214573PLM_26	tile				Dissolved
02-02-900-S026 - B	12x12 Vinyl floor tiles large brown and cream streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_96	mastic				Dissolved

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Analysis ID: 1214573PLM

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Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				
02-02-900-S027	Drywall joint compound	None Detected		100% Other	Tan Non Fibrous Homogeneous
1214573PLM_27					Crushed
02-02-900-S028 - A	12x12 Vinyl floor tiles white with large brown flecks	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_28	tile				Dissolved
02-02-900-S028 - B	12x12 Vinyl floor tiles white with large brown flecks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_97	mastic				Dissolved
02-02-900-S029	2x4 Acoustic ceiling tiles pinhole and fissure pattern	None Detected	50% Cellulose 30% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_29					Crushed
02-02-900-S030	Pipe elbow parging on furnace exhaust	None Detected	25% Mineral Wool 10% Cellulose	65% Other	Gray Fibrous Heterogeneous
1214573PLM_30					Crushed
02-02-900-S031 - A	12x12 Vinyl floor tiles white with light blue streaks	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_31	tile				Dissolved
02-02-900-S031 - B	12x12 Vinyl floor tiles white with light blue streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_98	mastic				Dissolved
02-02-900-S032	Drywall joint compound	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_32					Crushed

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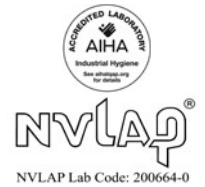
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Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S033 - A	12x12 Vinyl floor tiles green with brown and white streaks	3% Chrysotile		97% Other	Green Non Fibrous Heterogeneous
1214573PLM_33	tile				Dissolved
02-02-900-S033 - B	12x12 Vinyl floor tiles green with brown and white streaks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_99	mastic				Dissolved
02-02-900-S034 - A	12x12 Vinyl floor tiles grey with dark grey streaks	3% Chrysotile		97% Other	Gray Non Fibrous Heterogeneous
1214573PLM_34	tile				Dissolved
02-02-900-S034 - B	12x12 Vinyl floor tiles grey with dark grey streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_100	mastic				Dissolved
02-02-900-S035 - A	12x12 Vinyl floor tiles brown with white and dark brown streaks	3% Chrysotile		97% Other	Brown Non Fibrous Heterogeneous
1214573PLM_35	tile				Dissolved
02-02-900-S035 - B	12x12 Vinyl floor tiles brown with white and dark brown streaks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_101	mastic				Dissolved
02-02-900-S036 - A	12x12 Vinyl floor tiles white	None Detected		100% Other	Tan Non Fibrous Heterogeneous
1214573PLM_36	tile				Dissolved
02-02-900-S036 - B	12x12 Vinyl floor tiles white	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_102	mastic				Dissolved

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Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S037	Drywall joint compound	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_37					Crushed
02-02-900-S038	Tar paper wrap on straight fiberglass insulation	None Detected	80% Cellulose	20% Other	Brown, Black Fibrous Heterogeneous
1214573PLM_38					Dissolved
02-02-900-S039	Vinyl sheet flooring blue wave pattern	None Detected	15% Cellulose	85% Other	Blue Fibrous Heterogeneous
1214573PLM_39	vinyl only				Dissolved
02-02-900-S040	2x4 Acoustic ceiling tile	None Detected	40% Cellulose 40% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_40					Crushed
02-02-900-S041 - A	12x12 Vinyl floor tiles grey with dark grey streaks	3% Chrysotile		97% Other	Black Non Fibrous Heterogeneous
1214573PLM_41	tile				Dissolved
02-02-900-S041 - B	12x12 Vinyl floor tiles grey with dark grey streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_103	mastic				Dissolved
02-02-900-S042 - A	12x12 Vinyl floor tiles grey with abundant white and dark grey flecks	None Detected		100% Other	Tan Non Fibrous Heterogeneous
1214573PLM_42	tile				Dissolved
02-02-900-S042 - B	12x12 Vinyl floor tiles grey with abundant white and dark grey flecks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_104	mastic				Dissolved

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Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S043	Drywall joint compound	3% Chrysotile		97% Other	Tan, White Non Fibrous Homogeneous
1214573PLM_43					Crushed
02-02-900-S044 - A	12x12 Vinyl floor tiles light yellow with dark yellow and white specks	None Detected		100% Other	Yellow Non Fibrous Heterogeneous
1214573PLM_44	tile				Dissolved
02-02-900-S044 - B	12x12 Vinyl floor tiles light yellow with dark yellow and white specks	None Detected	2% Cellulose	98% Other	Yellow, Black Non Fibrous Heterogeneous
1214573PLM_105	mixed mastics				Dissolved
02-02-900-S045 - A	12x12 Vinyl floor tiles white and yellow streaks	None Detected		100% Other	Tan Non Fibrous Heterogeneous
1214573PLM_45	tile				Dissolved
02-02-900-S045 - B	12x12 Vinyl floor tiles white and yellow streaks	None Detected	4% Cellulose	96% Other	Black Non Fibrous Heterogeneous
1214573PLM_106	mastic				Dissolved
02-02-900-S046 - A	12x12 Vinyl floor tiles white with abundant grey flecks	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_46	tile				Dissolved
02-02-900-S046 - B	12x12 Vinyl floor tiles white with abundant grey flecks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_107	mastic				Dissolved
02-02-900-S047	Drywall joint compound	None Detected		100% Other	Tan Non Fibrous Homogeneous
1214573PLM_47					Crushed

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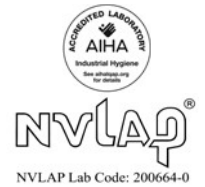
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Analysis ID: 1214573PLM

Date Received: 9/4/2012

Project: 02-02-900

Date Reported: 9/10/2012

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S048	2x2 Acoustic ceiling tile pinhole and fleck pattern	None Detected	50% Cellulose 30% Fiber Glass	10% Perlite 10% Other	Tan, White Fibrous Heterogeneous
1214573PLM_48					Crushed
02-02-900-S049	Drywall joint compound	None Detected		100% Other	Tan Non Fibrous Homogeneous
1214573PLM_49					Crushed
02-02-900-S050 - A	12x12 Vinyl floor tiles grey with brown streaks	2% Chrysotile		98% Other	Gray Non Fibrous Heterogeneous
1214573PLM_50	tile				Dissolved
02-02-900-S050 - B	12x12 Vinyl floor tiles grey with brown streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_108	mastic				Dissolved
02-02-900-S051	Ceiling plaster	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_51					Crushed
02-02-900-S052	Textured ceiling coat	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_52					Crushed
02-02-900-S053	Foil backed heatsheild for incandescent fixture	40% Chrysotile	40% Cellulose	20% Other	Silver, Tan Fibrous Heterogeneous
1214573PLM_53					Teased
02-02-900-S054	Textured ceiling coat	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_54					Crushed

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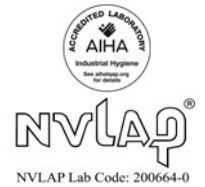
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Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S055 - A	12x12 Vinyl floor tiles red with abundant white streaks	3% Chrysotile		97% Other	Red Non Fibrous Heterogeneous
1214573PLM_55	tile				Dissolved
02-02-900-S055 - B	12x12 Vinyl floor tiles red with abundant white streaks	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_109	mastic				Dissolved
02-02-900-S056	Drywall joint compound	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_56					Crushed
02-02-900-S057	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_57					Crushed
02-02-900-S058	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_58					Crushed
02-02-900-S059 - A	12x12 Vinyl floor tiles white with brown streaks	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_59	tile				Dissolved
02-02-900-S059 - B	12x12 Vinyl floor tiles white with brown streaks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_110	mastic				Dissolved
02-02-900-S060	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_60					Crushed

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Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S061	Vinyl sheet flooring dark blue	None Detected		100% Other	Blue Non Fibrous Homogeneous
1214573PLM_61	<i>vinyl only</i>				Ashed
02-02-900-S062	Drywall joint compound	None Detected		100% Other	Tan Non Fibrous Homogeneous
1214573PLM_62					Crushed
02-02-900-S063	Mastic on furnace ductwork	None Detected	2% Synthetic Fibers	98% Other	Gray Non Fibrous Heterogeneous
1214573PLM_63					Dissolved
02-02-900-S064 - A	12x12 Vinyl floor tiles pale yellow with abundant yellow and white flecks	None Detected		100% Other	Yellow Non Fibrous Heterogeneous
1214573PLM_64	<i>tile</i>				Dissolved
02-02-900-S064 - B	12x12 Vinyl floor tiles pale yellow with abundant yellow and white flecks	None Detected	3% Cellulose	97% Other	Black Non Fibrous Heterogeneous
1214573PLM_111	<i>mastic</i>				Dissolved
02-02-900-S065 - A	Vinyl sheet flooring, dark grey flecks	None Detected	15% Cellulose	85% Other	Brown Fibrous Heterogeneous
1214573PLM_65	<i>vinyl</i>				Dissolved
02-02-900-S065 - B	Vinyl sheet flooring, dark grey flecks	None Detected		100% Other	Yellow Non Fibrous Heterogeneous
1214573PLM_112	<i>mastic</i>				Dissolved
02-02-900-S066 - A	Vinyl sheet flooring pale yellow with brown flecks	None Detected	15% Cellulose	85% Other	Yellow Fibrous Heterogeneous
1214573PLM_66	<i>vinyl</i>				Dissolved

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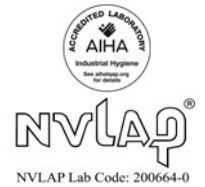
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Nathaniel Durham, MS or Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns, NL A1B 4C3

Attn: Nicole Power

Lab Order ID: 1214573

Analysis ID: 1214573PLM

Date Received: 9/4/2012

Date Reported: 9/10/2012

Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S066 - B	Vinyl sheet flooring pale yellow with brown flecks	None Detected		100% Other	Yellow Non Fibrous Heterogeneous
1214573PLM_113	mastic				Dissolved
02-02-900-S067	Drywall joint compound	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_67					Crushed
02-02-900-S068	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_68					Crushed
02-02-900-S069	Vinyl sheet flooring white with grey and brown mottles	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_69					Dissolved
02-02-900-S070	Drywall joint compound	2% Chrysotile		98% Other	White Non Fibrous Homogeneous
1214573PLM_70					Crushed
02-02-900-S071 - A	Vinyl sheet flooring brown stone pattern	None Detected	15% Cellulose	85% Other	Brown Fibrous Heterogeneous
1214573PLM_71	vinyl				Dissolved
02-02-900-S071 - B	Vinyl sheet flooring brown stone pattern	None Detected		100% Other	Yellow Non Fibrous Heterogeneous
1214573PLM_114	mastic				Dissolved
02-02-900-S072	Drywall joint compound	3% Chrysotile		97% Other	Tan, White Non Fibrous Homogeneous
1214573PLM_72					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency.

Dorlos Ammerman (116)

Analyst

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888

Nathaniel Durham, MS or Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns, NL A1B 4C3

Attn: Nicole Power

Lab Order ID: 1214573

Analysis ID: 1214573PLM

Date Received: 9/4/2012

Date Reported: 9/10/2012

Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S073	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_73					Crushed
02-02-900-S074	Drywall joint compound	3% Chrysotile		97% Other	Tan Non Fibrous Homogeneous
1214573PLM_74					Crushed
02-02-900-S075	Ceiling plaster	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_75					Crushed
02-02-900-S076 - A	Ceiling plaster	None Detected		100% Other	White Non Fibrous Heterogeneous
1214573PLM_76	finish				Crushed
02-02-900-S076 - B	Ceiling plaster	None Detected		100% Other	Gray Non Fibrous Heterogeneous
1214573PLM_115	base				Crushed
02-02-900-S077	Window sil plaster	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_77					Crushed
02-02-900-S078	2nd floor ceiling plaster	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_78					Crushed
02-02-900-S079	1st floor ceiling plaster	None Detected		100% Other	White Non Fibrous Homogeneous
1214573PLM_79					Crushed

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Dorlos Ammerman (116)

Analyst

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888

Nathaniel Durham, MS or Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns, NL A1B 4C3

Attn: Nicole Power

Lab Order ID: 1214573

Analysis ID: 1214573PLM

Date Received: 9/4/2012

Date Reported: 9/10/2012

Project: 02-02-900

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S080	Fire proofing	None Detected	65% Mineral Wool	35% Other	Gray Fibrous Heterogeneous
1214573PLM_80					Crushed
02-02-900-S081 - A	Pebble stone 12x12 vinyl floor tiles	None Detected		100% Other	Brown Non Fibrous Heterogeneous
1214573PLM_81	tile				Dissolved
02-02-900-S081 - B	Pebble stone 12x12 vinyl floor tiles	None Detected	2% Cellulose	98% Other	Black Non Fibrous Heterogeneous
1214573PLM_116	mastic				Dissolved
02-02-900-S082	Parging cement on water tanks and elbow pipes	25% Chrysotile		75% Other	White Fibrous Heterogeneous
1214573PLM_82					Teased

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency.

Dorlos Ammerman (116)

Analyst

Nathaniel Durham, MS or Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Dawn Benteau
Paul Staeben

Lab Order ID: 1308169

Analysis ID: 1308169_PLM

Date Received: 5/2/2013

Date Reported: 5/7/2013

Project: 02-02-00900; Engineering Building

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
02-02-900-S083 - A	12x12 Vinyl Floor Tiles - Orange With Brown Flecks	None Detected		100% Other	Orange Non Fibrous Heterogeneous
1308169PLM_1	tile				Dissolved
02-02-900-S083 - B	12x12 Vinyl Floor Tiles - Orange With Brown Flecks	None Detected	3% Cellulose	97% Other	Yellow Non Fibrous Heterogeneous
1308169PLM_2	mastic				Dissolved

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Ired Gulley (2)

Analyst

Approved Signatory

APPENDIX II

LEAD PAINT ANALYTICAL REPORT



Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3rd Ed. Method No. 3050B/Method No. 7420



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Dawn Benteau

Lab Order ID: 1214516

Analysis ID: 1214516_PBP

Date Received: 9/4/2012

Date Reported: 9/11/2012

Project: 02-02-900

Sample ID	Description	Mass (g)	Analytical Sensitivity (% by weight)	Concentration (% by weight)
Lab Sample ID	Lab Notes			
02-02-900-L001	White wall paint (engineering bld.)	0.0421	0.003%	0.025%
1214516PBP_1				
02-02-900-L002		0.0519	0.003%	0.26%
1214516PBP_2	cream wall paint			
02-02-900-L003		0.0274	0.005%	0.067%
1214516PBP_3	green wall paint			
02-02-900-L004		0.0624	0.002%	< 0.006%
1214516PBP_4	very light grey paint			
02-02-900-L005		0.0636	0.002%	0.041%
1214516PBP_5	dark blue wall paint			
02-02-900-L006		0.0367	0.004%	0.022%
1214516PBP_6	blue wall paint			
02-02-900-L007		0.0464	0.003%	< 0.009%
1214516PBP_7	navy blue wall paint			
02-02-900-L008		0.0415	0.003%	< 0.01%
1214516PBP_8	aqua green wall paint			
02-02-900-L009		0.0628	0.002%	< 0.006%
1214516PBP_9	red wall paint			
02-02-900-L010		0.0687	0.002%	< 0.006%
1214516PBP_10	light grey wall paint			

The quality control samples run with the samples in this report have passed all AIHA required specifications unless otherwise noted. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by AIHA or any other agency of the U.S. government.

Melissa Sharps (13)

Analyst

Laboratory Director



Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3rd Ed. Method No. 3050B/Method No. 7420



Customer: Pinchin LeBlanc Environmental
27 Austin St
2nd Flr
St Johns NL A1B 4C3

Attn: Dawn Benteau

Lab Order ID: 1214516

Analysis ID: 1214516_PBP

Date Received: 9/4/2012

Date Reported: 9/11/2012

Project: 02-02-900

Sample ID	Description	Mass (g)	Analytical Sensitivity (% by weight)	Concentration (% by weight)
Lab Sample ID	Lab Notes			
02-02-900-L011		0.0572	0.002%	< 0.007%
1214516PBP_11	pink wall paint			
02-02-900-L012		0.0532	0.003%	0.11%
1214516PBP_12	light green wall paint			
02-02-900-L013	(Yellow wall paint) engineering bld.	0.0494	0.003%	< 0.008%
1214516PBP_13				

The quality control samples run with the samples in this report have passed all AIHA required specifications unless otherwise noted. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by AIHA or any other agency of the U.S. government.

Melissa Sharps (13)

Analyst

Laboratory Director

APPENDIX III

SITE DRAWINGS



LEGEND:

- XXX PINCHIN LOCATION NUMBER
- ⊙ ASBESTOS SAMPLE ID NUMBER
- △ LEAD SAMPLE ID NUMBER
- N/A NOT ACCESSIBLE



CLIENT:

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING MATERIALS SURVEY

SITE ADDRESS:

ENGINEERING BUILDING, ST. JOHN'S CAMPUS, NEWFOUNDLAND AND LABRADOR

DRAWING NAME:

SAMPLE LOCATIONS LEVEL 1

REFERENCE:

PLEI SITE SURVEY

DATE:

OCTOBER 2012

PROJECT #:

02 - 02 - 00900

SCALE:

N.T.S.

FIGURE #:

1

DRAWN BY:

A. ANISCIKLI

CHECKED BY:

T. HARDY



MEZZANINE LEVEL ABOVE 1035

AREA ABOVE 1034B

AREA BELOW EN-1033



LEGEND:

- XXX PINCHIN LOCATION NUMBER
- ◎ ASBESTOS SAMPLE ID NUMBER
- ▲ LEAD SAMPLE ID NUMBER
- N/A NOT ACCESSIBLE



CLIENT:

MEMORIAL UNIVERSITY OF
NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING
MATERIALS SURVEY

SITE ADDRESS:

ENGINEERING BUILDING,
ST. JOHN'S CAMPUS,
NEWFOUNDLAND AND LABRADOR

DRAWING NAME:

SAMPLE LOCATIONS
LEVEL 2

REFERENCE:

PLEL SITE SURVEY

DATE:

OCTOBER 2012

PROJECT #:

02 - 02 - 00900

SCALE:

N.T.S.

FIGURE #:

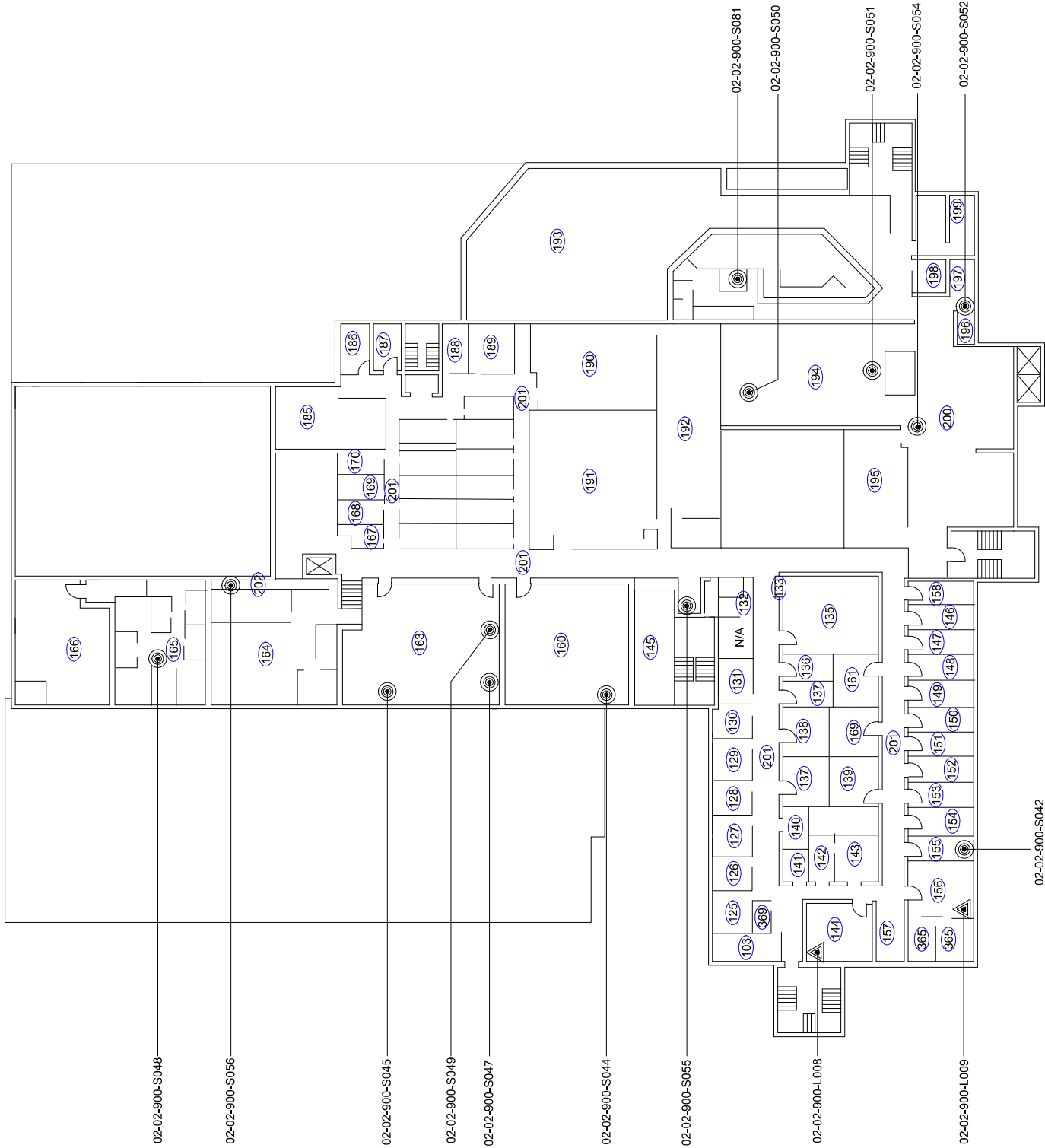
2

DRAWN BY:

A. ANISCIKLI

CHECKED BY:

T. HARDY





LEGEND:

- XXX PINCHIN LOCATION NUMBER
- ◎ ASBESTOS SAMPLE ID NUMBER
- ▲ LEAD SAMPLE ID NUMBER
- N/A NOT ACCESSIBLE



CLIENT:

MEMORIAL UNIVERSITY OF
NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING
MATERIALS SURVEY

SITE ADDRESS:

ENGINEERING BUILDING,
ST. JOHN'S CAMPUS,
NEWFOUNDLAND AND LABRADOR

DRAWING NAME:

SAMPLE LOCATIONS
LEVEL 3

REFERENCE:

PLEL SITE SURVEY

DATE:

OCTOBER 2012

PROJECT #:

02 - 02 - 00900

SCALE:

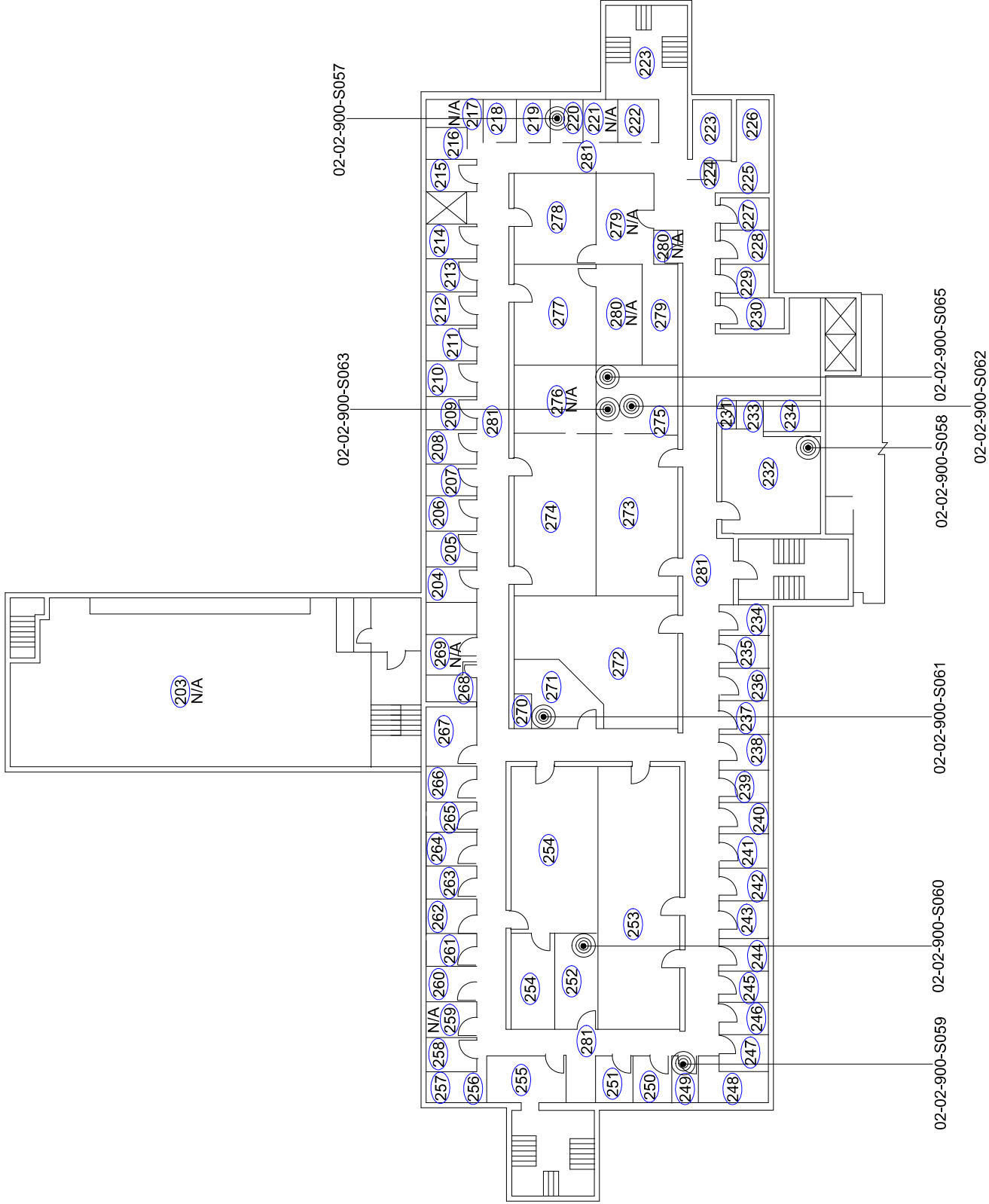
N.T.S.

FIGURE #:

3

DRAWN BY:
A. ANISCIKLI

CHECKED BY:
T. HARDY





LEGEND:

- XXX PINCHIN LOCATION NUMBER
- ◎ ASBESTOS SAMPLE ID NUMBER
- ▲ LEAD SAMPLE ID NUMBER
- N/A NOT ACCESSIBLE



CLIENT:

MEMORIAL UNIVERSITY OF
NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING
MATERIALS SURVEY

SITE ADDRESS:

ENGINEERING BUILDING,
ST. JOHN'S CAMPUS,
NEWFOUNDLAND AND LABRADOR

DRAWING NAME:

SAMPLE LOCATIONS
LEVEL 4

REFERENCE:

PLEL SITE SURVEY

DATE:

OCTOBER 2012

PROJECT #:

02 - 02 - 00900

SCALE:

N.T.S.

FIGURE #:

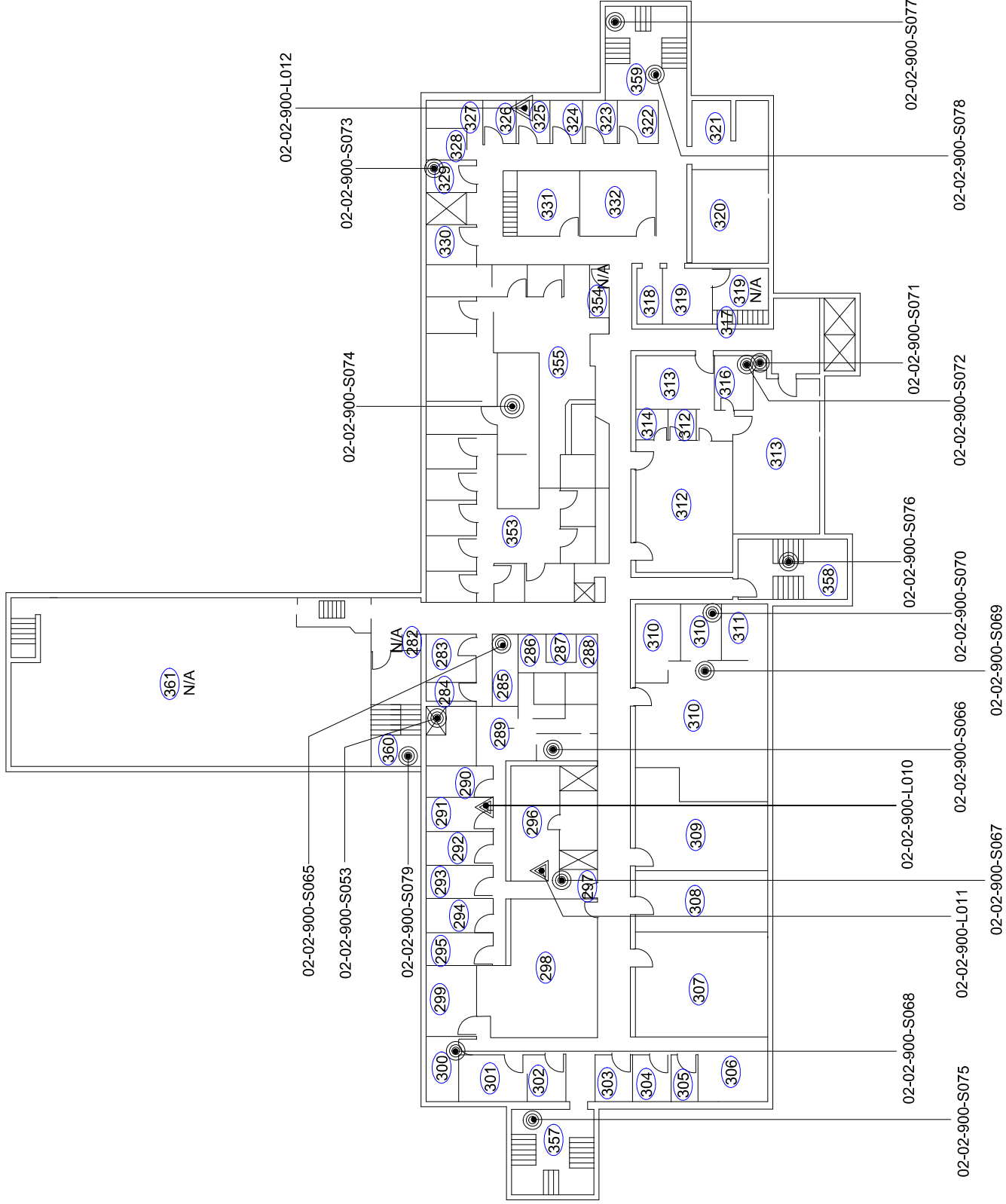
4

DRAWN BY:

A. ANISCIKLI

CHECKED BY:

T. HARDY





LEGEND:

- PINCHIN LOCATION NUMBER
- ASBESTOS SAMPLE ID NUMBER
- LEAD SAMPLE ID NUMBER
- N/A** NOT ACCESSIBLE



CLIENT:

MEMORIAL UNIVERSITY OF
NEWFOUNDLAND

PROJECT:

ASBESTOS AND LEAD PAINT BUILDING
MATERIALS SURVEY

SITE ADDRESS:

ENGINEERING BUILDING,
ST. JOHN'S CAMPUS,
NEWFOUNDLAND AND LABRADOR

DRAWING NAME:

SAMPLE LOCATIONS
LEVEL 5

REFERENCE:

PLEL SITE SURVEY

DATE:

OCTOBER 2012

PROJECT #:

02 - 02 - 00900

SCALE:

N.T.S.

FIGURE #:

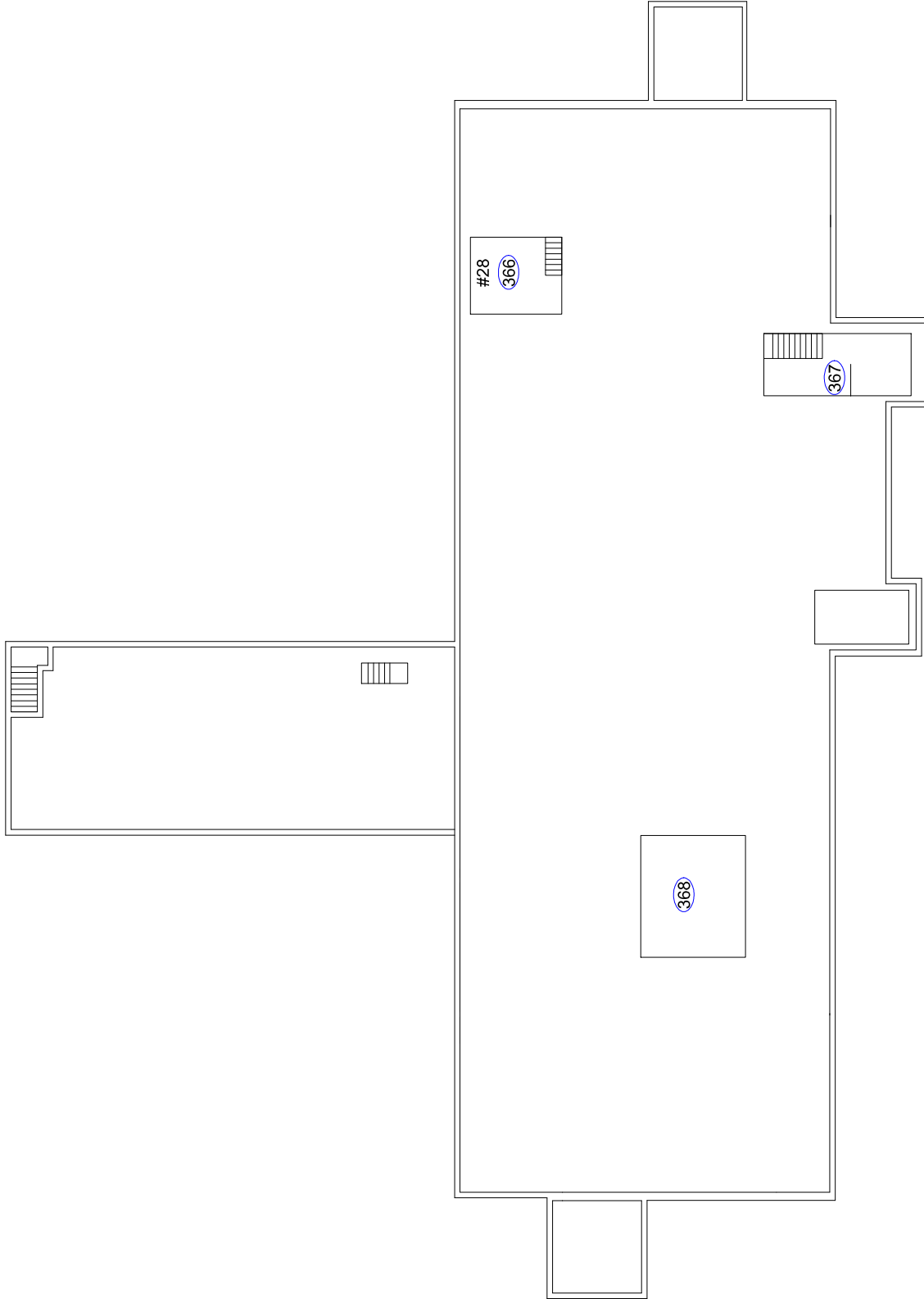
5

DRAWN BY:

A. ANISCIKLI

CHECKED BY:

T. HARDY



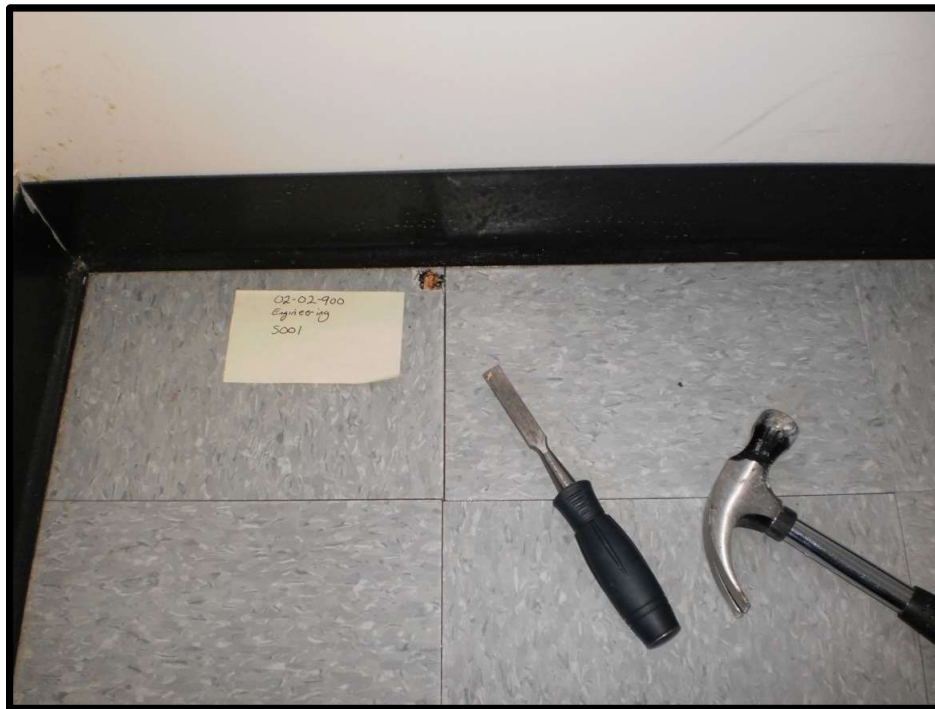
APPENDIX IV

SAMPLE LOG



ASBESTOS BULK SAMPLING FORM

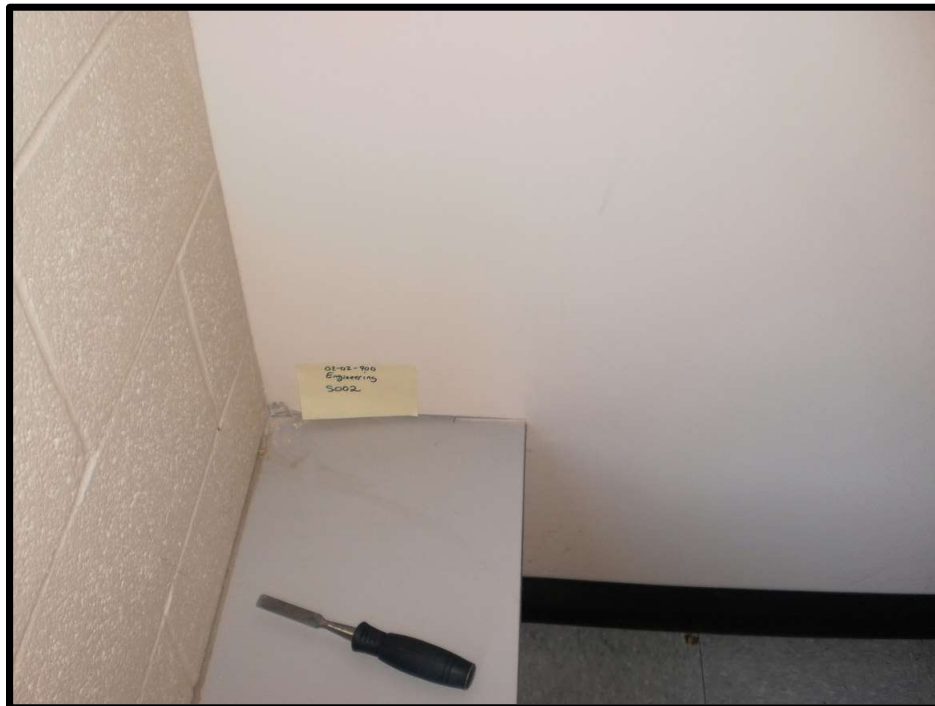
Sample #:	S001	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1052	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Greenish blue with large white and green specks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

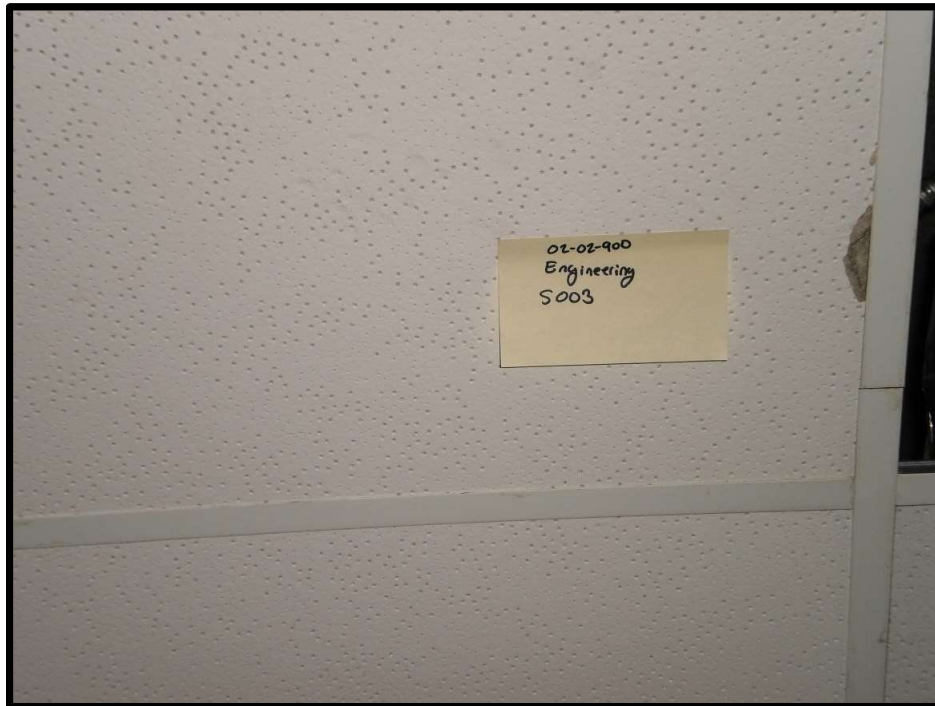
Sample #:	S002	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1052	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster X DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

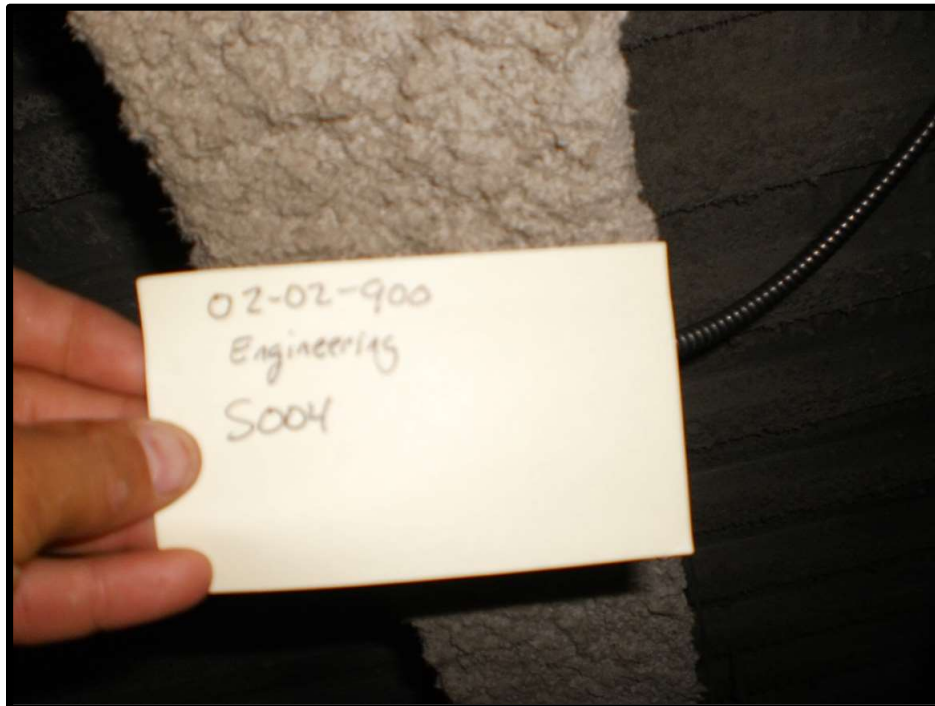
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Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1052	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 4' pinhole</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S004	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1052	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input checked="" type="checkbox"/> Steel F. P. ing <input checked="" type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input checked="" type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S005	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1052	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input checked="" type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input checked="" type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

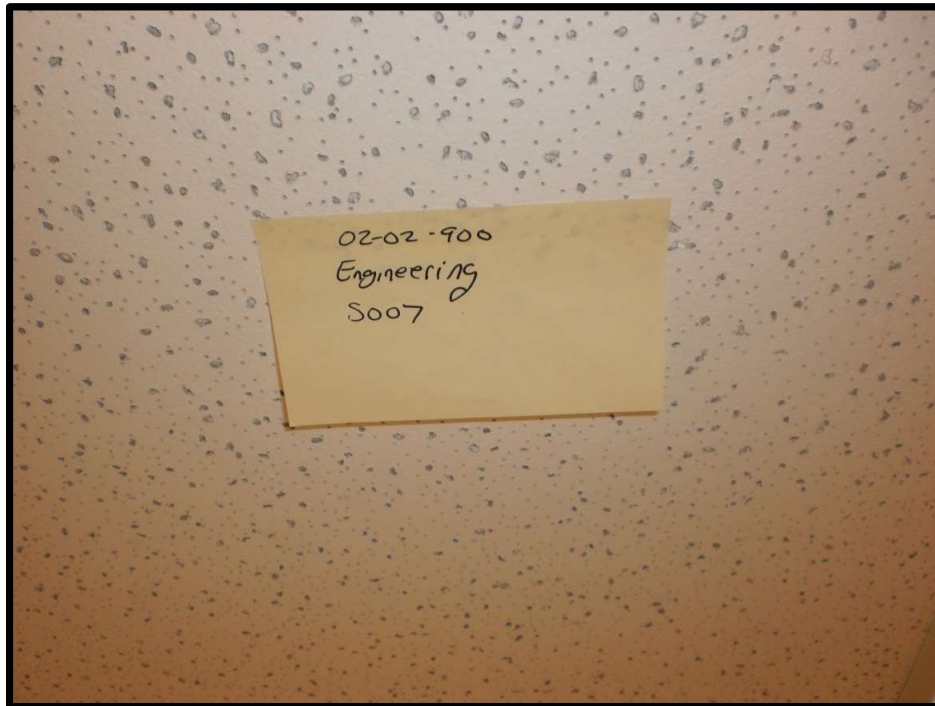
Sample #:	S006	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1051A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>White with blue streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

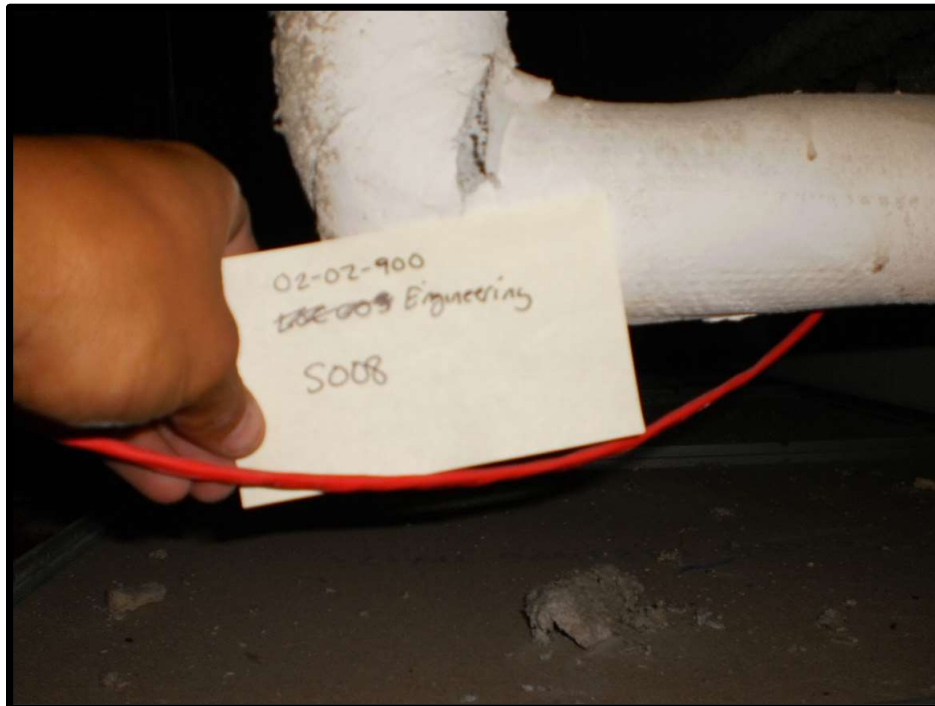
Sample #:	S007	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1051A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 2' pinhole fleck</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

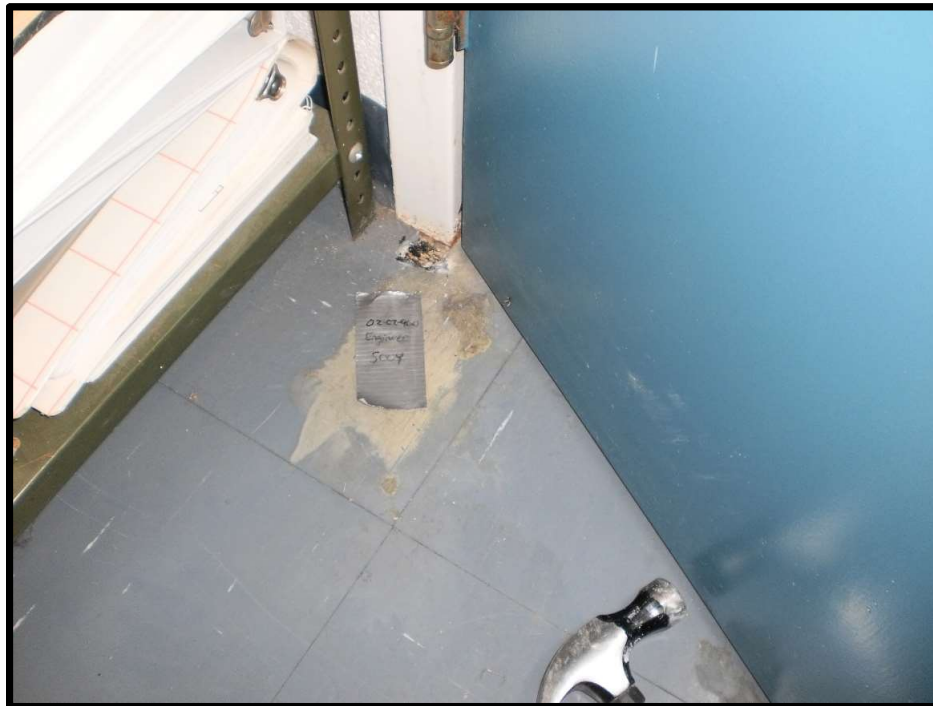
Sample #:	S008	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1051	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input checked="" type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input checked="" type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S009	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1053	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Blue with white streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S010	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1053	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 4' pinhole fleck</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

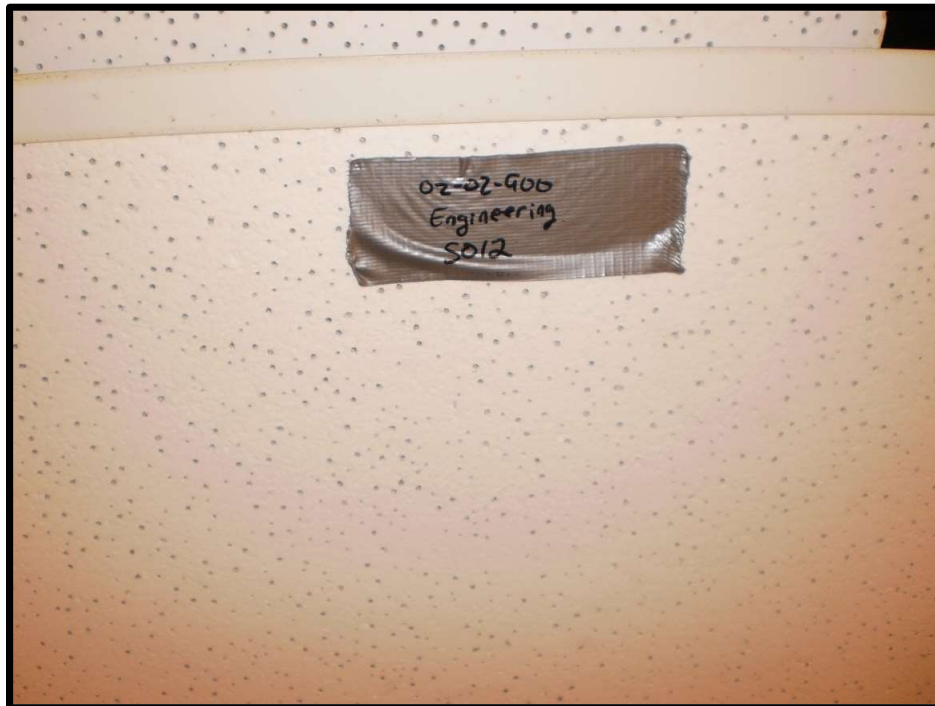
Sample #:	S011	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1056	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Light brown with large white streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S012	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1056	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 2' pinhole</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



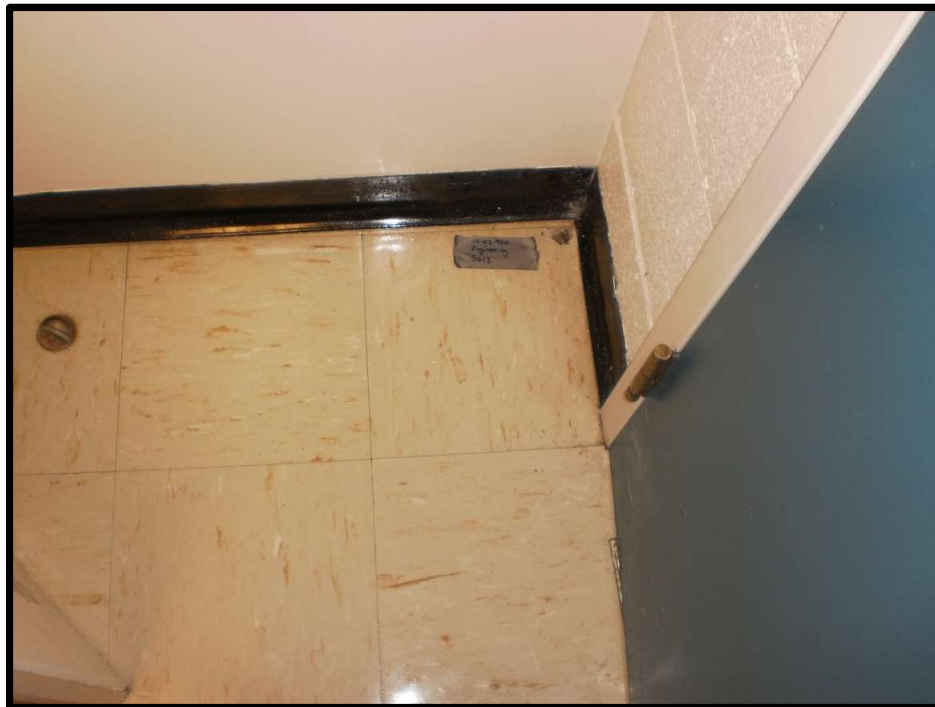


ASBESTOS BULK SAMPLING FORM

Sample #:	S013	Date Sampled:	July 25, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN 1061	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>Very light brown with large brown streaks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S014	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1049	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S015	Date Sampled:	July 25, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1049	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>Levelling compound on ductwork</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input checked="" type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S016	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1001	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Black</u>	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input checked="" type="checkbox"/> Other (counter)





ASBESTOS BULK SAMPLING FORM

Sample #:	S017	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN1001	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>Aqua colour with white and green flecks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

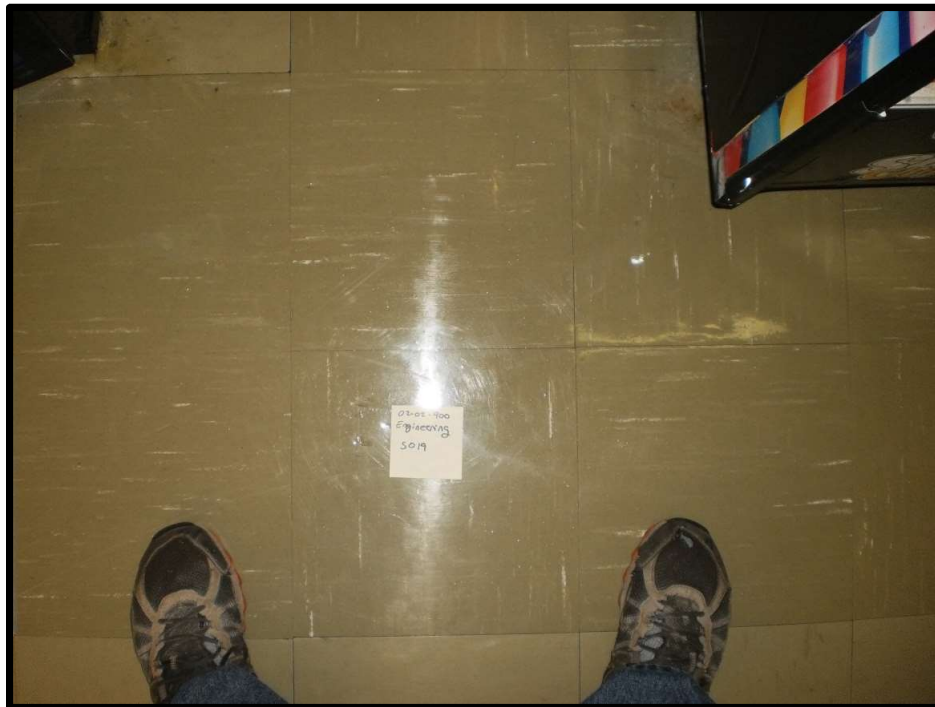
Sample #:	S018	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN1C01	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	
Bulk Sampling Parameters			
Pipe/Tank	Flooring	Ceiling	Roofing Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Green with thick green streaks</u>





ASBESTOS BULK SAMPLING FORM

Sample #:	S019	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1C01	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Green with thick white streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S020	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room 1015B	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>White with abundant grey</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing	<u>flecks</u>	





ASBESTOS BULK SAMPLING FORM

Sample #:	S021	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room 1017A	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

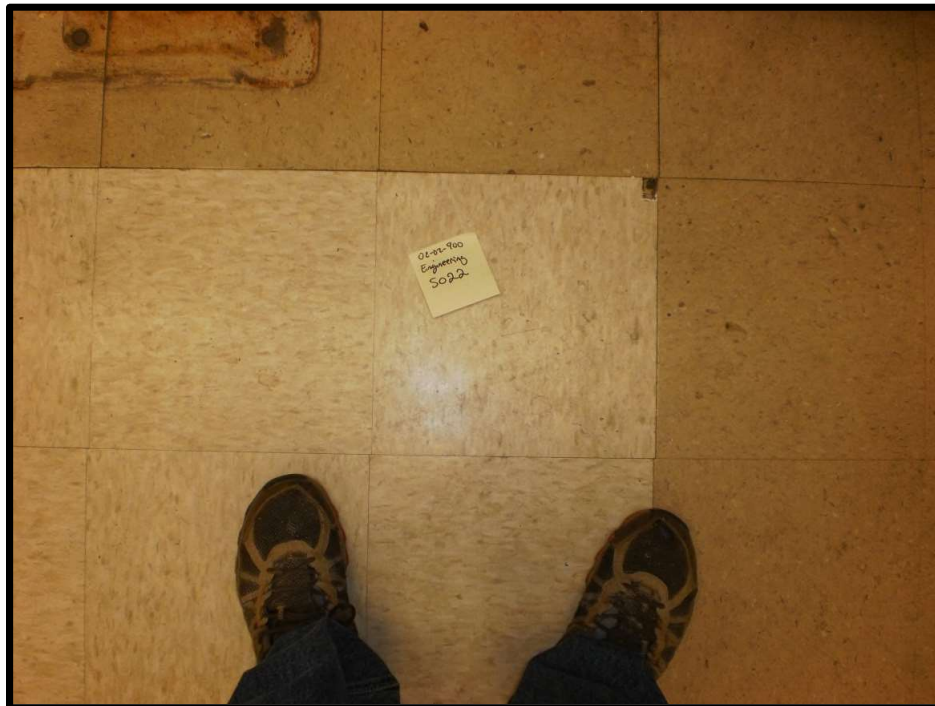
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic		Miscellaneous: _____
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural		No. of Phases: _____
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing		Colour: <u>Brown with abundant grey specks</u>
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S022	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room 1019A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>White mottled brown</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



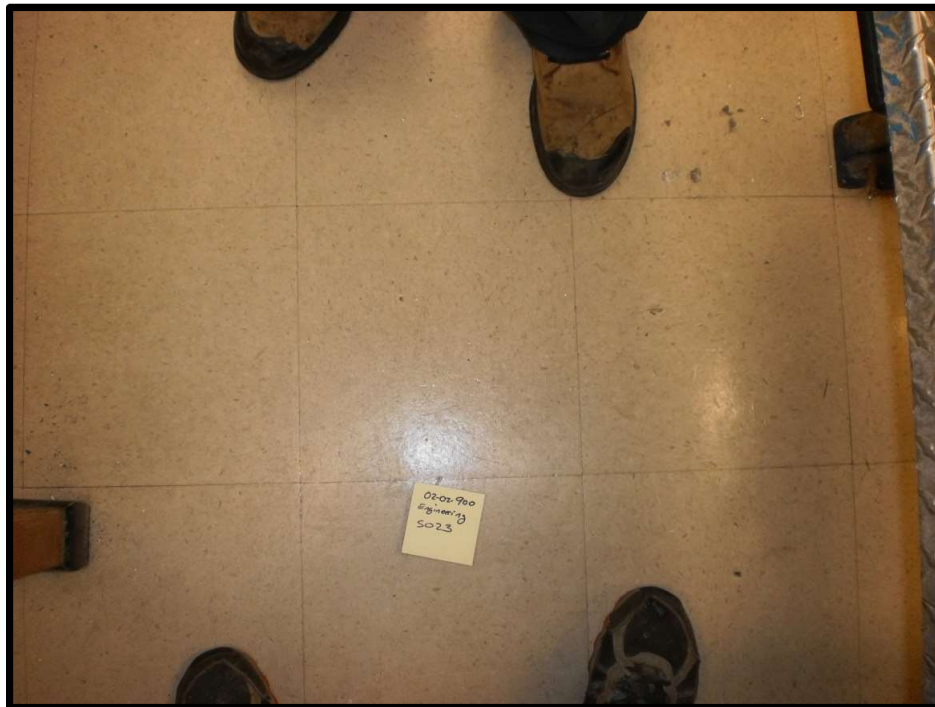


ASBESTOS BULK SAMPLING FORM

Sample #:	S023	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN1019A	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

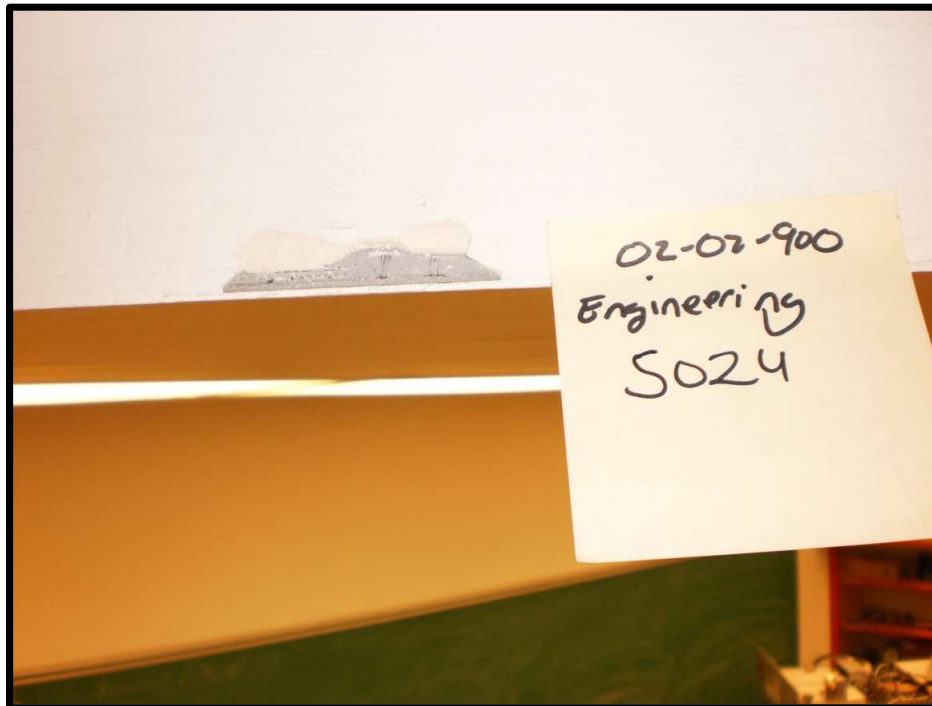
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>Light brown with red streaks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S024	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1019A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S025	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1020B	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap <div style="text-align: center;">HVAC</div> <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic <div style="text-align: center;">Wall</div> <input checked="" type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic <div style="text-align: center;">Structural</div> <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input checked="" type="checkbox"/> Other (fume hood)





ASBESTOS BULK SAMPLING FORM

Sample #:	S026	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1038F	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Cream and brown streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S027	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1038	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



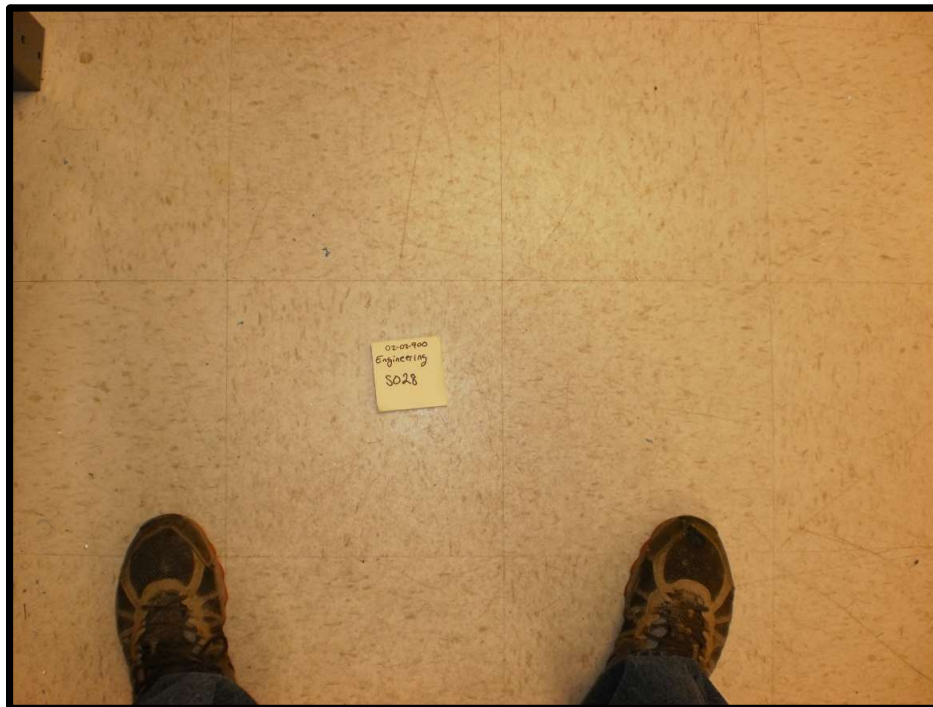


ASBESTOS BULK SAMPLING FORM

Sample #:	S028	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN1010	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

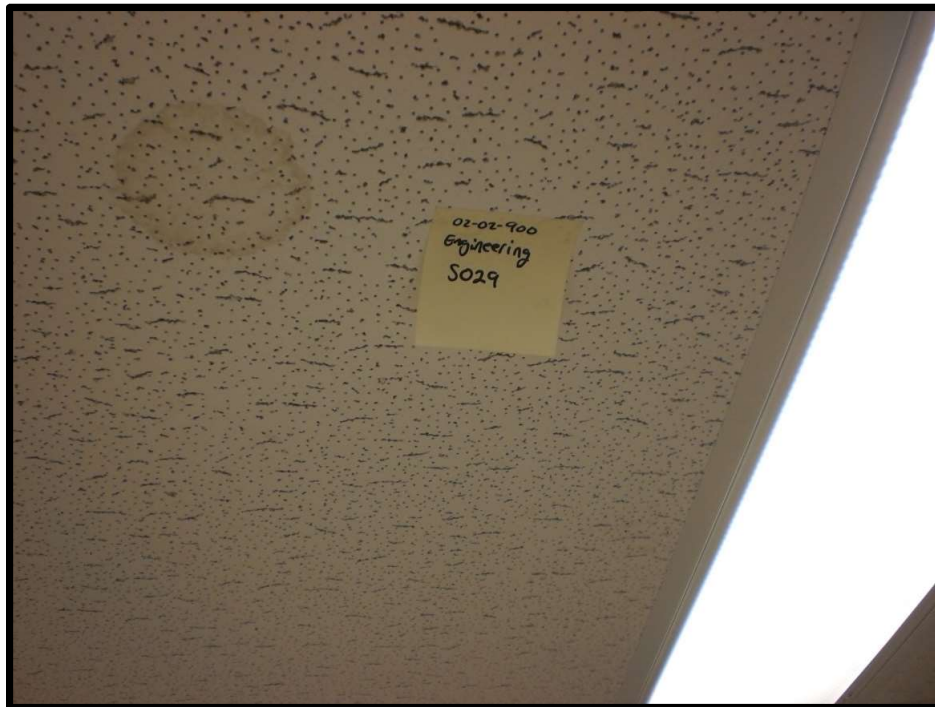
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>White with large brown specks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S029	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1034B	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 4' pinhole fissure</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

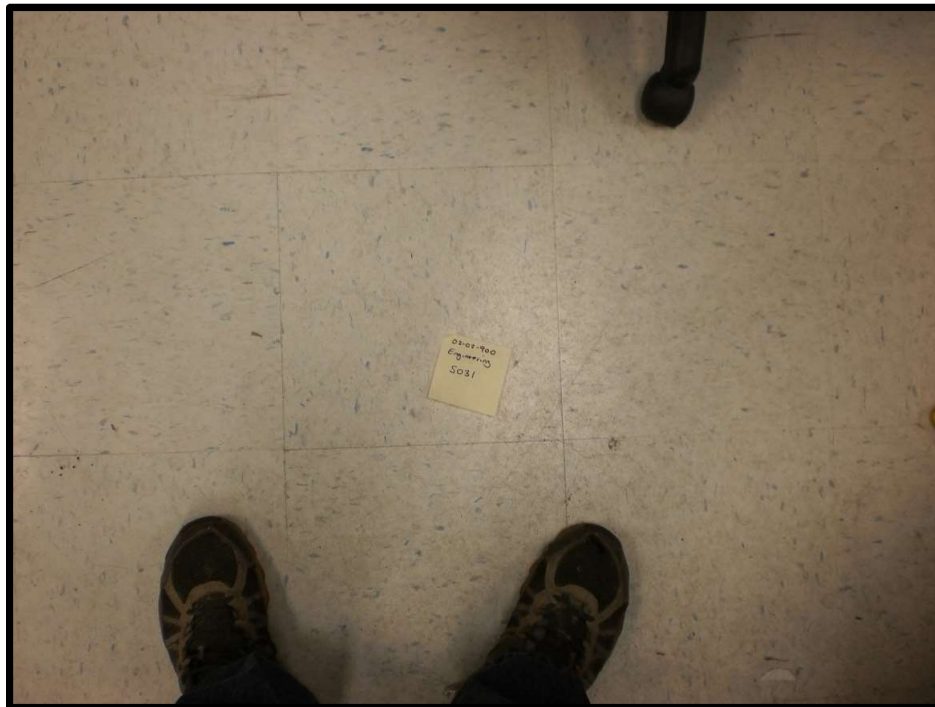
Sample #:	S030	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1034	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input checked="" type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap <div style="text-align: center;">HVAC</div> <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic <div style="text-align: center;">Wall</div> <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic <div style="text-align: center;">Structural</div> <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input checked="" type="checkbox"/> Other (open area)





ASBESTOS BULK SAMPLING FORM

Sample #:	S031	Date Sampled:	July 26, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room 1035E	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	
Bulk Sampling Parameters			
Pipe/Tank	Flooring	Ceiling	Roofing Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>White with light blue specks</u>





ASBESTOS BULK SAMPLING FORM

Sample #:	S032	Date Sampled:	July 26, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1035E	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



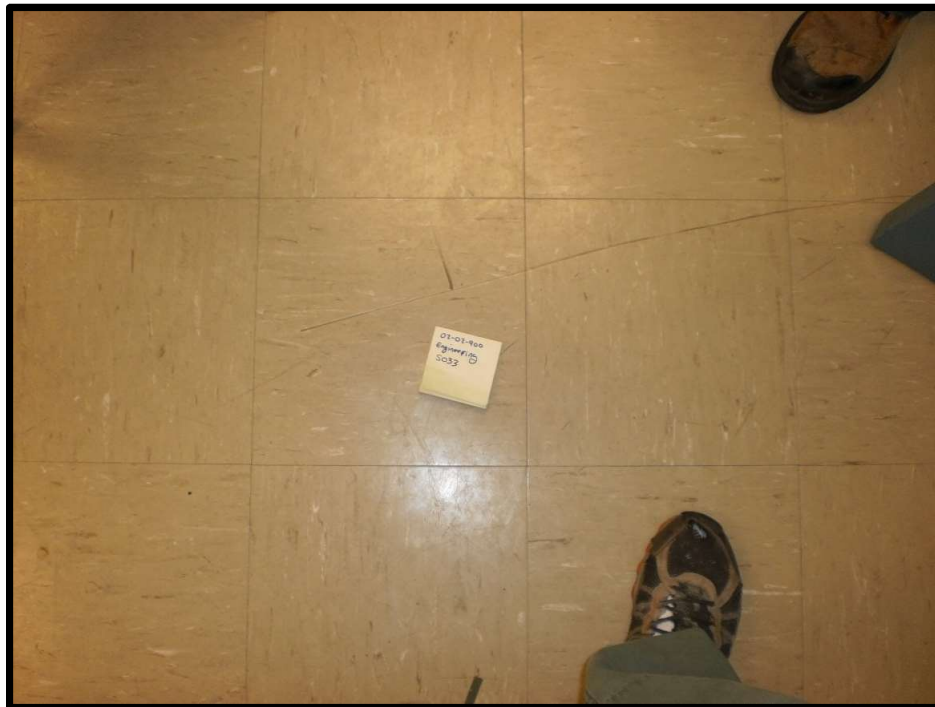


ASBESTOS BULK SAMPLING FORM

Sample #:	S033	Date Sampled:	July 27, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN1026A	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>Green with white and brown specks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S034	Date Sampled:	July 27, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1023A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Grey with dark grey streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



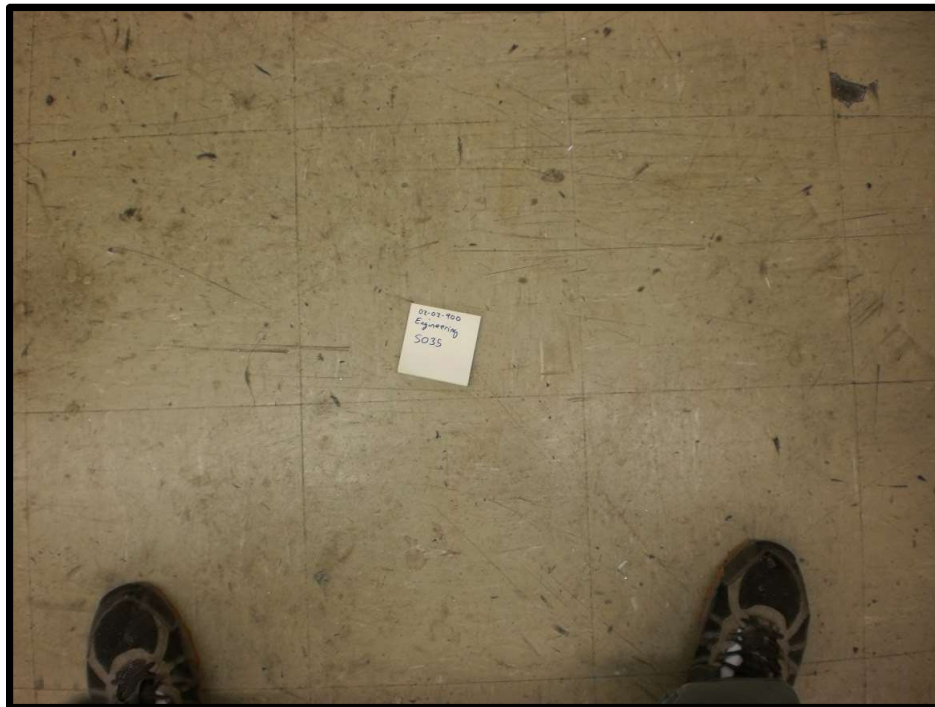


ASBESTOS BULK SAMPLING FORM

Sample #:	S035	Date Sampled:	July 27, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN1023F	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

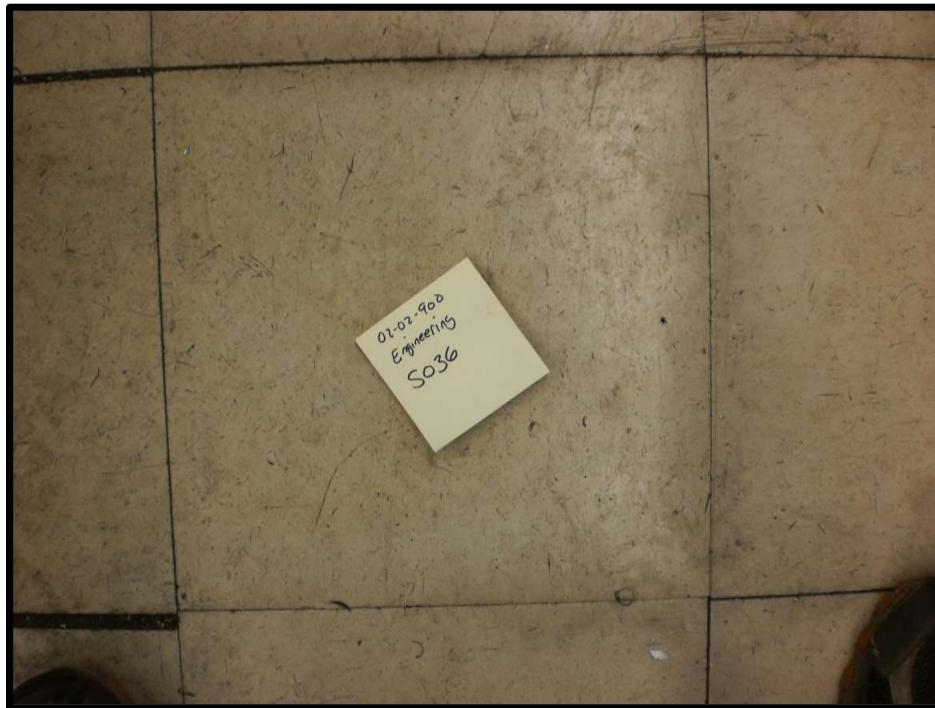
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>Brown with white and dark brown specks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S036	Date Sampled:	July 27, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1023F	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>White</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S037	Date Sampled:	July 27, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1023L/M	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster X DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor X Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

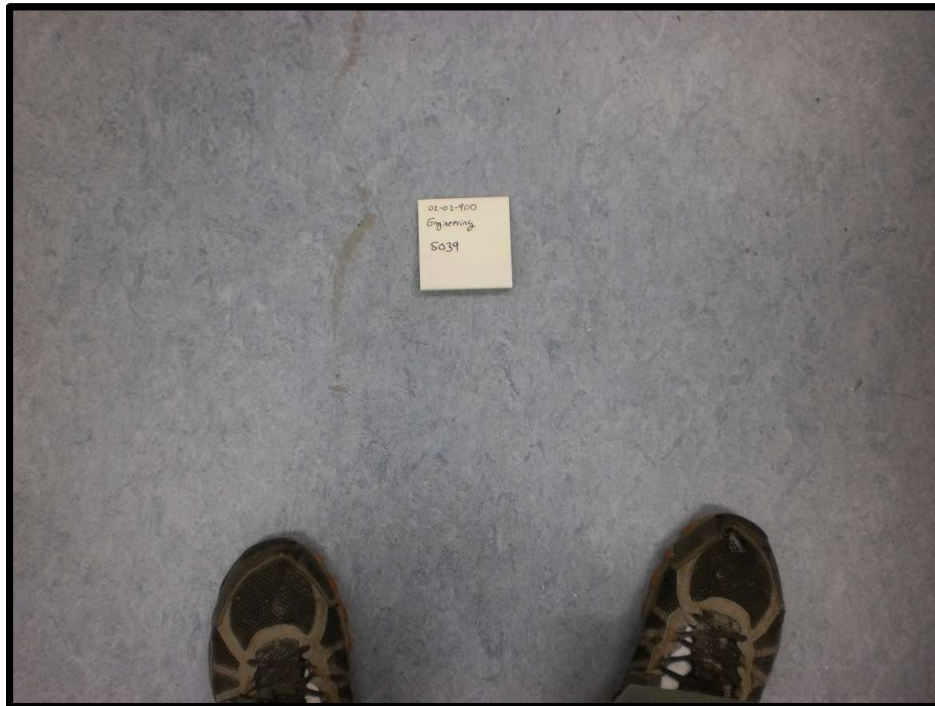
Sample #:	S038	Date Sampled:	July 27, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room 1023 (hallway)	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap <p style="text-align: center;">HVAC</p> <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic <p style="text-align: center;">Wall</p> <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic <p style="text-align: center;">Structural</p> <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>Tar paper</u>	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input checked="" type="checkbox"/> Above Ceiling <input type="checkbox"/> Other No. of Phases: _____ Colour: _____





ASBESTOS BULK SAMPLING FORM

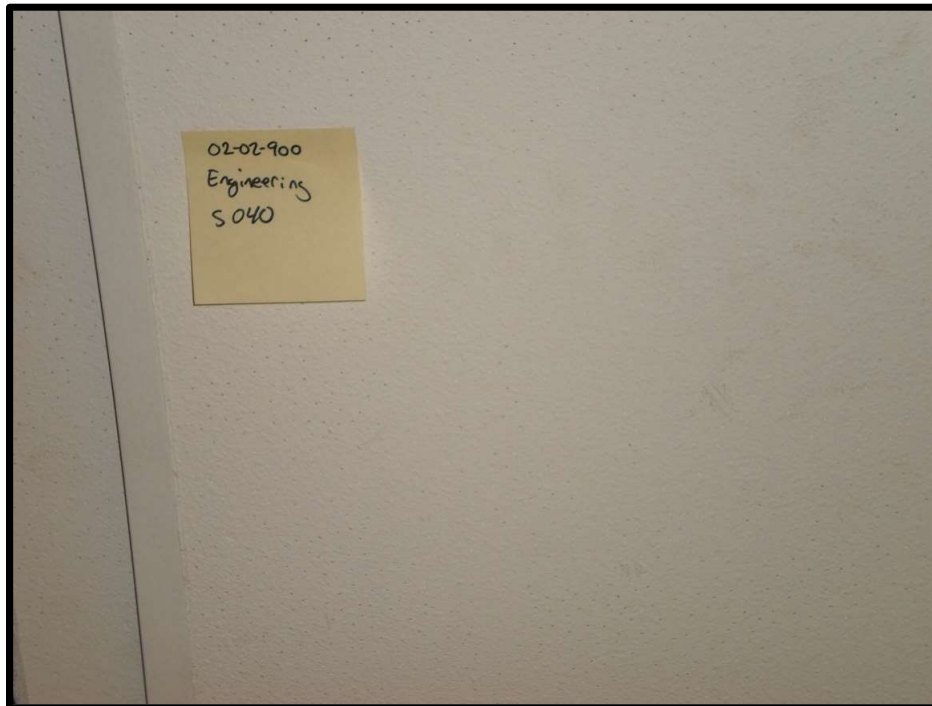
Sample #:	S039	Date Sampled:	July 27, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1020E	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile X Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Blue wave pattern</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

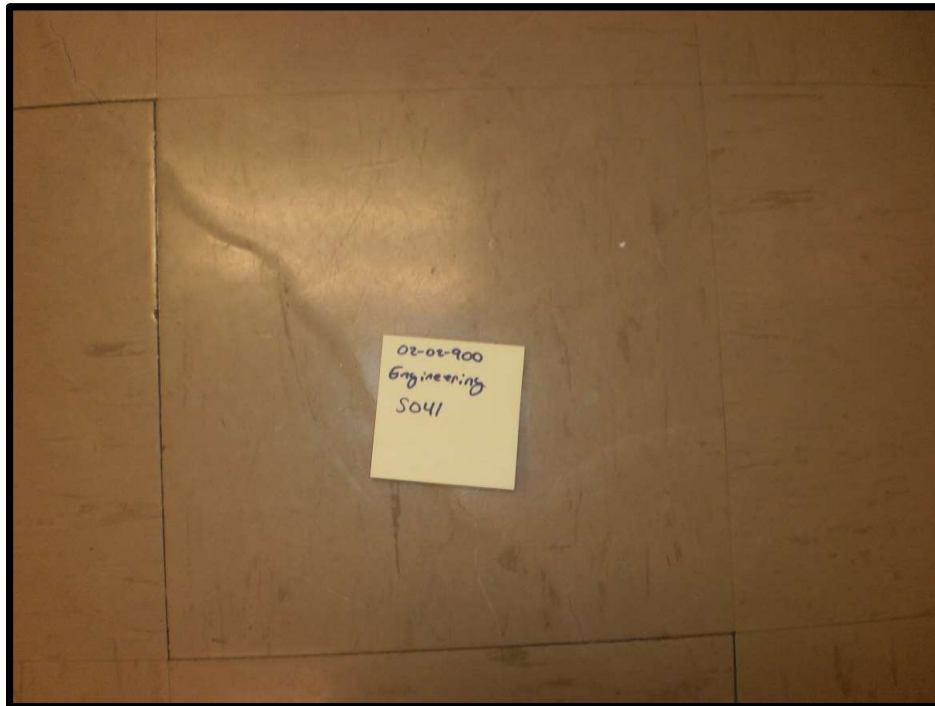
Sample #:	S040	Date Sampled:	July 27, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN1037	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 4' pinhole</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S041	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN2025	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Grey with dark grey streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



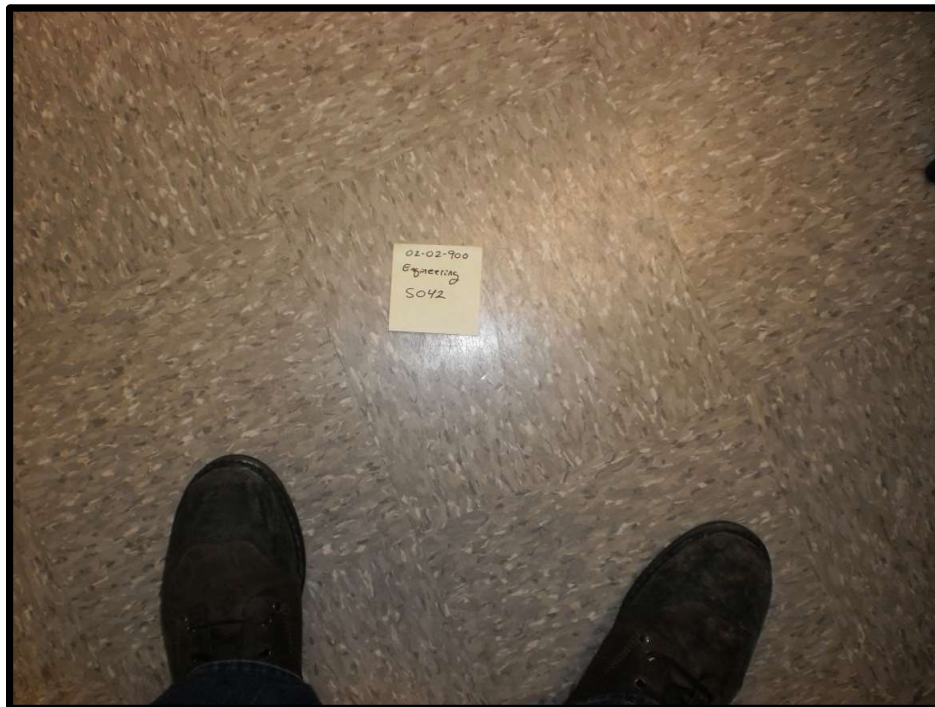


ASBESTOS BULK SAMPLING FORM

Sample #:	S042	Date Sampled:	July 30, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN2020	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>Grey with abundant white and dark grey flecks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S043	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN2018A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S044	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN2048	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Light yellow with dark yellow and white specks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S045	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room EN2050	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>White with yellow streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



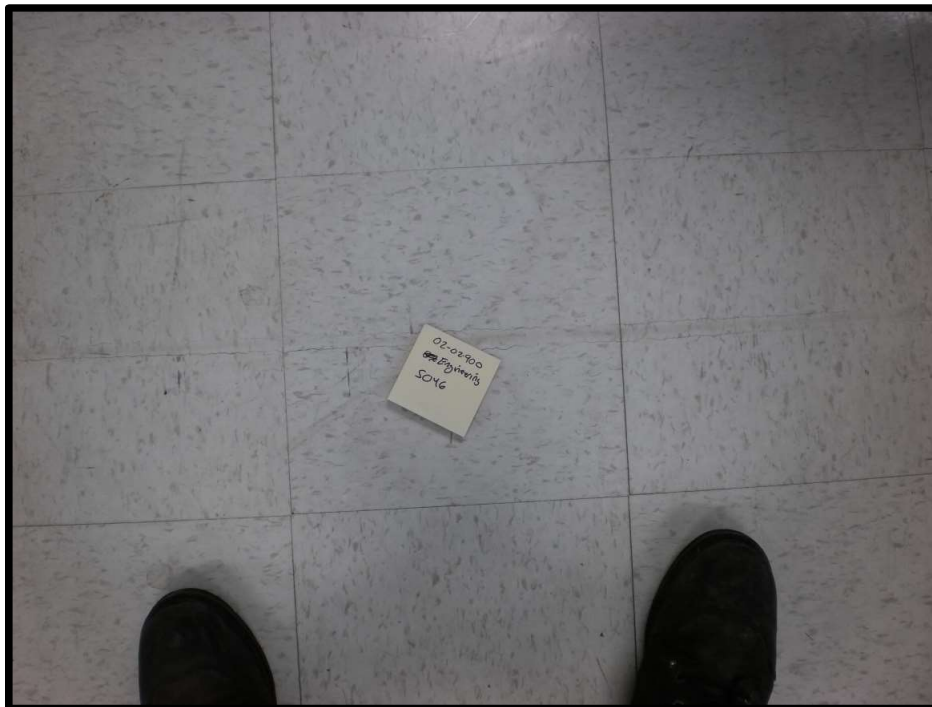


ASBESTOS BULK SAMPLING FORM

Sample #:	S046	Date Sampled:	July 30, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	Room EN2050	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	X12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural	No. of Phases: _____	
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	Colour: <u>White with abundant grey specks</u>	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S047	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	163, Room EN2050	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S048	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	165, Room EN2077	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>2' x 4' pinhole fleck</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S049	Date Sampled:	July 30, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	191, room EN2043	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

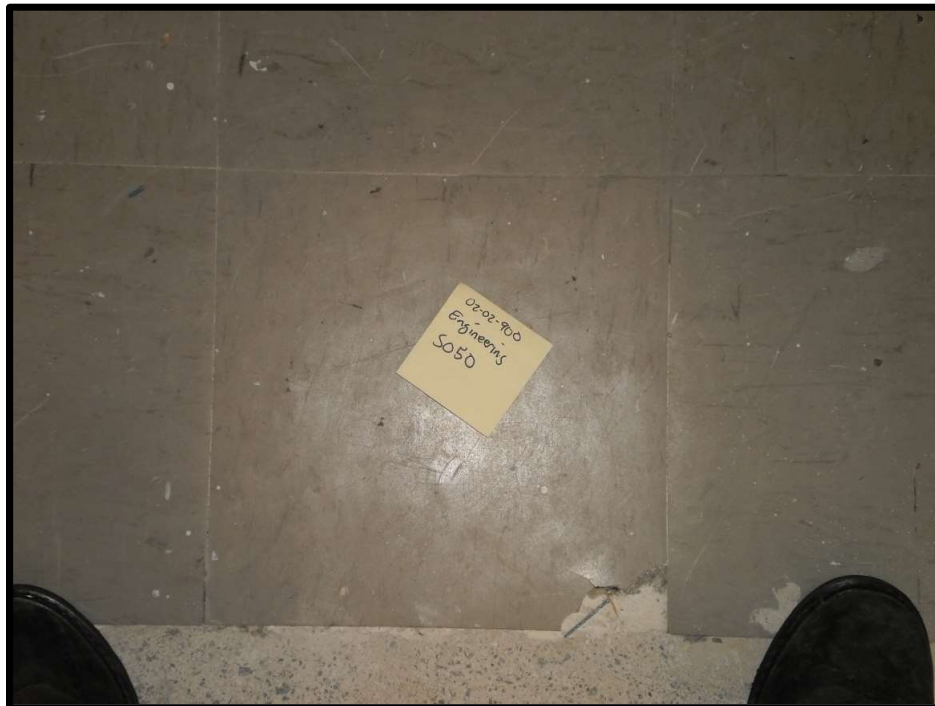
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	<input type="checkbox"/> 12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	<input type="checkbox"/> Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	X Wall Orientation
<input type="checkbox"/> Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	X DWJC	Structural		
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	No. of Phases: _____	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing	Colour: _____	





ASBESTOS BULK SAMPLING FORM

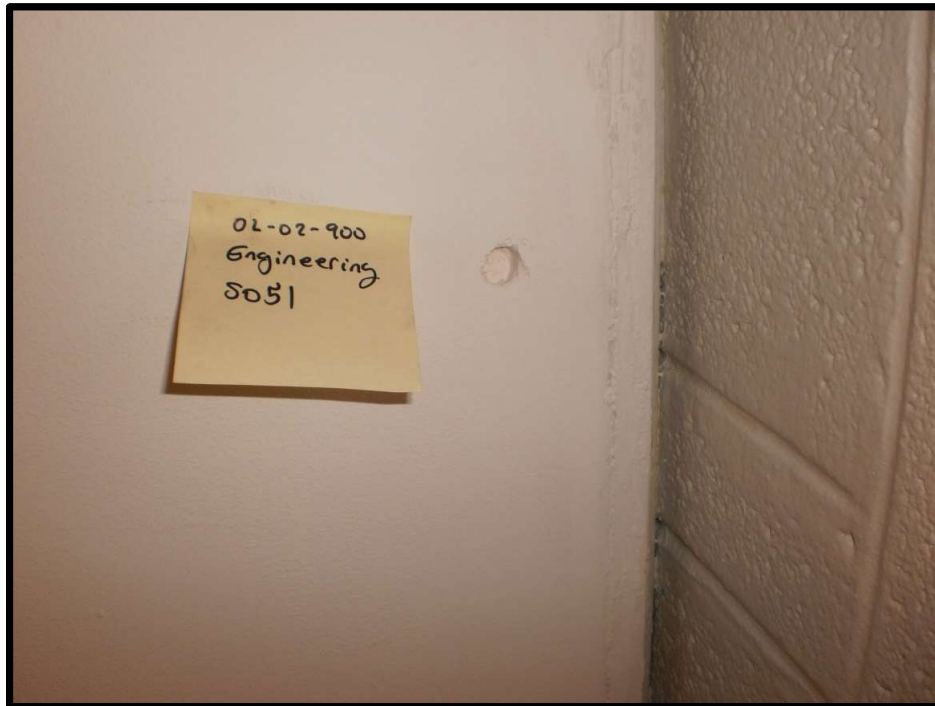
Sample #:	S050	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	194, room EN2006	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

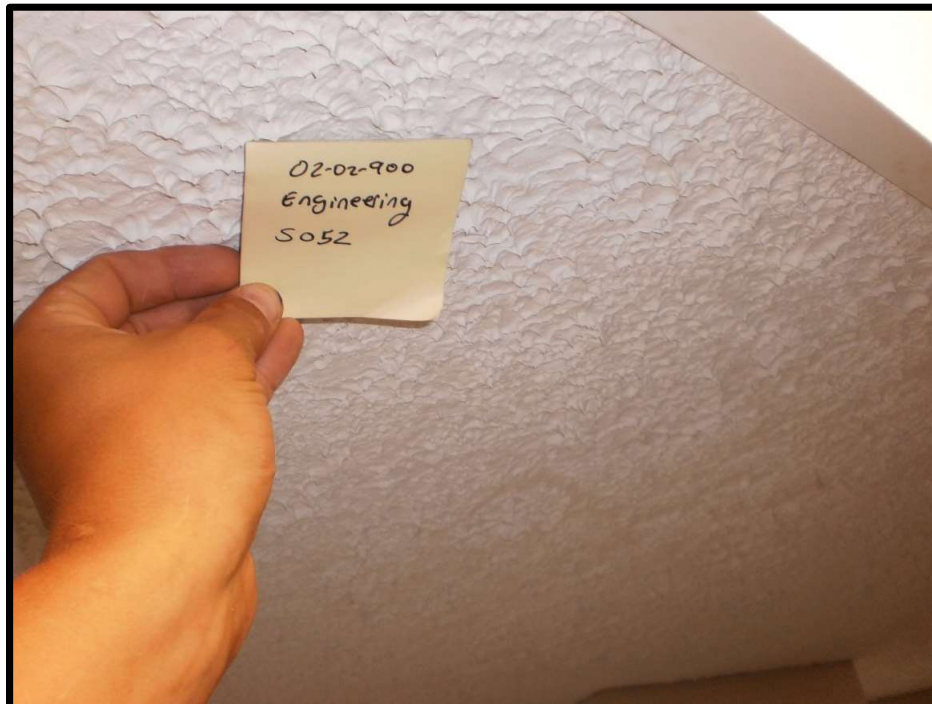
Sample #:	S051	Date Sampled:	July 30, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	194, room 2006	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input checked="" type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

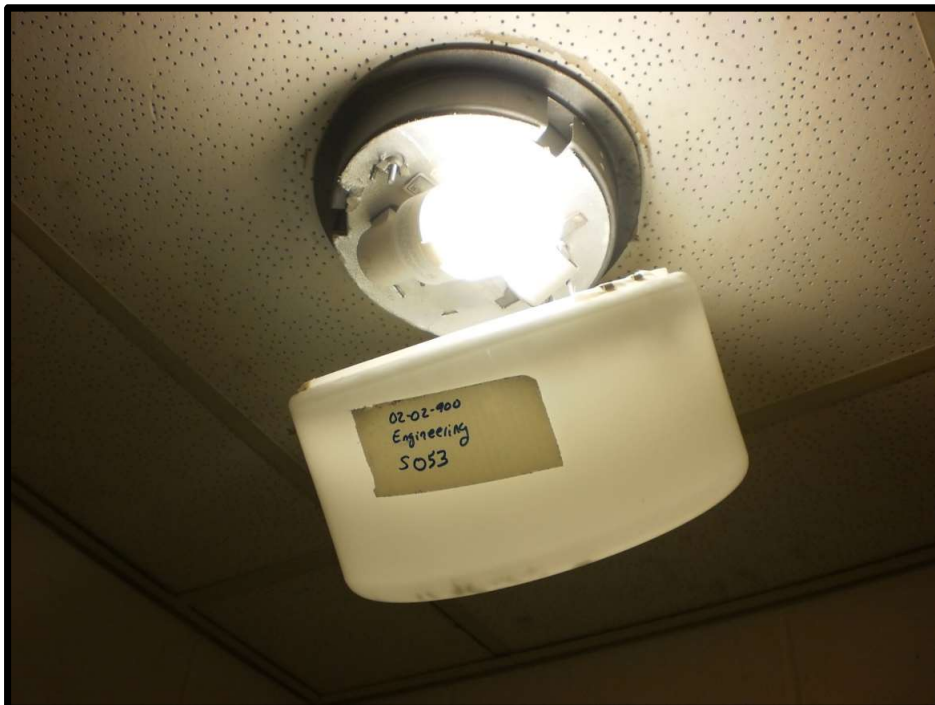
Sample #:	S052	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	196, room 2000	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input checked="" type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

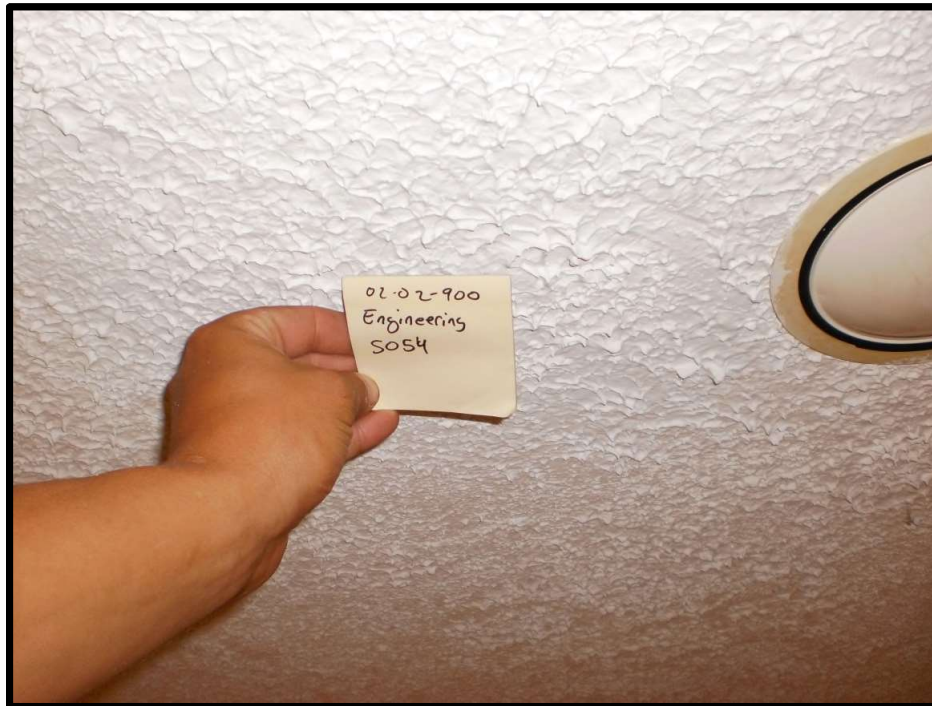
Sample #:	S053	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	196, room 2000	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>Heat Shield</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input checked="" type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

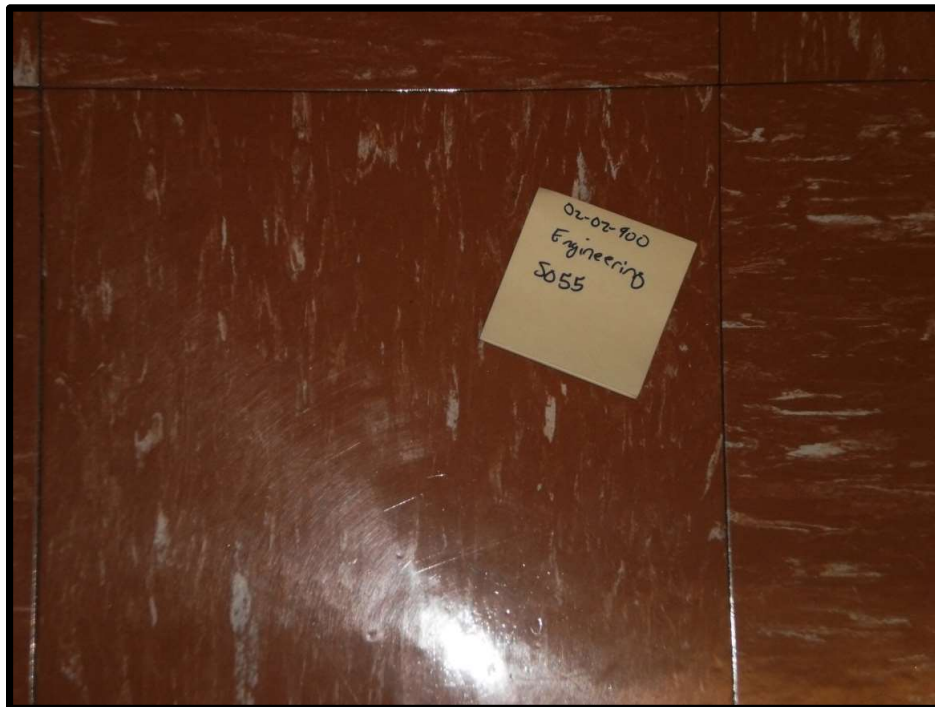
Sample #:	S054	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	200, room 2C01	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input checked="" type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S055	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	201, room 2C02	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Red with abundant white streaks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S056	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	202, room EN2002A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S057	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	220, room 3014	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

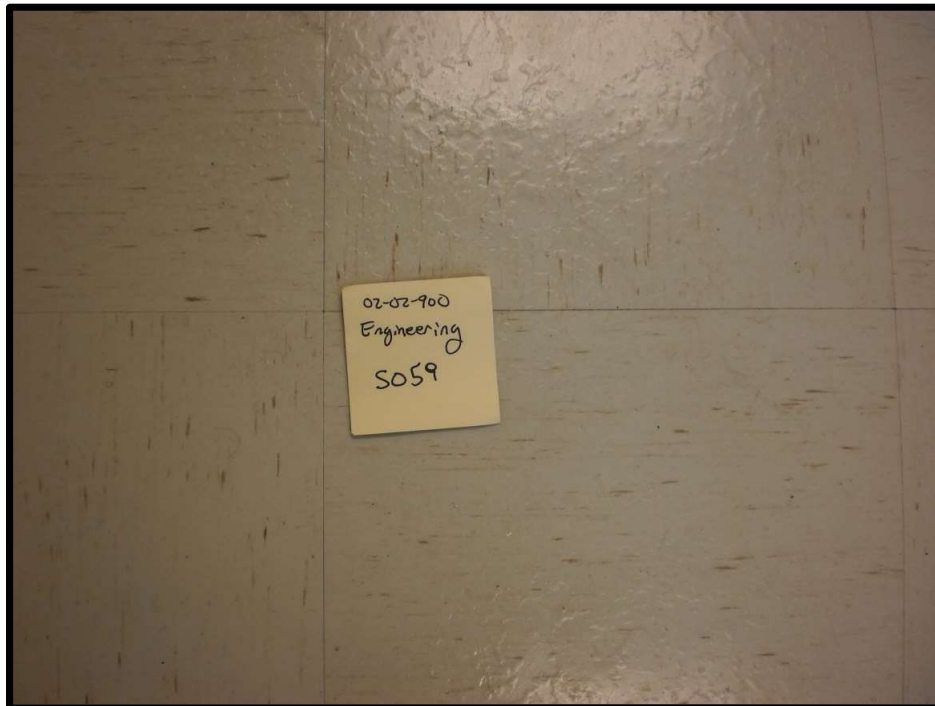
Sample #:	S058	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	232, room 3076	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S059	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	249, room EN3052	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>White with brown flecks</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

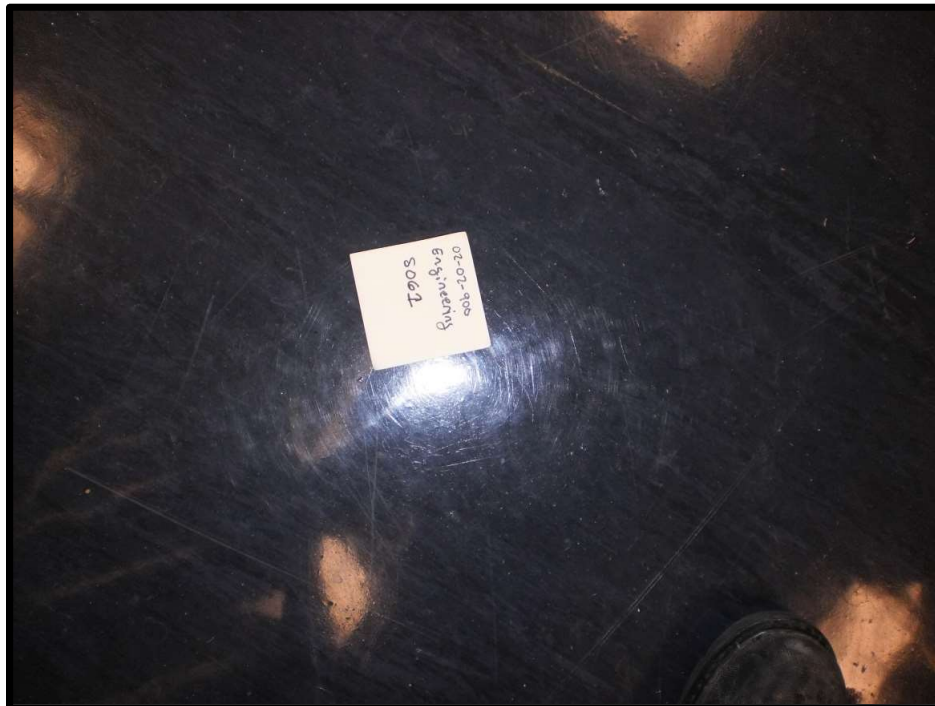
Sample #:	S060	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	450, room 3054	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster X DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor X Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

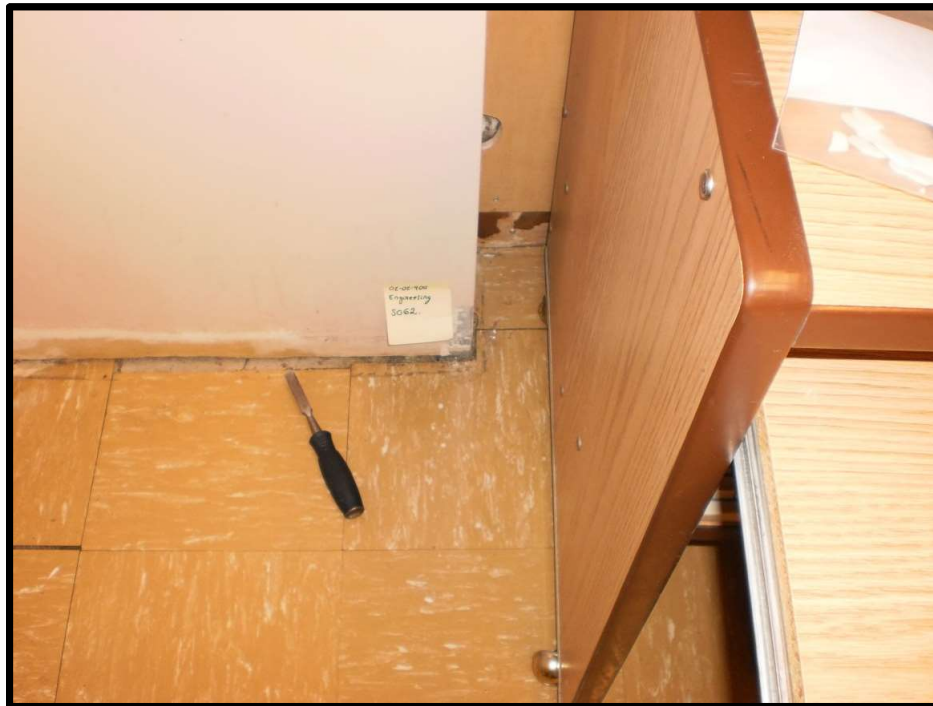
Sample #:	S061	Date Sampled:	July 31, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	271, room EN3058	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	
Bulk Sampling Parameters			
Pipe/Tank	Flooring	Ceiling	Roofing Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input checked="" type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Dark blue</u>





ASBESTOS BULK SAMPLING FORM

Sample #:	S062	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	275, room EN3000A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

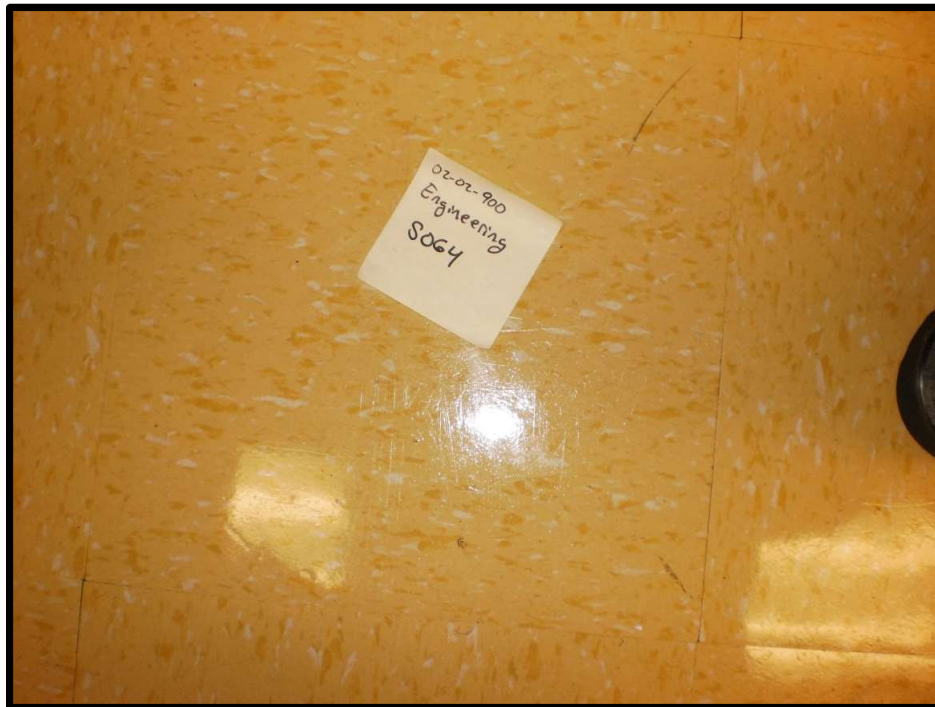
Sample #:	S063	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	275, room EN3000A	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vainly Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>Mastic</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input checked="" type="checkbox"/> Other (ductwork)





ASBESTOS BULK SAMPLING FORM

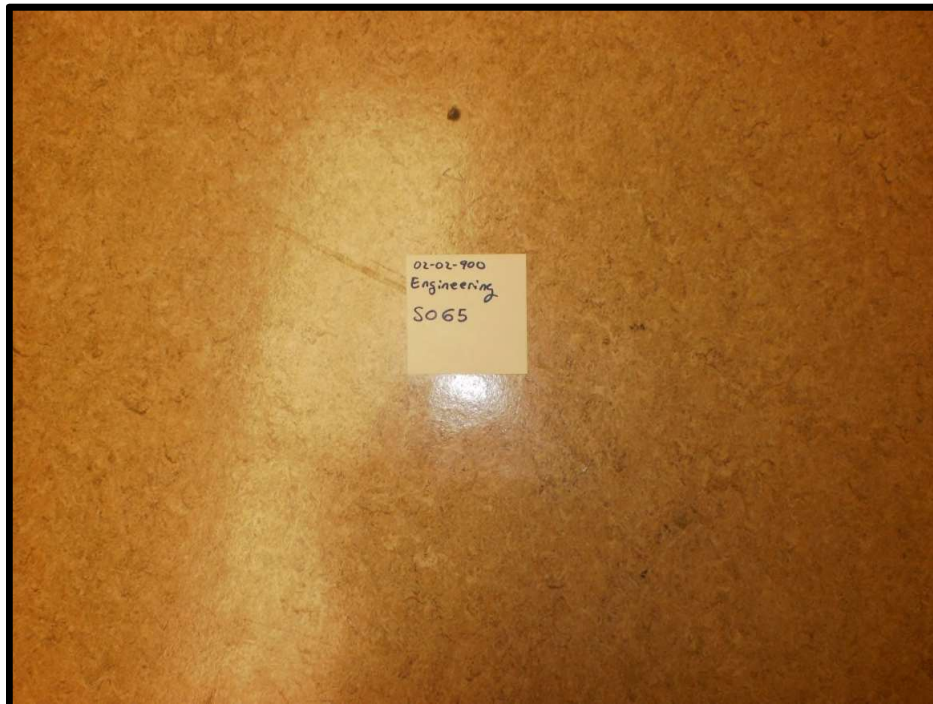
Sample #:	S064	Date Sampled:	July 31, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	275, room EN3000A	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	
Bulk Sampling Parameters			
Pipe/Tank	Flooring	Ceiling	Roofing
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Pale yellow with white and yellow flecks</u>
		Location	
		<input type="checkbox"/> X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other	





ASBESTOS BULK SAMPLING FORM

Sample #:	S065	Date Sampled:	July 31, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	285, room 4028	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile X Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Brown with light grey fleck</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other



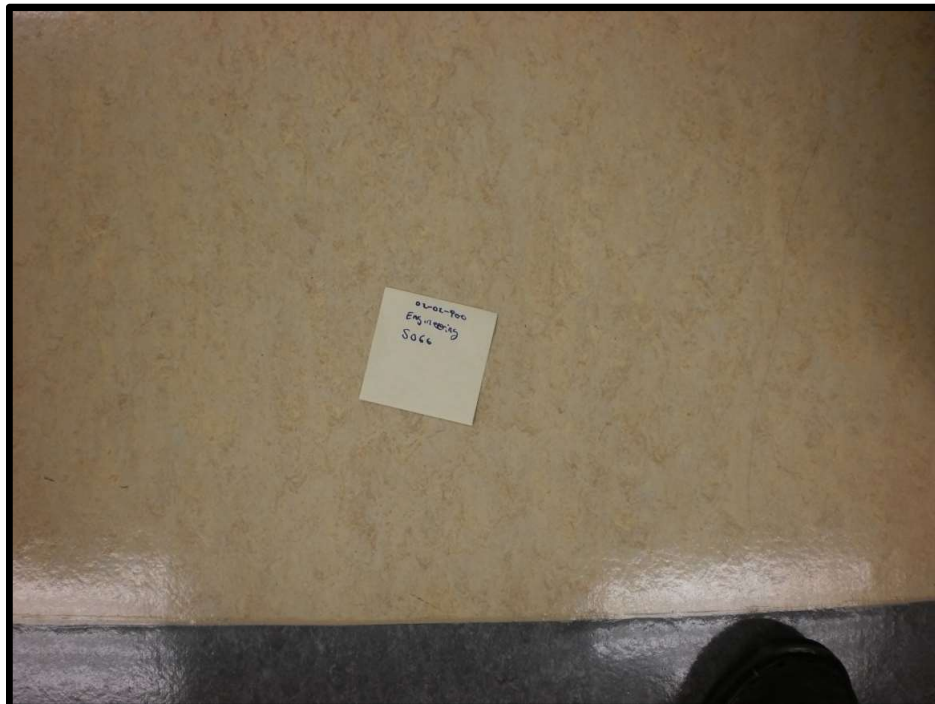


ASBESTOS BULK SAMPLING FORM

Sample #:	S066	Date Sampled:	August 1, 2012
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy
Location:	289, room 4030	Analysis:	SAI - PLM
MUN Project #:	02-02-900	Work Order #:	

Bulk Sampling Parameters

Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation	<input type="checkbox"/> 12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	X Floor
<input type="checkbox"/> Elbow	<input type="checkbox"/> 9'x9'Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
<input type="checkbox"/> Fitting	X Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		<input type="checkbox"/> Other
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic		Miscellaneous: _____
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural		No. of Phases: _____
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing		Colour: <u>Pale yellow with light brown</u>
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing		





ASBESTOS BULK SAMPLING FORM

Sample #:	S067	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	297, room 4032	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

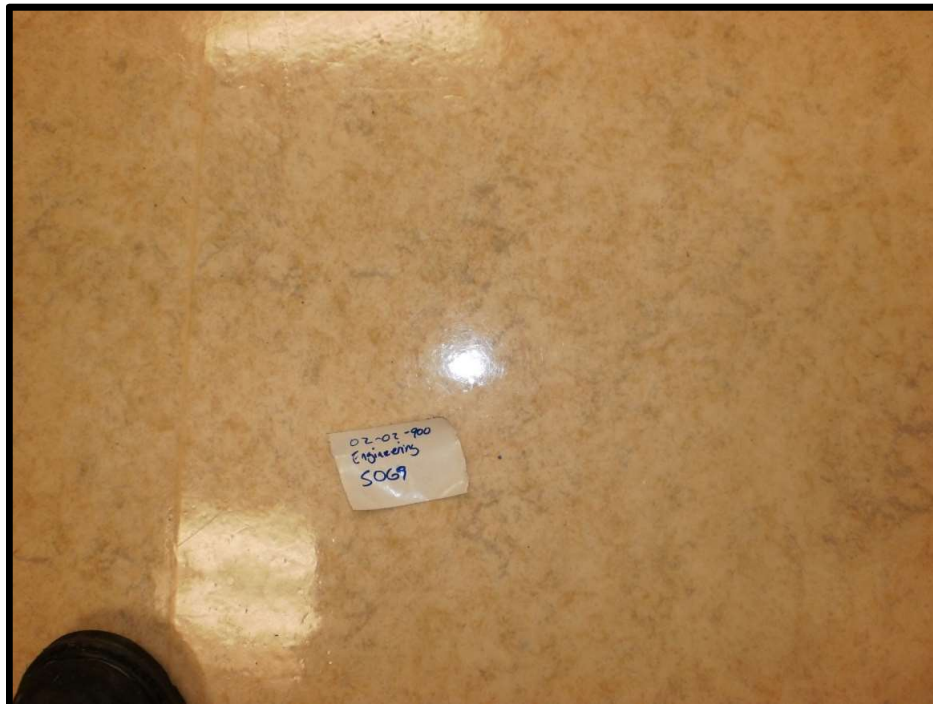
Sample #:	S068	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	300, room EN4042	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap <p style="text-align: center;">HVAC</p> <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic <p style="text-align: center;">Wall</p> <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic <p style="text-align: center;">Structural</p> <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S069	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	310, room EN4029	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input checked="" type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input checked="" type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

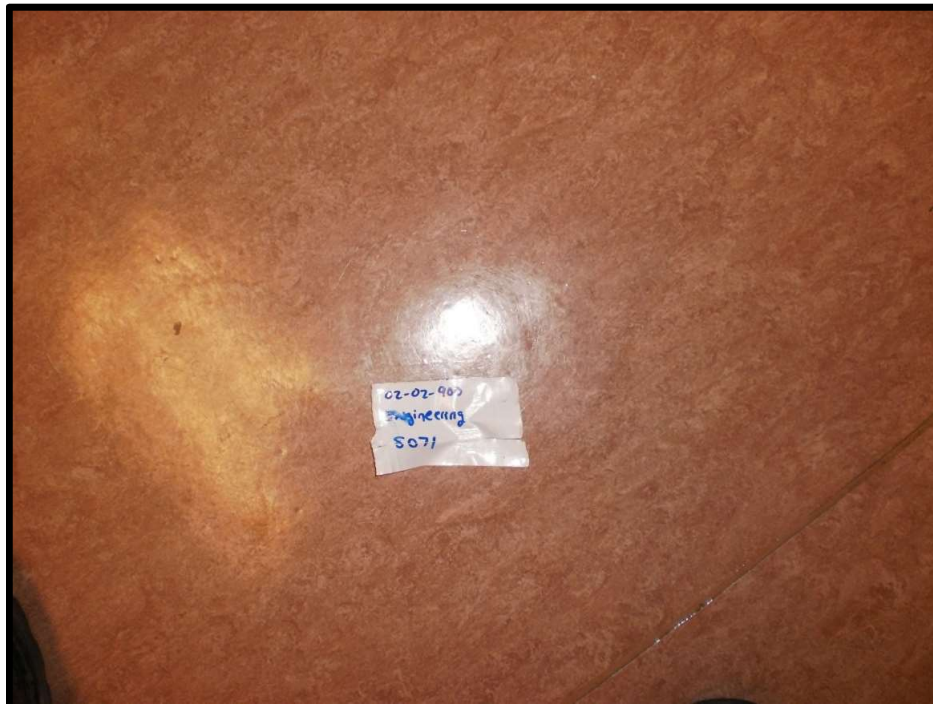
Sample #:	S070	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	310, room EN4029	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input checked="" type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S071	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	316	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input checked="" type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Brown stone</u>	<input checked="" type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

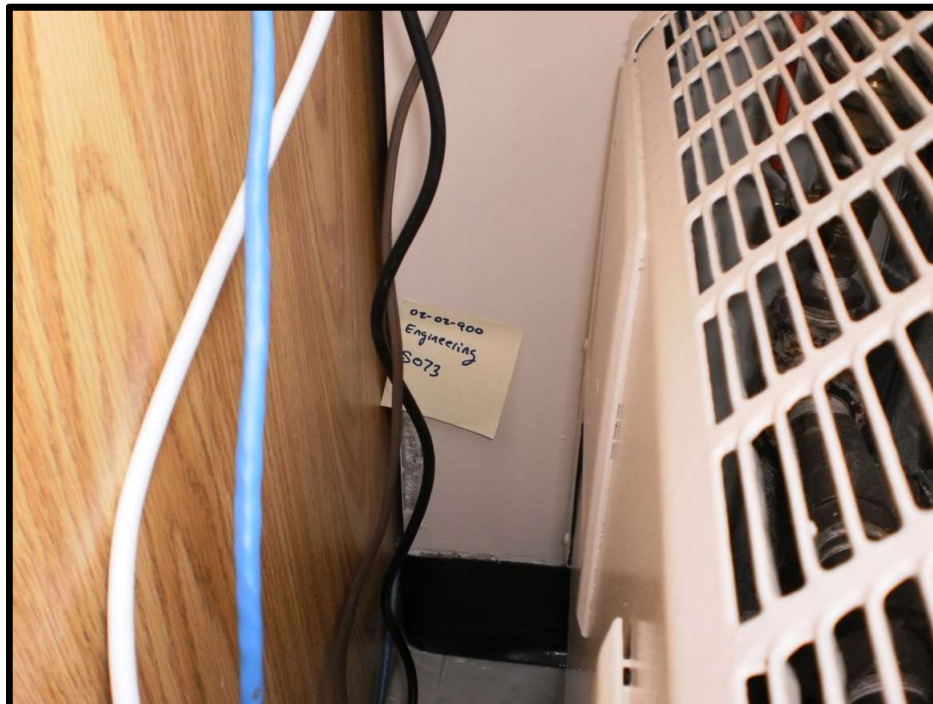
Sample #:	S072	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	316	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S073	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	329	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S074	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	355	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input checked="" type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S075	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	357	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input checked="" type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

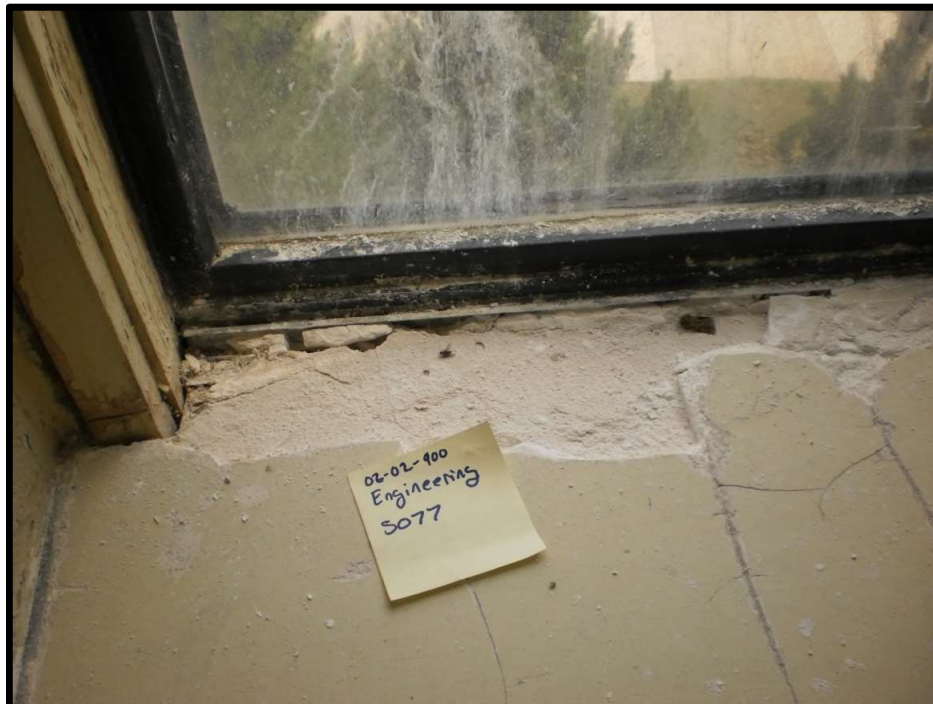
Sample #:	S076	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	358	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input checked="" type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

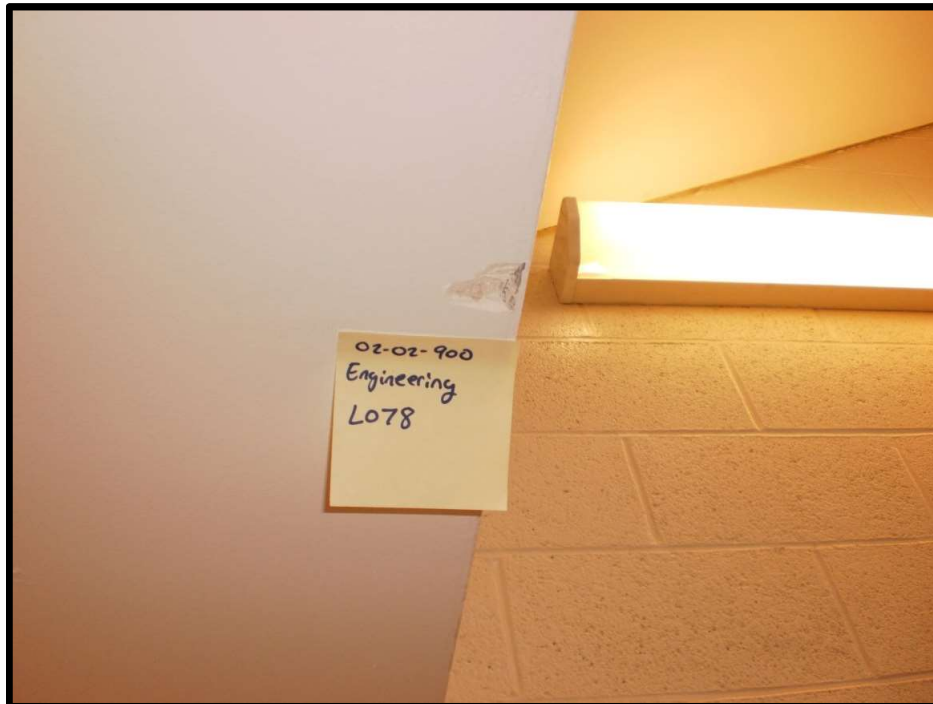
Sample #:	S077	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	359	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> X Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input checked="" type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

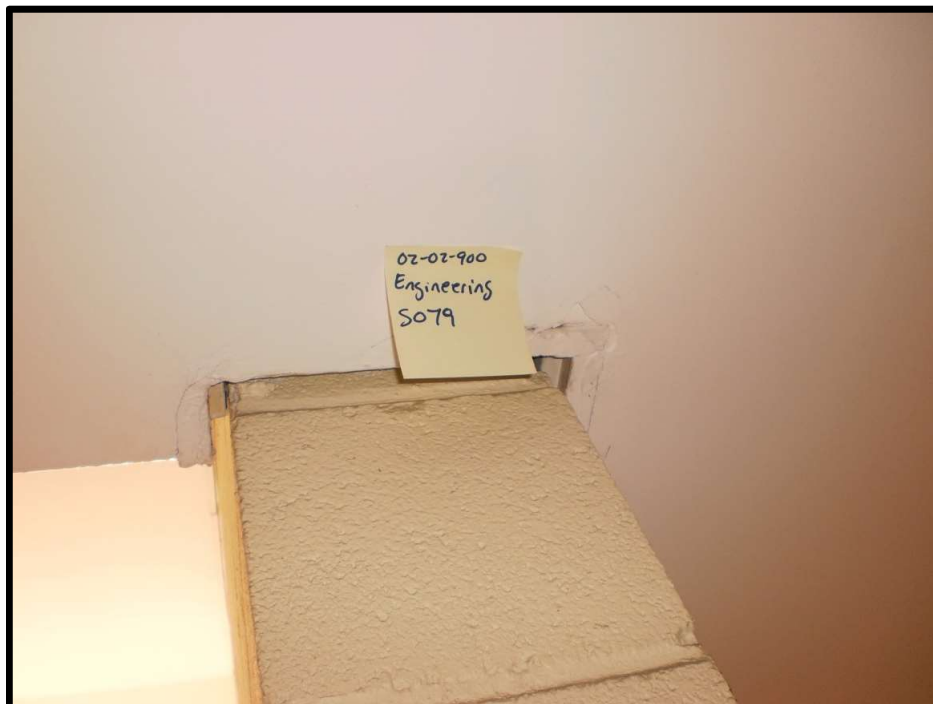
Sample #:	S078	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	359	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input checked="" type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

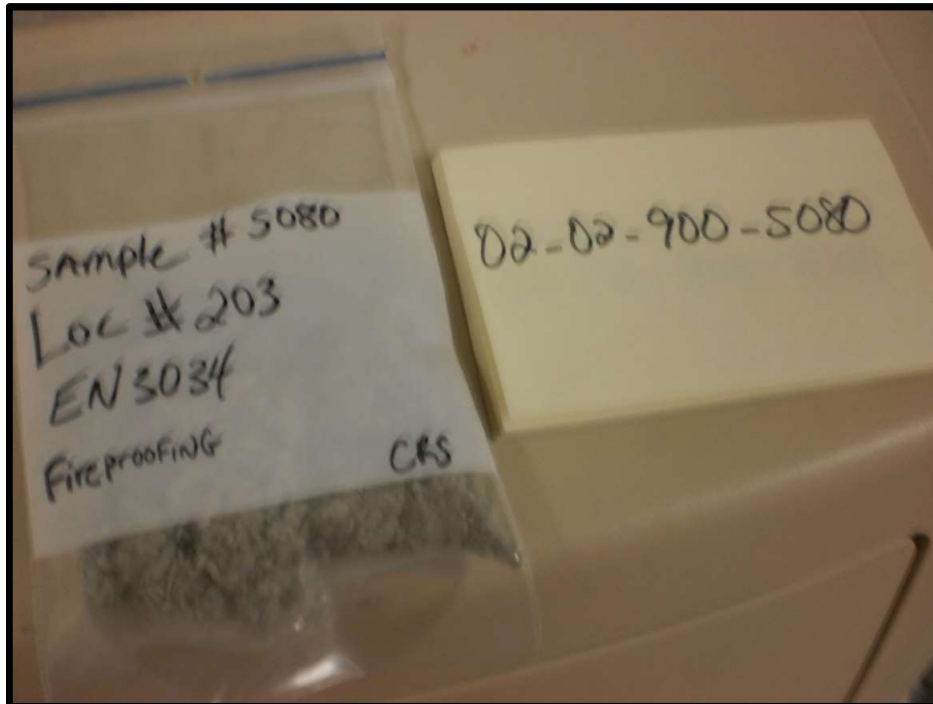
Sample #:	S079	Date Sampled:	August 1, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	360	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input checked="" type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input checked="" type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

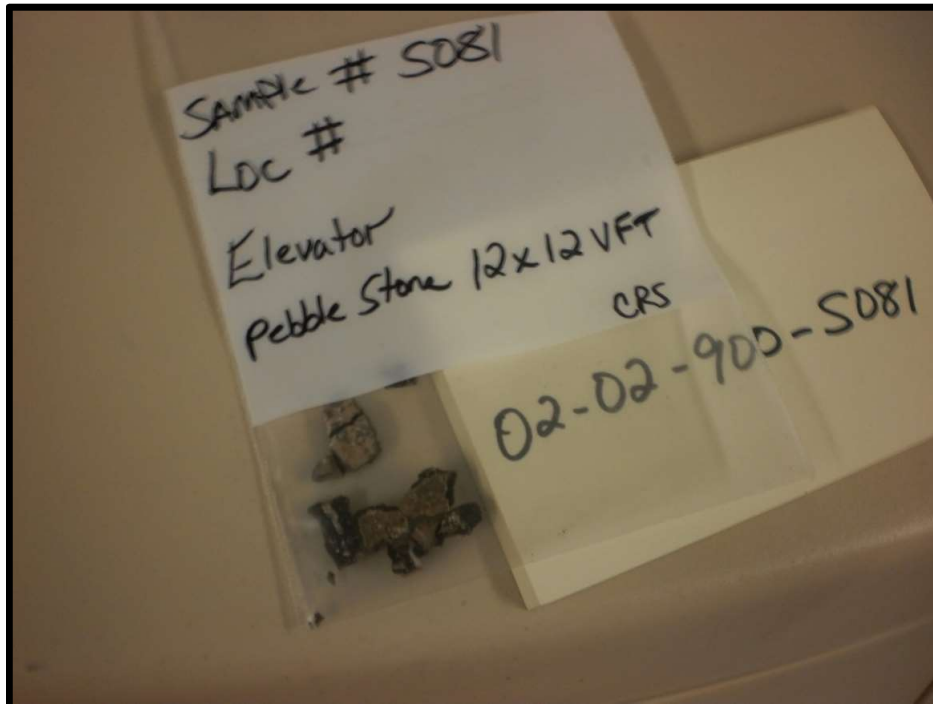
Sample #:	S080	Date Sampled:	August 10, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Curtis Snelgrove	
Location:	203, room EN3034	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	<input type="checkbox"/> 12'x12' Tile <input type="checkbox"/> 9'x9' Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: <u>Fireproofing</u> No. of Phases: _____ Colour: _____	<input type="checkbox"/> Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input checked="" type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

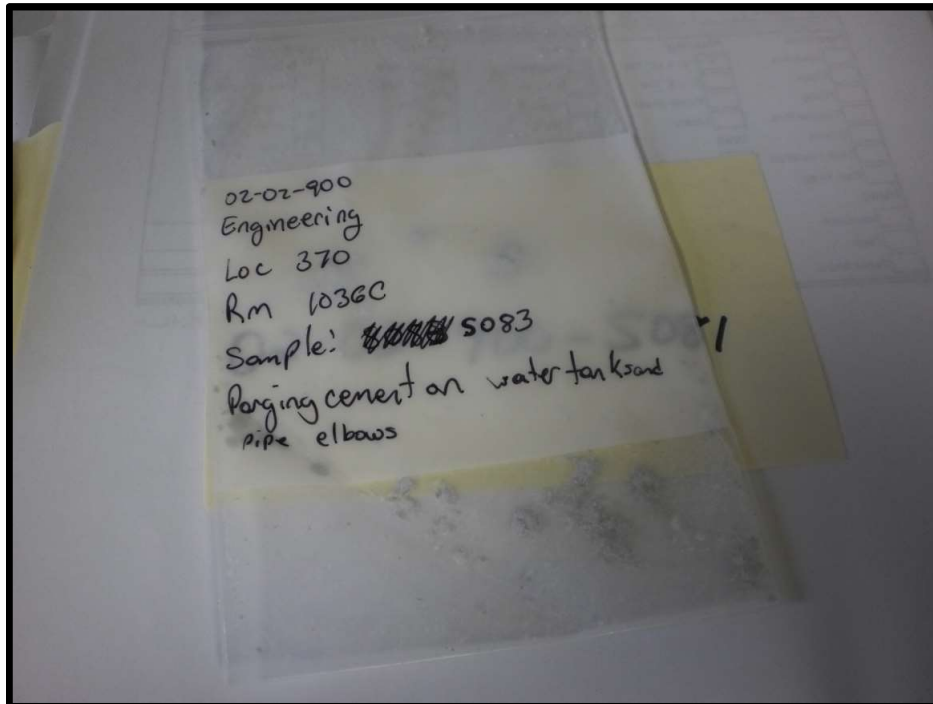
Sample #:	S081	Date Sampled:	August 10, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Curtis Snelgrove	
Location:	Elevator	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: <u>Pebble stone pattern</u>	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other





ASBESTOS BULK SAMPLING FORM

Sample #:	S082	Date Sampled:	August 13, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	EN1036C	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
X Insulation	<input type="checkbox"/> 12'x12' Tile	<input type="checkbox"/> Textured	<input type="checkbox"/> Shingle	<input type="checkbox"/> Floor
X Elbow	<input type="checkbox"/> 9'x9' Tile	<input type="checkbox"/> Stucco	<input type="checkbox"/> Rolled	<input type="checkbox"/> Wall Orientation
X Fitting	<input type="checkbox"/> Vinyl Sheet	<input type="checkbox"/> Popcorn	<input type="checkbox"/> Felt	<input type="checkbox"/> Ceiling
<input type="checkbox"/> Transite Pipe	<input type="checkbox"/> Mastic	<input type="checkbox"/> DWJC	<input type="checkbox"/> Tar	<input type="checkbox"/> Above Ceiling
<input type="checkbox"/> Gasket	Wall	<input type="checkbox"/> Plaster		X Other (tank)
<input type="checkbox"/> Tank Insulation	<input type="checkbox"/> Transite Panel	<input type="checkbox"/> Acoustic Tile (Dropped)		
<input type="checkbox"/> Pipe Wrap	<input type="checkbox"/> Textured Wall	<input type="checkbox"/> Acoustic Tile (Glued-on)		
HVAC	<input type="checkbox"/> Plaster	<input type="checkbox"/> Mastic	Miscellaneous: _____	
<input type="checkbox"/> Insulation	<input type="checkbox"/> DWJC	Structural		
<input type="checkbox"/> Tape		<input type="checkbox"/> Steel F. P. ing	No. of Phases: _____	
<input type="checkbox"/> Paper Wrap		<input type="checkbox"/> Deck F. P. ing	Colour: _____	





ASBESTOS BULK SAMPLING FORM

Sample #:	S083	Date Sampled:	August 13, 2012	
Building :	Engineering and Applied Sciences	Sampler:	Trent Hardy	
Location:	Room 2042	Analysis:	SAI - PLM	
MUN Project #:	02-02-900	Work Order #:		
Bulk Sampling Parameters				
Pipe/Tank	Flooring	Ceiling	Roofing	Location
<input type="checkbox"/> Insulation <input type="checkbox"/> Elbow <input type="checkbox"/> Fitting <input type="checkbox"/> Transite Pipe <input type="checkbox"/> Gasket <input type="checkbox"/> Tank Insulation <input type="checkbox"/> Pipe Wrap HVAC <input type="checkbox"/> Insulation <input type="checkbox"/> Tape <input type="checkbox"/> Paper Wrap	X 12'x12' Tile <input type="checkbox"/> 9'x9'Tile <input type="checkbox"/> Vinyl Sheet <input type="checkbox"/> Mastic Wall <input type="checkbox"/> Transite Panel <input type="checkbox"/> Textured Wall <input type="checkbox"/> Plaster <input type="checkbox"/> DWJC	<input type="checkbox"/> Textured <input type="checkbox"/> Stucco <input type="checkbox"/> Popcorn <input type="checkbox"/> DWJC <input type="checkbox"/> Plaster <input type="checkbox"/> Acoustic Tile (Dropped) <input type="checkbox"/> Acoustic Tile (Glued-on) <input type="checkbox"/> Mastic Structural <input type="checkbox"/> Steel F. P. ing <input type="checkbox"/> Deck F. P. ing	<input type="checkbox"/> Shingle <input type="checkbox"/> Rolled <input type="checkbox"/> Felt <input type="checkbox"/> Tar Miscellaneous: _____ No. of Phases: _____ Colour: _____	X Floor <input type="checkbox"/> Wall Orientation <input type="checkbox"/> Ceiling <input type="checkbox"/> Above Ceiling <input type="checkbox"/> Other

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Demolition and removal of selected portions of building or structure.
 - .2 Demolition and removal of selected site elements.
 - .3 Salvage of existing items to be reused or recycled.
- .2 Types of items you will not find described in this Section:
 - .1 Use of premises, and phasing, and Owner-occupancy requirements.
 - .2 Photographic Documentation for preconstruction photographs taken before selective demolition operations.
 - .3 Temporary Facilities and Controls for temporary construction and environmental-protection measures for selective demolition operations.
 - .4 Cutting and Patching for cutting and patching procedures.
 - .5 Construction Waste Management and Disposal for disposal of demolished materials.

1.2 DEFINITIONS

- .1 Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

- .1 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
 - .1 Coordinate with Owner's archaeologist, who will establish special procedures for removal and salvage.

1.4 SUBMITTALS

- .1 Schedule of Selective Demolition Activities: Indicate the following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building managers and other tenants' on-site operations are uninterrupted.
 - .2 Interruption of utility services. Indicate how long utility services will be interrupted.
 - .3 Coordination for shutoff, capping, and continuation of utility services.
 - .4 Use of elevator and stairs.
 - .5 Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
 - .6 Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - .7 Means of protection for items to remain and items in path of waste removal from building.

- .2 Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- .3 Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 Section *Photographic Documentation*. Submit before Work begins.
- .4 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .1 Comply with submittal requirements in Division 01 Section "*Construction Waste Management and Disposal*."

1.5 QUALITY ASSURANCE

- .1 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- .2 Standards: Comply with ANSI A10.6, NFPA 241, NBCC, and NFCC.
- .3 Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section *Project Management and Coordination*. Review methods and procedures related to selective demolition including, but not limited to, the following:
 - .1 Inspect and discuss condition of construction to be selectively demolished.
 - .2 Review structural load limitations of existing structure.
 - .3 Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - .4 Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - .5 Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

- .1 Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
 - .1 Comply with requirements specified in Division 01 Section *Summary*.
- .2 Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - .1 Before selective demolition, Owner will remove the following items:
 - .1 Items as selected by the Owner.
- .3 Notify Owner's Representative of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- .4 Hazardous Materials: It may be possible hazardous materials could be present in construction to be selectively demolished. **A report on the presence of hazardous materials is attached for review and use** (If no report is attached, request clarification from Owner's Representative. Examine report to become aware of locations where hazardous materials are present.
 - .1 Hazardous material remediation is specified elsewhere in the Contract Documents.
 - .2 Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- .5 Storage or sale of removed items or materials on-site is not permitted.

- .6 Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - .1 Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify that utilities have been disconnected and capped.
- .2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Owner's Representative.
- .5 Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- .6 Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - .1 Comply with requirements specified in Division 01 Section "*Photographic Documentation*."
 - .2 Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- .7 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- .1 Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - .1 Comply with requirements for existing services/systems interruptions specified in Division 01 Section *Summary*.
- .2 Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - .1 Arrange to shut off indicated utilities with utility companies.
 - .2 If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

- .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .1 Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- .1 Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - .1 Comply with requirements for access and protection specified in Division 01 Section *Temporary Facilities and Controls*.
- .2 Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - .1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - .2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - .3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - .4 Cover and protect furniture, furnishings, and equipment that have not been removed.
 - .5 Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section *Temporary Facilities and Controls*.
- .3 Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - .1 Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- .1 General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - .1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - .2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - .3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - .4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - .5 Maintain adequate ventilation when using cutting torches.
 - .6 Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - .7 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - .8 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

- .9 Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section *Construction Waste Management and Disposal*.
 - .2 Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Owner's Representative's approval.
 - .3 Removed and Salvaged Items:
 - .1 Clean salvaged items.
 - .2 Pack or crate items after cleaning. Identify contents of containers.
 - .3 Store items in a secure area until delivery to Owner.
 - .4 Transport items to Owner's storage area designated by Owner.
 - .5 Protect items from damage during transport and storage.
 - .4 Removed and Reinstalled Items:
 - .1 Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - .2 Pack or crate items after cleaning and repairing. Identify contents of containers.
 - .3 Protect items from damage during transport and storage.
 - .4 Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
 - .5 Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner's Representative, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- .1 Concrete: Demolish in small sections. Cut concrete to a depth of at least 19 mm at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
 - .2 Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
 - .3 Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
 - .4 Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
 - .5 Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
 - .1 Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
 - .6 Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weather tight. Refer to Division 07 for new roofing requirements.
 - .1 Remove existing roof membrane, flashings, copings, and roof accessories.
 - .2 Remove existing roofing system down to substrate.

- .7 Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- .1 General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an approved landfill.
 - .1 Do not allow demolished materials to accumulate on-site.
 - .2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - .3 Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - .4 Comply with requirements specified in Division 01 Section *Construction Waste Management and Disposal*.
- .2 Burning: Do not burn demolished materials.
- .3 Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- .1 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

- .1 Existing Construction to Be Removed: <Insert description of items and construction to be removed.>
- .2 Existing Items to Be Removed and Salvaged: <Insert description of items to be removed and salvaged.>
- .3 Existing Items to Be Removed and Reinstalled: <Insert description of items to be removed and reinstalled.>
- .4 Existing Items to Remain: <Insert description of items to remain.>

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Requirements and procedures for asbestos abatement of minor amounts of chrysotile asbestos-containing materials of the type describe within.
 - .1 Removing suspended ceilings, as indicated.
 - .2 Removal of asbestos containing material from piping and equipment.
 - .3 Enclosure of friable asbestos containing material.
 - .4 Application of tape or sealant or other covering to pipe and boiler insulation containing asbestos.
 - .2 Types of items you will not find described in this Section:
 - .1 Submittal Procedures.
 - .2 Health and Safety Requirements.
 - .3 Construction/Demolition Waste Management and Disposal.
 - .3 References
 - .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.205-94, Sealer for Application of Asbestos Fibre Releasing Materials.
 - .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
 - .4 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
 - .5 Underwriters' Laboratories of Canada (ULC).

1.2 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
- .2 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .3 Asbestos Containing Materials (ACMs): materials identified under *Existing Conditions* Article, including fallen materials and settled dust.
- .4 Minor Amounts of ACMs: less than or equal to 0.1 m² of friable material containing chrysotile asbestos.
- .5 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.
- .6 Authorized Visitors: Owner's Representatives, or designated representatives, and representatives of regulatory agencies.
- .7 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .8 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

- .9 Polyethylene: polyethylene sheeting or rip proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
 - .10 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
 - .5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.
 - .11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.
- 1.3 SUBMITTALS
- .1 Submit proof satisfactory to Owner's Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.
 - .2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
 - .3 Submit proof of Contractor's Asbestos Liability Insurance.
 - .4 Submit to Owner's Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
 - .5 Submit proof satisfactory to Owner's Representative that employees have had instruction on hazards of asbestos exposure, respirator use, dress, entry and exit from Asbestos Work Area, and aspects of work procedures and protective measures.
 - .6 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Owner's Representative. Minimum of one supervisor for every ten workers.
 - .7 Submit Worker's Compensation Board status and transcription of insurance.
 - .8 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
 - .1 encapsulants;
 - .2 amended water;
 - .3 slow drying sealer.
- 1.4 QUALITY ASSURANCE
- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with *Health and Safety Requirements*.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

- .1 Non-powered reusable or replaceable filter type respirator equipped with HEPA filter cartridges, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction.
 - .2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
 - .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
 - .3 Before leaving Asbestos Work Area, dispose of protective clothing as contaminated waste as specified.
 - .4 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are located.
 - .5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
 - .3 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.
- 1.5 WASTE MANAGEMENT AND DISPOSAL
- .1 Place materials defined as hazardous or toxic in designated containers.
 - .2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
 - .3 Fold up metal banding, flatten and place in designated area for recycling.
 - .4 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
 - .5 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.
- 1.6 EXISTING CONDITIONS
- .1 Results of tests of asbestos containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification manual. These are for general information only and are not necessarily representative of asbestos containing materials covered within scope of this Project.
- 1.7 SCHEDULING
- .1 Not later than ten (10) days before beginning Work on this Project notify following in writing:
 - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
 - .2 Regional Office of Labour Canada.
 - .3 Provincial/Territorial, Department of Labour.
 - .4 Disposal Authority.
 - .2 Inform sub trades of presence of friable asbestos containing materials identified in *Existing Conditions*.
 - .3 Submit to Owner's Representative copy of notifications prior to start of Work.

1.8 OWNER'S INSTRUCTIONS

- .1 Before beginning Work, provide to Owner's Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Proper fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Drop and Enclosure Sheets.
 - .1 Polyethylene: 0.15 mm thick.
 - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.
- .3 Waste Containers: contain waste in two separate containers.
 - .1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.
 - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
 - .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.
- .4 Glove bag:
 - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
 - .2 Glove bags intended for use in more than one location must be equipped with reversible, double pull, double throw zipper on top and at approximately mid-section of bag.
- .5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
 - .1 Sealer: flame spread and smoke developed rating less than 50.
- .7 Encapsulants: Type 2 surface film forming or Type 1 penetrating type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada.

PART 3 - EXECUTION

3.1 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos containing materials.

3.2 PROCEDURES

- .1 Do construction occupational health and safety in accordance with *Health and Safety Requirements*.
- .2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case *Helvetica Medium* letters reading as follows, where number in parentheses indicates font size to be used : *CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)*.
- .3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.
 - .1 Use HEPA vacuum, or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
 - .2 Do not use compressed air to clean up or remove dust from any surface.
- .4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
 - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
 - .2 When removing suspended ceilings and walls themselves do not enclose work area and when removing asbestos containing material from piping or equipment and *glove bag* method is not used erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.
- .5 Before removing suspended ceilings, remove friable material on upper surfaces using HEPA vacuum equipment.
 - .1 Remove and clean surfaces of ceiling panels using HEPA vacuum, wrap clean panels in 0.10 mm thick polyethylene, and store in building as directed by Owner's Representative.
 - .2 Clean *T* grid suspension system, disconnect, wrap in 0.10 mm thick polyethylene, and store in building as directed by Owner's Representative.
- .6 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
 - .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
 - .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .7 Pipe Insulation Removal Using Glove Bag:
 - .1 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.
 - .2 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.
 - .3 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

- .4 When glove bags are intended for use at more than one location: after wash down and application of sealer, seal off waste in lower section of bag using zipper at mid-section of bag. Remove air from top section of bag through elasticized valve using HEPA vacuum. Remove bag from pipe, reinstall in new location, and reseal to pipe prior to opening lower section of bag. Repeat stripping operation.
 - .5 If bag is to be moved along pipe, first remove air from top section through elasticized valve using HEPA vacuum. Next loosen straps, move bag, re-seal to pipe using double pull zipper to pass hangers. Repeat stripping operation.
 - .6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.
 - .7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.
 - .8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.
- .8 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .9 Clean-up:
- .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
 - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
 - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
 - .4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.
 - .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Owner's Representative to take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with Health Canada recommendations.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.
- .3 Ensure that respiratory safety factors are not exceeded.
- .4 During the course of Work, Owner's Representative to measure fibre content of air outside Work areas by means of fibrous aerosol monitors (FAM).
 - .1 When FAM readings exceed 0.25 f/cc, adopt more stringent Work procedures immediately and perform PCM test.
- .5 Stop Work when PCM measurements exceed 0.01 f/cc and correct procedures.

END OF SECTION .02

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Concrete masonry units (CMUs) (Non-decorative type).
 - .2 Decorative concrete masonry units.
 - .3 Acoustical concrete masonry units.
 - .4 Calcium silicate masonry units (CSUMs)
 - .5 Mortar and grout.
 - .6 Reinforcing steel.
 - .7 Masonry joint reinforcement.
 - .8 Ties and anchors.
 - .9 Embedded flashing.
 - .10 Miscellaneous masonry accessories.
 - .11 Cavity-wall insulation.
- .2 Similar types of items not described in this Section:
 - .1 Concrete building brick.
 - .2 Pre-faced concrete masonry units.
 - .3 Concrete facing brick.
 - .4 Face brick.
 - .5 Building (common) brick.
 - .6 Hollow brick.
 - .7 Glazed brick.
 - .8 Structural-clay facing tile.
 - .9 Firebox brick.
 - .10 Clay flue lining units.
 - .11 Stone trim units.
- .3 Other types of items not described in this Section:
 - .1 Dovetail slots for masonry anchors.
 - .2 Glass block.
 - .3 Furnishing cast stone trim.
 - .4 Installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
 - .5 Furnishing steel lintels and shelf angles for unit masonry.
 - .6 Water repellents applied to unit masonry.
 - .7 Exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
 - .8 Wall vents (brick vents).
 - .9 Interior brick flooring.
 - .10 Chemical-resistant, interior brick flooring.
 - .11 Stone window stools.
 - .12 Exterior unit masonry paving.
 - .13 Dry-laid, concrete unit retaining walls.
 - .14 Air barrier in exterior masonry wall assemblies.
 - .15 Firestopping at openings in masonry walls.

- .16 Fire-resistive joint systems at heads of masonry walls.
- .17 Sealing control and expansion joints in unit masonry.

1.3 DEFINITIONS

- .1 Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

- .1 Product Data: For each type of product indicated.
 - .1 Provide manufacturer's installation instructions for calcium silicate masonry units.
- .2 Shop Drawings: For the following:
 - .1 Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - .2 Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Show elevations of reinforced walls.
- .3 Samples for Verification: For each type and colour of the following:
 - .1 Decorative concrete masonry units.
 - .2 Calcium silicate masonry units.
 - .3 Pigmented and coloured-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 - .4 Weep holes/vents.
 - .5 Accessories embedded in masonry.
- .4 Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
- .5 Sustainability Submittals: For those products and materials required to meet the regional materials requirement specified herein, indicate location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.5 QUALITY ASSURANCE

- .1 Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and colour, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- .2 Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including colour for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- .3 Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per CAN/ULC-S101 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- .4 Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .1 Build mockups for each type of exposed unit masonry construction in sizes approximately 1500 mm long by 1200 mm high by full thickness, including face and backup wythes and accessories.
 - .1 Include a sealant-filled joint at least 400 mm long in each exterior wall mockup.

- .2 Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 300 mm wide by 400 mm high.
- .3 Include through-wall flashing installed for a 600 mm length in corner of exterior wall mockup approximately 400 mm down from top of mockup; with a 300 mm length of flashing left exposed to view (omit masonry above half of flashing).
- .4 Include studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
- .2 Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
- .3 Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
- .4 Protect accepted mockups from the elements with weather-resistant membrane.
- .5 Approval of mockups is for colour, texture, and blending of masonry units; relationship of mortar and sealant colours to masonry unit colours; tooling of joints; and aesthetic qualities of workmanship.
 - .1 Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Owner's Representative in writing.
- .6 Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- .5 Reinforcing Steel:
 - .1 Upon request, provide Owner's Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis.
 - .2 Upon request inform Owner's Representative of proposed source of material to be supplied.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - .1 Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 - .2 Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 - .3 Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
 - .4 Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
 - .5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
 - .6 Ship reinforcement and connectors, clearly identified in accordance with drawings.
- 1.7 PROJECT CONDITIONS
 - .1 Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - .1 Extend cover a minimum of 600 mm down both sides and hold cover securely in place.
 - .2 Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 600 mm down face next to unconstructed wythe and hold cover in place.
 - .2 Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

- .3 Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - .1 Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - .2 Protect sills, ledges, and projections from mortar droppings.
 - .3 Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - .4 Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

- .4 Cold weather requirements.
 - .1 Supplement Clause 5.15.2 of CSA-A371 with following requirements.
 - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature between 5 degrees C and 50 degrees C and protect site from wind chill.
 - .2 Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 4 deg C and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

- .5 Hot weather requirements.
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- .1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - .1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 MASONRY UNITS, GENERAL

- .1 Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

- .1 Regional Materials: Use only products that have been manufactured within 800 km of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 800 km of Project site, whenever these products are available.
- .2 Shapes: Provide shapes indicated and as follows:
 - .1 Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - .2 Provide bullnose units for outside corners, unless otherwise indicated.

- .3 Integral Water Repellent: Provide units made with integral water repellent where units could be exposed to the weather.
 - .1 Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
 - .1 Available Products:
 - .1 Addiment Incorporated; Block Plus W-10.
 - .2 Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
 - .3 Master Builders, Inc.; Rheopel.
 - .4 Concrete Masonry Units: CAN3-A165 Series (CAN3-A165.1).
 - .1 Classification: H/ 15/ A/ M; unless otherwise noted.
 - .2 Size: modular.
 - .5 Decorative Concrete masonry Units: CAN3-A165 Series (CAN3-A165.1).
 - .1 Face: split face, split ribbed, single and triple scored face, and other features as indicated.
 - .2 Classification: H/ 15/ A/ M; unless otherwise noted.
 - .3 Size: modular.
 - .4 Colour: As indicated.
 - .6 Acoustical Concrete masonry Units: CAN3-A165 Series (CAN3-A165.1) purpose made with slots to provide the acoustical characteristics specified.
 - .1 Classification: H/15/B/M
 - .2 Size: modular.
 - .3 Configuration: block containing two slots with noncombustible fibrous filler elements.
 - .4 Acoustical properties: Manufacturer's standard, unless otherwise indicated.
- 2.4 CALCIUM SILICATE MASONRY UNITS (CSUM)
- .1 Products: Subject to compliance with requirements, provide one of the following:
 - .1 Arriscraft International Inc.; Renaissance Masonry Units; and
 - .2 Approved alternate.
 - .2 Calcium Silicate Masonry Units: to CSA A82.3, Grade SW; solid units that have been pressure formed and autoclaved; having the following typical average properties when tested to the identified standard:
 - .1 Compressive Strength: 45.5 MPa, to ASTM C170.
 - .2 Absorption: 8.8 percent, to ASTM C97.
 - .3 Density: 2070 kg/m³, to ASTM C97.
 - .4 Modulus of Rupture: 5.3 MPa, to ASTM C99.
 - .3 Shapes, Sizes, Finishes, and Colours:
 - .1 90 mm bed depth;
 - .2 Modular sizes as indicated on drawings;
 - .3 Special shapes as indicated.
 - .4 Finish: on exposed faces and ends:
 - .1 Sandblasted finish, unless otherwise noted in the *Finishes Legends*;
 - .5 Colour: provide colour indicated in the *Finishes Legends*.

2.5 CONCRETE AND MASONRY LINTELS

- .1 General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
- .2 Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 3 Section *Cast-in-Place Concrete*.
- .3 Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Mortar: CSA A179; natural colour unless otherwise noted.
- .3 Non-staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type.
- .4 Mortar Colouring: ground coloured natural aggregates or metallic oxide pigments.
 - .1 Colour: natural unless otherwise indicated in the *Finishes Legends*.
- .5 Aggregate: aggregate passing 1.18 mm sieve, where 6 mm thick joints are indicated.
- .6 Grout: to CSA A179, Table 3.
- .7 Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - .1 Available Products:
 - .1 Addiment Incorporated; Mortar Kick.
 - .2 Euclid Chemical Company (The); Accelguard 80.
 - .3 Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
 - .4 Sonneborn, Div. of ChemRex; Trimix-NCA.
- .8 Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 - .1 Available Products:
 - .1 Addiment Incorporated; Mortar Tite.
 - .2 Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - .3 Master Builders, Inc.; Colour Cure Mortar Admix or Rheomix Rheopel.
- .9 Water: Potable.

2.7 REINFORCEMENT

- .1 Bar reinforcement: to CSA-A371 and CAN/CSA G30.18.
 - .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
- .2 Masonry Joint Reinforcement, General: CSA-A371 and CSA G30.14.
 - .1 Interior Walls: Mill- galvanized, carbon steel.

- .2 Exterior Walls: Hot-dip galvanized carbon or stainless steel.
- .3 Provide in lengths of not less than 3 m.
- .3 Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- .4 Masonry Joint Reinforcement for Multiwythe Masonry:
 - .1 Ladder type with 1 side rod at each face shell of hollow masonry units more than 100 mm in width, plus 1 side rod at each wythe of masonry 100 mm or less in width.

2.8 TIES, ANCHORS, CONNECTORS

- .1 Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
 - .1 Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
 - .2 Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 - .3 Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or 316.
 - .4 Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, Z180 zinc coating.
 - .5 Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 - .6 Stainless-Steel Sheet: ASTM A 666, Type 304 or 316.
 - .7 Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - .8 Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.
- .2 Connectors, General: to CSA-A370 and CSA-S304.
- .3 Rigid Connectors: Fabricate from steel bars 38 mm wide by 6.4 mm thick by 600 mm long, with ends turned up 50 mm or with cross pins, unless otherwise indicated.
 - .1 Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- .4 Partition Top Anchors: 2.5 mm thick metal plate with 10 mm diameter metal rod 150 mm long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube; unless otherwise indicated. Fabricate from steel, hot-dip galvanized after fabrication.
- .5 Adjustable Masonry-Veneer Anchors
 - .1 General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - .1 Structural Performance Characteristics: Capable of withstanding a 445-N load in both tension and compression without deforming or developing play in excess of 1.3 mm.
 - .2 Screw-Attached, Masonry-Veneer Anchors for Steel Stud Back-up: Units consisting of a wire tie and a metal anchor section; with insulation retainer.
 - .1 Fabricate sheet metal anchor sections and other sheet metal parts from 1.7 mm minimum thick, steel sheet, galvanized after fabrication.
 - .2 Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 4.8 mm minimum diameter, hot-dip galvanized steel or stainless-steel wire.
 - .3 Available Products:
 - .1 Blok-Lok BL607
 - .3 Embedded-Attached Masonry-Veneer Anchors for Unit Masonry Back-up: Units consisting of a wire tie and a metal anchor section, galvanized steel, with insulation retainer.
 - .1 Fabricate sheet metal anchor sections and other sheet metal parts from 1.7 mm thick, steel sheet, galvanized after fabrication.
 - .2 Fabricate wire connector sections from 4.8 mm diameter, hot-dip galvanized, and carbon -steel wire.

- .3 Available Products:
 - .1 Blok-Lok BL507
- .4 Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, 4.8 mm diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - .1 Available Products:
 - .1 ITW Buildex; Teks Maxiseal with Climaseal finish.
 - .2 Textron Inc., Textron Fastening Systems; Elco Drill-Flex with Stalgard finish.
- .5 Tie System for Concrete: stainless steel spiral bits, with insulation retainer Back-up
 - .1 Spira-Lok Helitical Wall Ties System; or equivalent.

2.9 MISCELLANEOUS ANCHORS

- .1 Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM F 568M, Property Class 4.6; with ASTM A 563M hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- .2 Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - .1 Corrosion Protection for installations inside of the building envelope's vapour barrier: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns).
 - .2 Corrosion Protection for other locations: Stainless-steel components complying with ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.10 EMBEDDED FLASHING MATERIALS

- .1 Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 7 Section *Sheet Metal Flashing and Trim* and as follows:
 - .1 Metal Drip Edges: Fabricate from metal flashing. Extend at least 75 mm into wall and 13 mm out from wall, with outer edge bent down 30 degrees and hemmed.
 - .2 Metal Flashing Terminations: Fabricate from metal flashing. Extend at least 75 mm into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 19 mm and down into joint 10 mm to form a stop for retaining sealant backer rod.
- .2 Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:
 - .1 Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 1.0 mm.
- .3 Masonry Cavity Firestop: Firestop masonry cavities indicated by installing continuous sheet metal back-up to flexible flashing consisting of commercial quality sheet to ASTM A653-M96, with Z275 designation zinc coating, 0.38 mm minimum thickness. Overlap joints by 50 mm.
 - .1 Locations: Masonry cavities containing foam insulations.
- .4 Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- .1 Compressible Filler: Premoulded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- .2 Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- .3 Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - .1 Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 3 mm less than depth of outer wythe, in colour selected from manufacturer's standard.
 - .2 Aluminium Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminium, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted before installation to comply with Division 9 painting Sections in colour approved by Owner's Representative to match that of mortar.
 - .3 Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-moulded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in colour approved by Owner's Representative to match that of mortar.
- .4 Cavity Drainage Material: choice of
 - .1 Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - .2 6 mm washed pea gravel, free of fines.

2.12 CAVITY-WALL INSULATION

- .1 Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminium-foil-faced), Class 2 (glass-fibre-reinforced).
- .2 Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.13 MASONRY CLEANERS

- .1 Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discolouring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.14 MORTAR AND GROUT MIXES

- .1 General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - .1 Do not use calcium chloride in mortar or grout.
 - .2 Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar colour is consistent.
- .2 Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- .3 Mortar for Unit Masonry: Comply with CSA 179 Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - .1 For reinforced masonry, use Type S.

- .2 For exterior, above-grade, load-bearing and non-load-bearing walls, and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- .4 Pigmented Mortar: Use coloured cement product.
 - .1 Pigments shall not exceed 10 percent of Portland cement by weight.
- .5 Coloured-Aggregate Mortar: Produce required mortar colour by using coloured aggregates and natural colour or white cement as necessary to produce required mortar colour.
- .6 Pointing Mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour and not more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
- .7 Mortar for Calcium Silicate Masonry Units: to CSA A179, Proportion specification, 1 part Portland cement, 1 part hydrated lime, 6 parts mortar aggregate by volume for both cementitious materials and aggregate; integral colour as selected by Owner's Representative.
- .8 Grout for Unit Masonry: to CSA A179, Table 3.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - .1 For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - .2 Verify that reinforcing dowels are properly placed.
- .2 Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
- .2 Calcium silicate masonry units: install in accordance with manufacturer's installation instructions including requirement to dampen units when necessary to ensure an adequate bond.
- .3 Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build singlewythe walls to actual widths of masonry units, using units of widths indicated.
- .4 Build chases and recesses to accommodate items specified in this and other Sections.
- .5 Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

- .6 Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- .7 Select and arrange units for exposed unit masonry to produce a uniform blend of colours and textures.
 - .1 Mix units from several pallets or cubes as they are placed.
- .8 Matching Existing Masonry: Match coursing, bonding, colour, and texture of existing masonry.
- .9 Comply with construction tolerances in notes to Clause 5.3 of CSA-A371 and with the following:
 - .1 For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 3 mm in 3 m, 6 mm in 6 m, or 12 mm maximum.
 - .2 For vertical alignment of exposed head joints, do not vary from plumb by more than 6 mm in 3 m, or 12 mm maximum.
 - .3 For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 3 mm in 3 m, 6 mm in 6 m, or 12 mm maximum.
 - .4 For exposed bed joints, do not vary from thickness indicated by more than plus or minus 3 mm, with a maximum thickness limited to 12 mm. Do not vary from bed-joint thickness of adjacent courses by more than 3 mm.
 - .5 For exposed head joints, do not vary from thickness indicated by more than plus or minus 3 mm. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 3 mm.
 - .6 For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1.5 mm except due to warpage of masonry units within tolerances specified for warpage of units.
 - .7 For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1.5 mm from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

- .1 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- .2 Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 100 mm horizontal face dimensions at corners or jambs.
- .3 Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 100 mm. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 100 mm horizontal face dimensions at corners or jambs.
- .4 Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- .5 Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- .6 Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- .7 Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

- .8 Fill cores in hollow concrete masonry units with grout 600 mm under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- .9 Supply and install Partition Top Anchors and lateral support and anchorage where masonry walls terminate at the underside of the structure in accordance with CSA-S304.1 spaced at 1200 mm maximum, and as indicated.
- .10 Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - .1 Install compressible filler in joint between top of partition and underside of structure above.
 - .2 At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Fire Stop Systems."

3.4 MORTAR BEDDING AND JOINTING

- .1 Lay hollow concrete masonry units as follows:
 - .1 With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - .2 With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - .3 With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - .4 With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- .2 Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- .3 Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- .4 Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

- .1 General: Supply and install masonry reinforcement in accordance with CSA-A370, CSA-A371, and CSA-S304.1 unless indicated otherwise.
- .2 Notify Owner's Representative 48 hours before concealing reinforcement and connectors with the placement of concrete, mortar, or grout.
- .3 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .4 General: Install entire length of longitudinal side rods in mortar with a minimum cover of 16 mm on exterior side of walls, 13 mm elsewhere. Lap reinforcement a minimum of 150 mm.
 - .1 Space reinforcement not more than 400 mm o.c.
 - .2 Space reinforcement not more than 200 mm o.c. in foundation walls and parapet walls.
 - .3 Provide reinforcement not more than 200 mm above and below wall openings and extending 300 mm beyond openings.
 - .1 Reinforcement above is in addition to continuous reinforcement.
- .5 Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

- .6 Provide continuity at wall intersections by using prefabricated T-shaped units.
- .7 Provide continuity at corners by using prefabricated L-shaped units.
- .8 Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- .1 General: Supply and install masonry connectors in accordance with CSA-A370, CSA-A371, CAN/CSA-A23.1, and CSA-S304.1 unless indicated otherwise.
- .2 Notify Owner's Representative 48 hours before concealing reinforcement and connectors with the placement of concrete, mortar, or grout.
- .3 Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - .1 Provide an open space not less than 13 mm in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - .2 Anchor masonry to structural members with connectors embedded in masonry joints and attached to structure.
 - .3 Space connectors as indicated, but not more than 600 mm o.c. vertically and 900 mm o.c. horizontally.

3.7 CAVITY WALL INSULATION

- .1 Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 300 mm o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - .1 Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 ANCHORING MASONRY VENEERS

- .1 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, and CSA-A371, and as indicated.
- .2 Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - .1 Fasten connector through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - .2 Embed connector sections and continuous wire in masonry joints.
 - .3 Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - .4 Space connectors as indicated, but not more than 600 mm o.c. vertically and 800 mm o.c. horizontally. Install additional anchors within 300 mm of openings and at intervals, not exceeding 200 mm, around perimeter.

3.9 CONTROL AND EXPANSION JOINTS

- .1 General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- .2 Form control joints in concrete masonry using one of the following methods:

- .1 Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - .2 Install preformed control-joint gaskets designed to fit standard sash block.
 - .3 Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - .4 Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- .3 Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section *Joint Sealants*, but not less than 10 mm.
- .1 Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- 3.10 LINTELS
- .1 Install steel lintels where indicated.
 - .2 Provide concrete or masonry lintels where shown and where openings of more than 300 mm for brick-size units and 600 mm for block-size units are shown without structural steel or other supporting lintels.
 - .3 Provide minimum bearing of 200 mm at each jamb, unless otherwise indicated.
 - .4 Reinforce masonry lintels and bond beams as indicated.
 - .5 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371, and CSA-A179.
- 3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS
- .1 General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
 - .2 Install flashing as follows, unless otherwise indicated:
 - .1 Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - .2 At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 200 mm, and 38 mm into the inner wythe.
 - .3 At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 200 mm; with upper edge tucked under building paper or building wrap, lapping at least 100 mm.
 - .4 At lintels and shelf angles, extend flashing a minimum of 150 mm into masonry at each end. At heads and sills, extend flashing 150 mm at ends and turn up not less than 50 mm to form end dams.
 - .5 Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 13 mm back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - .3 Masonry Cavity Firestop: Locate sheet metal firestop immediately underneath the Masonry Cavity Flashing. Extend sheet metal firestop 50 mm under veneer, across air space behind veneer and up face of sheathing at least 50 mm and mechanically secure to back-up at 600 mm o.c., lapping at least 100 mm.

- .4 Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - .1 Use specified weep/vent products to form weep holes.
 - .2 Space weep holes 600 mm o.c., unless otherwise indicated.
- .5 Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 *Miscellaneous Masonry Accessories* Article.
 - .1 Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 50 mm, to maintain drainage.
- .6 Install vents in head joints in exterior wythes of first course of masonry immediately below embedded flashing and as follows.
 - .1 Space vents 600 mm o.c., unless otherwise indicated.
 - .2 Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- .1 Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - .1 Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - .2 Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- .2 Supply and install masonry reinforcement in accordance with CSA-A370, CSA-A371, and CSA-S304.1 unless indicated otherwise.
 - .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
 - .2 Do not field bend reinforcement and connectors except where indicated or authorized by Owner's Representative.
 - .3 When field bending is authorized, bend without heat, applying a slow and steady pressure.
 - .4 Replace bars and connectors which develop cracks or splits.
 - .5 Insure reinforcement is not continuous across movement joints unless otherwise indicated.
- .3 Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - .1 Do grout work in accordance with CSA A179 except where specified otherwise.
 - .2 Limit height of vertical grout pours to not more than 1520 mm.
 - .3 Notify Owner's Representative 48 hours before concealing reinforcement and connectors with the placement of concrete, mortar, or grout.

3.13 FIELD QUALITY CONTROL

- .1 Inspectors: Owner may engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
- .2 Take representative samples of mortar for testing consistency of strength and colour according to CSA A179.

3.14 REPAIRING, POINTING, AND CLEANING

- .1 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
 - .2 Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
 - .3 In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
 - .4 Final Cleaning - General: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - .1 Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - .2 Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Owner's Representative's approval of sample cleaning before proceeding with cleaning of masonry.
 - .3 Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - .4 Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - .5 Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - .6 Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - .5 Final Cleaning - CSUM: Clean a 10 sq. m. area of wall designated by Owner's Representative as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:
 - .1 Protect windows, sills, doors, trim, and other work from damage.
 - .2 Remove large particles with stiff fibre brushes or wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
 - .3 Scrub with solution of 25 ml trisodium phosphate and 25 ml household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose.
 - .4 Repeat cleaning process as often as necessary to remove mortar and other stains.
 - .6 Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.
- 3.15 MASONRY WASTE DISPOSAL
- .1 Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
 - .2 Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - .1 Crush masonry waste to less than 100 mm in each dimension.
 - .2 Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
 - .3 Do not dispose of masonry waste as fill within 450 mm of finished grade.
 - .3 Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Framing with dimension lumber.
 - .2 Framing with engineered wood products.
 - .3 Rooftop equipment bases and support curbs.
 - .4 Wood blocking, cants, and nailers.
 - .5 Wood furring.
 - .6 Wood sleepers.
 - .7 Backing panels for electrical equipment.
- .2 Types of items you will not find described in this Section:
 - .1 Interior wood stairs intended to be covered with tread and riser covers, excluding landings.
 - .2 Elevated exterior decks including wood decking, stairs, guards, and support framing.
 - .3 Utility shelving.
 - .4 Heavy timber construction.
 - .5 Sheathing, including wall, floor, and roof sheathing and plywood floor underlayment.
 - .6 Building wrap.
 - .7 Shop-fabricated wood trusses.

1.3 DEFINITIONS

- .1 Exposed Framing: Framing not concealed by other construction.
- .2 Dimension Lumber: Lumber of 38 mm actual or greater but less than 114 mm actual in least dimension.
- .3 Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - .1 NLGA: National Lumber Grades Authority.

1.4 SUBMITTALS

- .1 Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- .2 Sustainability Submittal:
 - .1 Provide chain-of-custody certificates certifying that wood products comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

1.5 QUALITY ASSURANCE

- .1 Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

- .2 Forest Certification: Provide lumber obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, *FSC Principles and Criteria for Forest Stewardship*.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- .1 Lumber: Lumber: unless specified otherwise, softwood, moisture content 19% (S-dry) or less.
 - .1 In accordance with:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .2 Factory mark each piece of lumber with grade stamp of grading agency.
 - .3 For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - .4 Provide dressed lumber, S4S, unless otherwise indicated.
 - .5 Forestry Stewardship Council (FSC) certified.
- .2 Engineered Wood Products:
 - .1 Glulam in accordance with Structural Glued-Laminated Timber CAN/CSA-O122.
 - .2 Wood I-joists in accordance with Prefabricated Wood I-Joists ASTM D 5055.
 - .3 Structural Composite Lumber (SCL) in accordance with ASTM D 5456.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- .1 Preservative Treatment by Pressure Process: to CSA O80 Series 2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated with inorganic boron (SBX).
 - .1 Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - .2 For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colourants, bleed through, or otherwise adversely affect finishes.
- .2 Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- .3 Mark lumber with treatment quality mark of an inspection agency approved by the Canadian Lumber Standards Accreditation Board.
 - .1 For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- .4 Application: Treat items indicated on Drawings, and the following, unless otherwise noted.
 - .1 Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapour barriers, and waterproofing.
 - .2 Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
 - .3 Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - .4 Wood framing members that are less than 460 mm above the ground in crawlspaces or unexcavated areas.
 - .5 Wood floor plates that are installed over concrete slabs-on-grade.

- .5 Surface treat wood materials with wood preservative and not pressure treated when wood materials are in direct contact with modified bituminous roofing membranes.

2.3 DIMENSION LUMBER FRAMING

- .1 Maximum Moisture Content: 19 percent.
- .2 Non-Load-Bearing Interior Partitions: No. 2 grade and the following species:
 - .1 Spruce-pine-fir; NLGA.
- .3 Framing Other Than Non-Load-Bearing Interior Partitions: No. 2 grade and the following species:
 - .1 Spruce-pine-fir; NLGA.
- .4 Ceiling Joists (Non-Load-Bearing): Construction or No. 2 grade and the following species:
 - .1 Spruce-pine-fir; NLGA.
- .5 Joists, Rafters, and other framing not listed above: No. 1 or No. 2 grade and the following species:
 - .1 Spruce-pine-fir; NLGA.
- .6 Exposed Framing Indicated to Receive a Stained or Natural Finish: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - .1 Species and Grade: Spruce-pine-fir, No. 1 grade; NLGA.

2.4 ENGINEERED WOOD PRODUCTS

- .1 Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, to Structural Glued-Laminated Timber CAN/CSA-O122 and manufactured with an exterior-type adhesive containing no urea formaldehyde.
- .2 Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive and containing no urea formaldehyde.
- .3 Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
 - .1 Provide I-joists manufactured without urea formaldehyde.
 - .2 Structural Properties: Provide units with depths and design values not less than those indicated.
- .4 Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
 - .1 Manufacturer: Provide products by same manufacturer as I-joists.
 - .2 Material: All-veneer product glued-laminated wood or product made from any combination solid lumber, wood strands, and veneers. Provide rim boards made without urea formaldehyde.
 - .3 Thickness: 32 mm, unless otherwise noted.

2.5 MISCELLANEOUS LUMBER

- .1 General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

- .1 Blocking.
 - .2 Nailers.
 - .3 Rooftop equipment bases and support curbs.
 - .4 Cants.
 - .5 Furring.
- .2 For items of dimension lumber size, provide Standard grade lumber with 19 percent maximum moisture content and the following species:
- .1 Spruce-pine-fir; NLGA.
- .3 For exposed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
- .1 Spruce-pine-fir, No. 1 Common grade, NLGA.
- .4 For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
- .1 Spruce -pine-fir, Standard grade, NLGA.
- .5 For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- .6 For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- .7 For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- 2.6 BACKING PANELS FOR ELECTRICAL EQUIPMENT
- .1 Telephone and Electrical Equipment Backing Panels: G1S plywood to CSA O151, fire-retardant treated in other than wood structured buildings, in thickness indicated or, if not indicated, not less than 18.5 mm thickness.
- 2.7 FASTENERS
- .1 General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - .1 Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
 - .1 Do not use electro-plated galvanized fasteners.
 - .2 Nails, Brads, and Staples: CSA B111.
 - .3 Power-Driven Fasteners: NES NER-272.
 - .4 Wood Screws: ASME B18.6.1.
 - .5 Lag Bolts: ASME B18.2.3.8M.
 - .6 Bolts: Steel bolts complying with ASTM F 568M, Property Class 4.6; with ASTM A 563M hex nuts and, where indicated, flat washers.

.1 Anchor bolts: 12.5 mm diameter x 250 mm long.

.7 Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

.1 Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.8 METAL FRAMING ANCHORS

.1 Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, Z180 coating designation, unless otherwise noted.

.1 Provide anchors with Z550 coating when in contact with wood treated with preservative.

.2 Joist Hangers: U-shaped joist hangers with 50 mm long seat and 32 mm wide nailing flanges at least 85 percent of joist depth.

.1 Thickness: as required but not less than 1.3 mm.

.3 I-Joist Hangers: U-shaped joist hangers with 50 mm long seat and 32 mm wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

.1 Thickness: as required but not less than 1.3 mm.

.4 Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

.1 Thickness: as required but not less than 1.3 mm.

.5 Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 25 mm above base and with 50 mm minimum side cover, socket 1.6 mm thick, and standoff and adjustment plates 2.8 mm thick.

.6 Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

.1 Width: 32 mm.

.2 Thickness: 1.3 mm.

.3 Length: 600 mm.

.7 Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 38 mm wide by 1.3 mm thick.

2.9 MISCELLANEOUS MATERIALS

.1 Sill-Sealer Gaskets: Closed-cell neoprene foam, 6.4 mm thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

.1 Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

.2 Framing Standard: Comply with more stringent of *NBCC 2005 Part 9* and these specifications.

- .3 Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
 - .4 Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
 - .5 Do not splice structural members between supports, unless otherwise indicated.
 - .6 Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - .7 Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Use longest practical lengths.
 - .8 Comply with manufacturer's instructions for applying field treatment to cut surfaces of preservative-treated lumber.
 - .1 Use inorganic boron for items that are continuously protected from liquid water.
 - .2 Use copper naphthenate for items not continuously protected from liquid water.
 - .9 Securely attach rough carpentry work to substrate by anchoring and fastening.
 - .10 Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
 - .11 For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - .1 Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
- 3.2 ANCHOR BOLT AND SILL PLATE INSTALLATION
- .1 Construct sill plates from wood treated with preservative.
 - .2 Anchor sill plates to concrete and masonry foundation using anchor bolts embedded into foundation.
 - .1 Insure each individual sill plate segment is secured to concrete and masonry foundations with a minimum of two anchor bolts spaced not more than 1800 mm, within 300 mm of each end, and embedded into the foundation a minimum of 100 mm..
 - .2 Provide full contact between sill plate and foundation. Fill any voids between the sill plate and concrete and masonry foundations with full bed of non-shrink structural grout.
 - .3 Grind level any concrete and masonry imperfections preventing the level installation of the sill plate.
 - .3 Provide continuous sill-sealer gaskets between sill plates and concrete and masonry construction.
- 3.3 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION
- .1 Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved. Blocking for the following items includes, but is not limited to:
 - .1 Handrails.
 - .2 Grab bars.
 - .3 Cabinetry.
 - .4 Stair stringers.

- .5 Wood panelling.
- .6 M&E supports.

- .2 Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.4 WOOD FURRING INSTALLATION

- .1 Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.5 WALL AND PARTITION FRAMING INSTALLATION

- .1 General: Provide single bottom plate and double top plates using members of 38 mm actual thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction, unless otherwise indicated.
 - .1 For exterior walls, provide 38-by-140 mm actual size wood studs spaced 610 mm o.c., unless otherwise indicated.
 - .2 For interior partitions and walls, provide 38-by-89 mm actual size wood studs spaced 406 mm o.c., unless otherwise indicated.
 - .3 Provide continuous horizontal blocking at mid-height of partitions, using members of 38 mm actual thickness and of same width as wall or partitions.
- .2 Construct corners and intersections with three or more studs.
- .3 Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - .1 For non-load-bearing partitions, provide double-jamb studs and headers not less than 89 mm actual depth for openings 1200 mm and less in width, 140 mm actual depth for openings 1200 to 1800 mm in width, 184 mm actual depth for openings 1800 to 3000 mm in width, and not less than 235 mm actual depth for openings 3 to 3.6 m in width.
 - .2 For load-bearing walls, provide double-jamb studs for openings 1500 mm and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to NBCC 2005 Part 9.
- .4 Provide diagonal bracing in exterior walls, at both walls of each external corner and walls, at locations indicated, at 45-degree angle, full-story height, unless otherwise indicated. Use 19-by-89 mm actual-size boards, let-in flush with faces of studs.

3.6 FLOOR JOIST FRAMING INSTALLATION

- .1 General: Install floor joists with crown edge up and support ends of each member with not less than 38 mm of bearing on wood or metal, or 76 mm on masonry. Attach floor joists as follows:
 - .1 Where supported on wood members, by toe nailing or by using metal framing anchors.
 - .2 Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- .2 Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 1200 mm.

- .3 Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 50 mm from top or bottom.
- .4 Provide solid blocking of 38 mm actual thickness by depth of joist at ends of joists unless nailed to header or band.
- .5 Lap members framing from opposite sides of beams, girders, or partitions not less than 102 mm or securely tie opposing members together. Provide solid blocking of 38 mm actual thickness by depth of joist over supports.
- .6 Anchor members paralleling masonry with 6.4-by-32 mm metal strap anchors spaced not more than 2438 mm o.c., extending over and fastening to 3 joists. Embed anchors at least 102 mm into grouted masonry with ends bent at right angles and extending 102 mm beyond bend.
- .7 Provide solid blocking between joists under jamb studs for openings.
- .8 Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - .1 Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- .9 Provide bridging of type indicated below, at intervals of 2438 mm o.c., between joists.
 - .1 Diagonal wood bridging formed from bevel-cut, 19-by-64 mm actual- size lumber, double-crossed and nailed at both ends to joists.

3.7 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- .1 Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - .1 Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 19-by-184 mm actual- size or 38-by-89 mm actual- size stringers spaced 1200 mm o.c. crosswise over main ceiling joists.
- .2 Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - .1 At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 50 mm deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - .2 At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 50 mm deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- .3 Provide collar beams (ties) as indicated or, if not indicated, provide 19-by-140 mm actual size boards between every third pair of rafters, but not more than 1219 mm o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- .4 Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.8 PROTECTION

- .1 Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply borate treatment. Apply borate solution by spraying

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Wall sheathing: plywood, gypsum board, and board types.
 - .2 Roof sheathing: plywood and board types.
 - .3 Subflooring: plywood and board types.
 - .4 Underlayment: plywood and board types.
 - .5 Building wrap.
 - .6 Sheathing joint-and-penetration treatment.
 - .7 Flexible flashing at openings in sheathing.

- .2 Types of items you will not find described in this Section:
 - .1 Backing panels for electrical equipment.

1.3 SUBMITTALS

- .1 Product Data: For building wrap, flexible flashings, and joint-and-penetration treatment. Include manufacturer's installation instructions.
- .2 Sustainability Submittals:
 - .1 For adhesives, including printed statement of VOC content.
 - .2 For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 - .3 Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

1.4 QUALITY ASSURANCE

- .1 Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance by a testing and inspecting agency acceptable to authorities having jurisdiction.
- .2 Source Limitations: Obtain building wrap and flexible flashing material from single source.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 Provide dressed lumber, S4S, unless otherwise indicated.
- 2.2 WOOD PANEL PRODUCTS, GENERAL
 - .1 Plywood panels: to CAN/CSA-O325.0.
 - .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .4 Poplar plywood (PP): to CSA O153, standard construction.
 - .5 Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
 - .6 Factory mark panels to indicate compliance with applicable standard.
- 2.3 PRESERVATIVE-TREATED LUMBER AND PLYWOOD
 - .1 Preservative Treatment by Pressure Process: to CSA O80 Series.
 - .1 Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - .2 Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - .3 Application: Treat items specifically indicated on drawings as pressure treated and lumber and plywood in contact with masonry or concrete.
- 2.4 WALL SHEATHING
 - .1 Plywood Wall Sheathing: DFP or CSP sheathing grade or PP standard sheathing grade, T&G edge.
 - .1 Locations: Over wood framing, unless otherwise noted.
 - .2 Board Sheathing: NLGA Number 4 common grade or better, 19 mm thick.
 - .1 Location: Only where specified on drawings.
 - .3 Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - .1 Locations: Over steel stud framing and where specifically indicated on drawings.
- 2.5 ROOF SHEATHING
 - .1 Plywood Roof Sheathing: Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, T&G edge.
 - .1 Locations: Typical, unless otherwise indicated.
 - .2 Board Sheathing: NLGA Number 3 common grade or better, 19 mm thick.
 - .1 Location: Only where specified on drawings.

2.6 SUBFLOORING AND UNDERLAYMENT

- .1 Plywood Subflooring: Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, T&G edge.
 - .1 Locations: Typical, unless otherwise indicated.
- .2 Board Sub-Floor: NLGA Number 3 common grade or better, 19 mm thick.
 - .1 Location: Only where specified on drawings.
- .3 Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 6.4 mm over smooth subfloors and not less than 9.5 mm over board or uneven subfloors.
- .4 Plywood Underlayment: Plywood, DFP or CSP grade, or PP grade, square edge.
 - .1 Locations: Typical, unless otherwise indicated.
- .5 Board Underlayment: NLGA Number 2 grade or better, 19 mm thick.
 - .1 Location: When specified on drawings.

2.7 FASTENERS

- .1 General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - .1 For roof and wall sheathing and wood treated with preservative, provide fasteners with hot-dip zinc coating complying with A CAN/CSA-G164 or Type 304 stainless steel.
- .2 Nails, Brads, and Staples: to CSA B111.
- .3 Power-Driven Fasteners: NES NER-272.
- .4 Wood Screws: ASME B18.6.1.
- .5 Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - .1 For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- .6 Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - .1 For steel framing from 0.84 to 2.84 mm thick, attach sheathing to comply with ASTM C 954.

2.8 WEATHER-RESISTANT SHEATHING PAPER

- .1 Building Wrap: spunbonded olefin type to CAN/CGSB-51.32.
 - .1 Air leakage rate at 75 Pa air pressure not greater than 0.02 L/s/m².
 - .2 Water vapour transmission of greater than 1100 Ng/Pa.s.m².
 - .3 Water penetration resistance of 200 cm minimum in accordance with AATCC-127.
 - .4 Allowable UV Exposure Time: Not less than three months.
- .2 Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- .1 Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fibre sheathing tape and for covering exposed fasteners.
- .2 Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fibre tape, minimum 50 mm wide, 390 by 390 or 390 by 780 threads/m , of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

2.10 MISCELLANEOUS MATERIALS

- .1 Adhesives for Field Gluing Panels to Framing: Formulation complying with CGSB-71.26, cartridge-loaded, that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - .1 Use adhesives that have a VOC content of 70g/L or less.
- .2 Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.6 mm.
- .3 Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- .4 Floor Underlayment Paper: purpose made heavy-weight underlayment flooring paper made from 100% recycled paper products.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- .1 Comply with requirements of NBC 1995 Part 9 supplemented by following paragraphs.
- .2 Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- .3 Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- .4 Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- .5 Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- .6 Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- .7 Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

- .8 Install underlayment floor paper over top of subfloor when either or both the subfloor and the underlayment consist of board lumber.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- .1 Fastening Methods: Fasten panels as indicated below:
 - .1 Subflooring:
 - .1 Glue and nail to wood framing.
 - .2 Screw to cold-formed metal framing.
 - .3 Space panels 3 mm apart at edges and ends.
 - .4 Install board type sub-flooring at 45 degrees to floor framing.
 - .2 Wall and Roof Sheathing:
 - .1 Nail to wood framing.
 - .2 Screw to cold-formed metal framing.
 - .3 Space panels 3 mm apart at edges and ends.
 - .3 Underlayment:
 - .1 Nail to subflooring.
 - .2 Space panels 0.8 mm apart at edges and ends.
 - .3 Install board-type underlayment perpendicular to the subfloor.
 - .4 Fill and sand edge joints of underlayment receiving resilient flooring right before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

- .1 Comply with GA-253 and with manufacturer's written instructions.
 - .1 Fasten gypsum sheathing to wood framing with screws.
 - .2 Fasten gypsum sheathing to cold-formed metal framing with screws.
 - .3 Install boards with a 9.5-mm gap where non-load-bearing construction abuts structural elements.
 - .4 Install boards with a 6.4-mm gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- .2 Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- .3 Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
 - .1 Space fasteners approximately 200 mm o.c. and set back a minimum of 9.5 mm from edges and ends of boards.
 - .2 For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- .4 Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - .1 Space fasteners approximately 200 mm o.c. and set back a minimum of 9.5 mm from edges and ends of boards.
 - .2 For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.4 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- .1 General: Cover sheathing with weather-resistant sheathing paper as follows:

- .1 Cut back barrier 13 mm on each side of the break in supporting members at expansion- or control-joint locations.
 - .2 Apply barrier to cover vertical flashing with a minimum 100 mm overlap, unless otherwise indicated.
- .2 Building Wrap: Comply with manufacturer's written instructions.
- .1 Seal seams, edges, fasteners, and penetrations with tape.
 - .2 Extend into jambs of openings and seal corners with tape.
- 3.5 SHEATHING JOINT-AND-PENETRATION TREATMENT
- .1 Seal gypsum board sheathing joints according to sheathing manufacturer's written instructions, except when adhered membrane is scheduled for application directly over top of panel.
 - .1 Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after towelling. Seal other penetrations and openings.
- 3.6 FLEXIBLE FLASHING INSTALLATION
- .1 Apply flexible flashing at all framed openings and where indicated to comply with manufacturers written instructions.
 - .1 Prime substrates as recommended by flashing manufacturer.
 - .2 Lap seams and junctures with other materials at least 100 mm, except that at flashing flanges of other construction, laps need not exceed flange width.
 - .3 Lap flashing over weather-resistant building paper at bottom and sides of openings.
 - .4 Lap weather-resistant building paper over flashing at heads of openings.
 - .5 After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:

- .1 Casework as follows:
 - .1 Wood cabinets.
 - .2 Plastic-laminate cabinets.
 - .3 Thermoset decorative panel (mcp) cabinets
- .2 Countertops as follows:
 - .1 Plastic-laminate countertops.
 - .2 Solid-surfacing-material countertops.
 - .3 Galvanized steel countertops.
 - .4 Linoleum countertops.
- .3 Swing gates incorporated into millwork.
- .4 Shop finishing of interior woodwork.

- .2 Types of items you will not find described in this Section:

- .1 Countertops as follows:
 - .1 Wood countertops.
 - .2 Stainless steel countertops.
 - .3 Epoxy countertops.
 - .4 Laminated-plastic laboratory tops.
 - .5 Stone countertops.
- .2 Casework as follows:
 - .1 Residential type kitchen and bathroom vanity cabinets.
 - .2 Metal casework.
 - .3 Laboratory-type casework.
- .3 Wood panelling as follows:
 - .1 Flush wood panelling and wainscoting.
 - .2 Pre-manufactured / proprietary wood panelling system.
 - .3 Board paneling.
 - .4 Plastic-laminate-clad flush paneling.
 - .5 Stile and rail wood paneling.
- .4 Other items as follows:
 - .1 Clothes closet shelving and closet rods.
 - .2 Interior standing and running trim.
 - .3 Interior frames and jambs.
 - .4 Interior ornamental work.
 - .5 Stairwork and rails.
 - .6 Wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.3 DEFINITIONS

- .1 Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
 - .2 Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 1200 mm above floor, and visible surfaces in open cabinets or behind glass doors.
 - .1 Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets are defined as *concealed*.
 - .3 Semi-exposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cabinets 1980 mm or more above floor are defined as *semi-exposed*.
 - .4 Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.
- 1.4 SUBMITTALS
- .1 Product Data
 - .1 For each type of product indicated.
 - .2 Shop Drawings
 - .1 Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - .1 Show details full size.
 - .2 Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - .3 Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
 - .3 Samples for Verification
 - .1 Lumber with or for transparent finish, not less than 125 mm wide by 600 mm long, for each species and cut, finished on 1 side and 1 edge.
 - .2 Veneer-faced panel products with or for transparent finish, 200 by 250 mm, for each species and cut. Include at least one face-veneer seam and finish as specified.
 - .3 Lumber and panel products with shop-applied opaque finish, 300 sq. cm for lumber and 200 by 250 mm for panels, for each finish system and colour, with 1/2 of exposed surface finished.
 - .4 Plastic laminates, 200 by 250 mm, for each type, colour, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
 - .5 Thermoset decorative-panels, 200 by 250 mm, for each type, colour, pattern, and surface finish, with edge banding on 1 edge.
 - .6 Solid-surfacing materials, 150 mm square.
 - .7 Linoleum sheet flooring materials, 150 mm square.
 - .8 Galvanized steel sheet materials, 150 mm square
 - .9 Corner pieces as follows:
 - .1 Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 450 mm high by 450 mm wide by 150 mm deep.
 - .2 Miter joints for standing trim.
 - .10 Exposed cabinet hardware and accessories, one unit for each type and finish.
 - .4 Sustainability Submittals
 - .1 Product Data for installation adhesives, including printed statement of VOC content.

- .2 Product Data
 - .1 For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
 - .2 For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.
- .3 Product Data for products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
 - .1 Include statement indicating costs for each product having recycled content.
- .4 Certificates
 - .1 Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
- 1.5 QUALITY ASSURANCE
 - .1 Fabricator Qualifications
 - .1 Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - .2 Installer Qualifications
 - .1 Fabricator of products.
 - .3 Quality Standard
 - .1 Unless otherwise indicated, comply with AWMAC's *Architectural Woodwork Quality Standards* for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - .4 Forest Certification
 - .1 Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, *FSC Principles and Criteria for Forest Stewardship*.
 - .5 Mock-ups
 - .1 Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .2 Reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - .6 Preinstallation Conference
 - .1 Conduct conference at Project site to comply with requirements in Division 01 Section *Project Management and Coordination*.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - .1 Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in *Project Conditions* Article.
- 1.7 PROJECT CONDITIONS
 - .1 Environmental Limitations

.1 Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

.2 Field Measurements

.1 Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

.3 Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

.1 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General

.1 Provide materials that comply with requirements of AWMAC's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

.2 Lumber for Exposed and Semi-Exposed-to-View Locations

.1 Forestry Stewardship Council (FSC) certified.

.2 Wood Species for Transparent Finish:

.1 Refer to drawings.

.2 If wood species is not indicated on drawings, then provide maple.

.3 Wood Species for Opaque Finish:

.1 Refer to drawings.

.2 If wood species is not indicated on drawings, then provide any closed-grain hardwood.

.3 Lumber for Concealed Locations

.1 Forest Stewardship Council (FSC) certified.

.2 Softwood lumber: to CAN/CSA-O141.

.1 Wood species: Pine.

.3 Hardwood lumber: to National Hardwood Lumber Association (NHLA)

.4 Medium-Density Fiberboard

.1 To ANSI A208.2, Grade MD.

.2 Made with binder containing no urea formaldehyde.

.3 Provide products made from not less than 80% recycled wood fibre.

.5 Particleboard

.1 ANSI A208.1, Grade M-2-Exterior Glue.

- .2 Made with binder containing no urea formaldehyde.
- .3 Provide products made from not less than 80% recycled wood fibre.

- .6 Hardboard
 - .1 To CAN/CGSB-11.3.
 - .2 Made with binder containing no urea formaldehyde.
 - .3 Forestry Stewardship Council (FSC) certified.

- .7 Veneer-Faced Panel Products (Hardwood Plywood)
 - .1 To HPVA HP-1.
 - .2 Made with adhesive containing no urea formaldehyde.
 - .3 Forestry Stewardship Council (FSC) certified.
 - .4 Items exposed-to-view and scheduled for a transparent finish
 - .1 Grade
 - .1 Grade A or better veneer, unless otherwise noted.
 - .2 Cut & Matching: Any one of the following
 - .1 Plain sliced, book match.
 - .2 Rotary cut, whole piece face.
 - .3 Or approved alternate.
 - .5 Items semi-exposed-to-view and scheduled for a transparent finish
 - .1 Grade: Grade B or better veneer for, unless otherwise noted.

- .8 Baltic Plywood
 - .1 Birch or other closed grain hardwood veneer.
 - .1 Baltic/Russian/Finland Hardwood Plywood consisting of multiple thin, solid veneer layers.
 - .2 Europly as marketed by Columbia Forest Products;
 - .3 Or approved alternate.

- .9 Softwood Plywood
 - .1 Canadian softwood plywood (CSP) to CSA O151, standard construction or better.
 - .2 Made with adhesive containing no urea formaldehyde.
 - .3 Forestry Stewardship Council (FSC) certified.

- .10 Thermoset Decorative Panels
 - .1 Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - .2 Colours, Patterns, and Finish
 - .1 Refer to drawings.
 - .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full line of standard colours, patterns, and finishes.
 - .3 Provide 2-4 mm thick PVC edge banding on components with exposed or semi exposed edges.
 - .1 Colour
 - .1 Refer to drawings.
 - .2 If not indicated on drawings, then provide colour to match thermoset decorative panel.

- .11 High-Pressure Decorative Laminate
 - .1 NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - .2 Colours, Patterns, and Finish
 - .1 Refer to drawings.
 - .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full line of standard colours, patterns, and finishes.

- .12 Solid-Surfacing Material
 - .1 Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - .2 Type
 - .1 Standard type, unless Special Purpose type is indicated.
 - .3 Colours and Patterns
 - .1 Refer to drawings.
 - .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full line of standard colours and patterns.

- .13 Sheet Metal
 - .1 Commercial grade steel to ASTM A924-97 (M-97), galvanized to ASTM A 653/A 653M, Z275 coating designation.
 - .2 Thickness: 1.3 mm (18 gauge nominal).

- .14 Linoleum Sheet Flooring
 - .1 Refer to drawings.
 - .2 If not described on drawings, then provide manufacturer's standard linoleum sheet flooring, colour selected by Owner's Representative from manufacturer's full line of standard colours.
 - .3 Adhesive: Manufacturer's standard.
 - .4 Welding Rods: manufacturer's standard, colour to match flooring.

- .15 Float Glass for Cabinet Doors
 - .1 To CAN/CGSB-12.3, clear, transparent, not less than 4.0 mm thick.

- .16 Safety Glass, when specifically noted
 - .1 To CAN/CGSB 12.1-M90, clear, transparent, not less than 4.0 mm thick. Provide one of the following, unless otherwise noted.
 - .1 Laminated glass.
 - .2 Tempered glass.

- 2.2 CABINET HARDWARE AND ACCESSORIES
 - .1 General
 - .1 Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section *Door Hardware*.

 - .2 Drawer and Door Handles
 - .1 Refer to drawings.
 - .2 If handles are not described on drawings provide
 - .1 Richelieu 3487181, 14 mm round x 261 mm long stainless steel pull
 - .2 Or equivalent.

 - .3 Frameless Concealed Hinges (European Type)
 - .1 To BHMA A156.9, B01602, 135 degrees of opening, self-closing.

 - .4 Adjustable Shelf Standards and Supports
 - .1 To BHMA A156.9, B04071; with shelf rests, B04081.

 - .5 Shelf Rests
 - .1 To BHMA A156.9, B04013; metal.

- .6 Closet Rods and Flanges
 - .1 Clothes Rods of 33diameter chrome-plated steel tubes.
 - .2 Rod Flanges of chrome-plated steel or stainless steel.

- .7 Drawer Slides
 - .1 To BHMA A156.9, B05091.
 - .2 For cabinets used as part of a domestic kitchen cabinet arrangement or kitchenette arrangement in staff rooms, lunch rooms, board rooms, and other similar locations:
 - .1 Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted and extending under bottom edge of drawer; partial-extension type; epoxy-coated steel with polymer rollers.
 - .2 Trash Bin Slides: Grade 1HD-200; for trash bins not more than 500 mm high and 400 mm wide.
 - .3 For all other millwork: side mounted; full-extension type; zinc-plated steel ball-bearing slides
 - .1 Box Drawer Slides: Grade 1; for drawers not more than (150 mm) high and (600 mm) wide.
 - .2 File Drawer Slides: Grade 1HD-100; for drawers more than 150 mm high or 600 mm wide.
 - .3 Pencil Drawer Slides: Grade 1; for drawers not more than 75 mm high and 600 mm wide.
 - .4 Keyboard Slides: Grade 1; for computer keyboard shelves.
 - .5 Trash Bin Slides: Grade 1HD-200; for trash bins not more than 500 mm high and 400 mm wide.
 - .6 All Other Drawers: Grade 1HD-100.

- .8 Swing Gate Hardware
 - .1 Single Direction Swing Hinges
 - .1 Toilet partition hardware - surface hinge in stainless, Richelieu #71130-170/71230-170; or equivalent.
 - .2 Latch
 - .1 Reversible secret latch, Richelieu 600100; or equivalent.

- .9 Locks
 - .1 For Door: BHMA A156.11, E07121.
 - .2 For Drawer: BHMA A156.11, E07041.
 - .3 Master key all locks located in each millwork item (i.e. reception desk, bar, kitchenette, etc.)
 - .4 Provide 2 keys per lock.

- .10 Grommets for Cable Passage through Countertops
 - .1 51mm OD, black, moulded-plastic grommets and matching plastic caps with slot for wire passage.

- .11 Cutlery Tray
 - .1 Moulded polystyrene cutlery tray, custom cut to fit drawer size.

- .12 Hardware Finishes
 - .1 Exposed Hardware
 - .1 Refer to drawings.
 - .2 If finish is not indicated on drawings, then provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - .1 Satin Stainless Steel: BHMA 630.
 - .2 Concealed Hardware
 - .1 Provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

- .13 Door and Drawer Bumpers
 - .1 Plastic, polyurethane, neoprene or similar bumper, c/w tack or similar, but not of the self-adhesive type.

2.3 MISCELLANEOUS MATERIALS

- .1 Furring, Blocking, Shims, and Hanging Strips
 - .1 Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- .2 Anchors
 - .1 Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- .3 Adhesives, General
 - .1 Do not use adhesives that contain urea formaldehyde.
 - .2 VOC Limits for Installation Adhesives and Glues
 - .1 Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - .1 Wood Glues: 30 g/L.
 - .2 Contact Adhesive: 250 g/L.

2.4 FABRICATION, GENERAL

- .1 AWMAC Interior Woodwork Grade
 - .1 Refer to drawings.
 - .2 If grade is not indicated on drawings, then provide AWMAC Custom grade interior woodwork.
- .2 Wood Moisture Content
 - .1 Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- .3 Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - .1 Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 19 mm Thick or Less: 1.5 mm.
 - .2 Edges of Rails and Similar Members More Than 19 mm Thick: 3 mm.
 - .3 Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1.5 mm.
- .4 Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - .1 Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- .5 Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - .1 Seal edges of openings in countertops with a coat of varnish.
- .6 Edge Banding
 - .1 Refer to drawings for type of edge banding on exposed and semi-exposed edges of composite wood panel products.
 - .1 Where drawings do not indicate edge banding, provide:
 - .1 Provide 2-3 mm PVC edge banding on MCP panels and panels with plastic laminate finish.

- .2 Provide solid wood edging on wood-veneered panels.
 - .7 Install glass to comply with applicable requirements in Division 08 Section *Glazing* and in GANA's "*Glazing Manual*." For glass in wood frames, secure glass with removable stops.
 - .8 Provide all hardware shown and all hardware required for complete and functional assembly.
- 2.5 CABINETS – IN GENERAL
- .1 Type of Cabinet Construction
 - .1 Refer to drawings.
 - .2 If cabinet construction is not indicated on drawings, then provide flush overlay.
 - .2 Drawer Construction
 - .1 Refer to drawings.
 - .2 If drawings do not describe drawer construction, provide drawers constructed to one of the following requirements:
 - .1 Wood Drawer Bodies
 - .1 Drawer Sides and Backs: 15.5 mm Baltic plywood or 12.5 mm hardwood; with glued dovetail joints.
 - .2 Drawer Bottoms: 6.4 mm hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 12.7 mm material for drawers more than 600 mm wide.
 - .3 Complete with clear transparent finish throughout, unless otherwise noted.
 - .2 Steel Drawer Bodies
 - .1 Steel drawer pans formed from 0.9 mm thick metal, metallic phosphate treated, and finished with manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 0.025 mm for topcoat and 0.05 mm for system.
 - .3 Provide dust panels of 6.4 mm plywood above compartments and drawers, unless located directly under tops.
 - .4 Provide drawer and door bumpers on all drawer and cabinet doors.
- 2.6 WOOD CABINETS FOR TRANSPARENT FINISH
- .1 Wood Species Exposed Surfaces: Refer to drawings.
 - .1 If wood species is not indicated on drawings, then provide maple.
 - .2 Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
- 2.7 WOOD CABINETS FOR OPAQUE FINISH
- .1 Wood Species
 - .1 Refer to drawings.
 - .2 If wood species is not indicated on drawings, then provide any closed-grain hardwood.
 - .2 Species for Exposed Lumber Surfaces
 - .1 Refer to drawings.
 - .2 If wood species is not indicated on drawings then provide any closed-grain hardwood.
 - .3 Panel Product for Exposed Surfaces
 - .1 Refer to drawings.

- .2 If panel product is not indicated on drawings then provide medium-density fiberboard.

2.8 PLASTIC-LAMINATE CABINETS

.1 Laminate Cladding for Exposed Surfaces

- .1 High-pressure decorative laminate complying with the following requirements:
 - .1 Horizontal Surfaces Other Than Tops: Grade HGS.
 - .2 Postformed Surfaces: Grade HGP.
 - .3 Vertical Surfaces: Grade VGS.

.2 Concealed Backs of Panels with Exposed Plastic Laminate Surfaces

- .1 High-pressure decorative laminate, Grade BKL.

.3 Colours, Patterns, and Finishes

- .1 Refer to drawings.
- .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full range.

2.9 THERMOSET DECORATIVE PANEL (MCP) CABINETS

.1 Colours, Patterns, and Finishes

- .1 Refer to drawings.
- .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full range.

2.10 PLASTIC-LAMINATE COUNTERTOPS

.1 High-Pressure Decorative Laminate Grade

- .1 HGS for flat countertops and HGP for Postformed countertops.

.2 Colours, Patterns, and Finishes

- .1 Refer to drawings.
- .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full range.

.3 Grain Direction, if applicable

- .1 Parallel to cabinet fronts.

.4 Edge Treatment

- .1 Refer to drawings.

.5 Core Material

- .1 Particleboard or plywood.

.6 Core Material at Sinks

- .1 Particleboard made with exterior glue or exterior-grade plywood.

.7 Paper Backing

- .1 Provide paper backing on underside of countertop substrate.

2.11 SOLID-SURFACING-MATERIAL COUNTERTOPS

.1 Solid-Surfacing-Material Thickness

- .1 13 mm, unless otherwise noted.

- .2 Colours, Patterns, and Finishes
 - .1 Refer to drawings.
 - .2 If not indicated on drawings, then selected by Owner's Representative from manufacturer's full range.
- .3 Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - .1 Fabricate tops with shop-applied edges of materials and configuration indicated.
 - .2 Fabricate tops with loose back-splashes and end-splashes for field application.
- .4 Install integral sink bowls in countertops in shop.
- .5 Drill holes in countertops for plumbing fittings and soap dispensers in shop.
- 2.12 GALVANIZED STEEL COUNTERTOPS
 - .1 Material
 - .1 Galvanized sheet metal. Use largest practical sheet sizes. Layout sheets so seems are located symmetrically about the entire countertop. Butt seems tight together. Protect surface from construction damage.
 - .2 Core Material
 - .1 Plywood.
 - .3 Edge Treatment
 - .1 Fold top down to form boxed edge, with hemmed edges. File all edges smooth and free of burrs.
- 2.13 LINOLEUM COUNTERTOPS
 - .1 Material
 - .1 Linoleum sheet flooring, adhered to core material, with heat welded seams, as per manufacturer's installation instructions. Layout material so seems are located symmetrically about the entire countertop. Protect surface from construction damage.
 - .2 Core Material
 - .1 Plywood.
 - .3 Edge Treatment
 - .1 Refer to drawings.
 - .2 If not indicated on drawings then provide maple edge, profiled.
- 2.14 SHOP FINISHING
 - .1 Grade
 - .1 Provide finishes of same grades as items to be finished.
 - .2 General
 - .1 Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touch-up, cleaning, and polishing until after installation.
 - .3 Preparation for Finishing

- .1 Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
- .2 Backpriming
 - .1 Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- .4 Transparent Finish
 - .1 Provide anyone of the following finishes for woodwork intended for a transparent finish.
 - .1 AWMAC Finish System: Synthetic penetrating oil.
 - .2 AWMAC Finish System: Nitrocellulose lacquer.
 - .3 AWMAC Finish System: Catalyzed lacquer.
 - .4 AWMAC Finish System: Acrylic lacquer.
 - .5 AWMAC Finish System: Conversion varnish.
 - .6 AWMAC Finish System: Catalyzed vinyl.
 - .2 Staining
 - .1 Refer to drawings to determine if staining is required, and if so, colours required.
 - .2 If staining is not referred to in drawings, no staining is required.
 - .3 Wash Coat for Stained Finish
 - .1 Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - .4 Filled Finish for Open-Grain Woods
 - .1 After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - .2 Apply wash-coat sealer after staining and before filling.
 - .1 Sheen
 - .1 Refer to drawings.
 - .2 If sheen is not indicated on drawings then provide satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.
- .5 Opaque Finish
 - .1 Provide anyone of the following finishes for woodwork intended for an opaque finish.
 - .1 AWMAC Finish System: Nitrocellulose lacquer.
 - .2 AWMAC Finish System: Catalyzed lacquer.
 - .3 AWMAC Finish System: Acrylic lacquer.
 - .4 AWMAC Finish System: Conversion varnish.
 - .5 AWMAC Finish System: Catalyzed vinyl.
 - .2 Colour
 - .1 Refer to drawings.
 - .2 If colours are not indicated on drawings then selected by Owner's Representative from manufacturer's full range.
 - .3 Sheen
 - .1 Refer to drawings.
 - .2 If sheen is not indicated on drawings then provide satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

- .2 Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- .1 Grade
 - .1 Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
 - .2 Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
 - .3 Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 3 mm in 2400 mm.
 - .4 Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - .5 Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- .6 Cabinets
 - .1 Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - .2 Install cabinets with no more than 3 mm in 2400mm sag, bow, or other variation from a straight line.
 - .3 Maintain veneer sequence matching of cabinets with transparent finish.
 - .4 Fasten wall cabinets through back, near top and bottom, at ends and not more than 400 mm o.c. with No. 10 wafer-head screws sized for 25mm penetration into wood framing, blocking, or hanging strips.
 - .5 For cabinets used as part of a domestic kitchen cabinet arrangement or kitchenette arrangement in staff rooms, lunch rooms, board rooms, and other similar locations, provide one cutlery tray in the drawer closets to the sink.
- .7 Countertops
 - .1 Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - .2 Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in colour to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - .3 Install countertops with no more than 3 mm in 2400mm sag, bow, or other variation from a straight line.
 - .4 Secure backsplashes and to walls with adhesive.
 - .5 Calk space between backsplash and wall with sealant specified in Division 07 Section *Joint Sealants*.
- .8 Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- .1 Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- .2 Clean, lubricate, and adjust hardware.
- .3 Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
 - .2 Fire-resistive joint systems for the following:
 - .1 Floor-to-floor joints.
 - .2 Floor-to-wall joints.
 - .3 Head-of-wall joints.
 - .4 Wall-to-wall joints.
 - .5 Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.
 - .3 Identification of vertical fire separations.
- .2 Types of items not described in this Section:
 - .1 Expansion control for fire-resistive architectural joint systems.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- .1 General: For through-penetration through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- .2 General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- .3 Regulatory Requirements: Provide firestop systems that meet requirements of:
 - .1 ULC S-115-M.
 - .2 Governing codes having local jurisdiction.
- .4 Required Ratings: Provide firestop systems with the following ratings determined per *Regulatory Requirements*:
 - .1 For penetrations through a fire separation or a membrane forming part of an assembly required to have a fire resistance rating provide a firestop system with a *F* Rating, as determined by ULC-S115-M that is equal to the fire resistance rating of the construction being penetrated.

- .2 For penetrations through a Fire Wall or horizontal fire separation provide a firestop system with a *FT* Rating, as determined by ULC-S115-M, that is equal to the fire resistance rating of the construction being penetrated.
- .3 For joints provide a firestop system with an Assembly Rating as determined by ULC-S115-M which is equal to the fire resistance rating of the construction being penetrated.
- .5 Exposure: For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - .1 For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
 - .2 For floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - .3 For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
- .6 Flame Spread and Smoke Classifications: For firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per CAN/ULC-S102.
- .7 Movement: Provide firestop system capable of 50% movement for locations specifically indicated, and 25% movement for all other locations.
- .8 Re-Entry: Provide firestop system capable of enduring periodic re-entry to add or remove penetrating items.
 - .1 For the purposes of this project, cast-in-place materials such as mortars are not considered capable of allowing periodic re-entry. Further, and as an example, removable bricks and pillows would be considered as a firestop material intended to allow re-entry at cable tray penetrations, provided they are in compliance with all other aspects of this specification. Re-entry locations would include but not be limited to those penetrations and sleeves containing or intended to contain wires, conduits, pipes, and cable trays. Locations not intended for re-entry would include cracks, seams, and joints, and seams between wall/floor construction and pipe sleeves or ductwork.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: A firm experienced in installing firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- .2 Installation Responsibility: Assign installation of firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- .3 Source Limitations: Obtain firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- .4 Fire-Test-Response Characteristics: Provide firestop systems that comply with one of the following requirements and those specified in Part 1 *Performance Requirements* Article:
 - .1 Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is cJL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - .2 Firestop systems are identical to those tested per testing standard referenced in *Part 1 Performance Requirements* Article. Provide rated systems complying with the following requirements:
 - .1 Firestop system products bear classification marking of qualified testing and inspecting agency.

- .2 Firestop systems correspond to those indicated by reference to firestop system designations listed by the following:
 - .1 U.L.C Fire Resistance Directory.
- .3 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).

1.6 SUBMITTALS

- .1 Product Data: For each type of product indicated, including manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC firestop systems to be used and manufacturer's installation instructions.
- .2 Shop Drawings: For each firestop system, show each type of construction condition penetrated, relationships to adjoining construction and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - .1 Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestop system configuration for construction and penetrating items.
 - .2 Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular firestop condition, submit illustration, with modifications marked, approved by firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- .3 Firestop System Schedule: Indicate locations of each firestop system, along with the following information:
 - .1 Types of penetrating items.
 - .2 Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - .3 firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- .4 Manufacturer's engineering judgment identification number and drawing details when no ULC system is available for an application. Engineered judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- .5 Sustainability Submittals
 - .1 For penetration firestopping, including printed statement of VOC content and chemical components.
 - .2 For fire-resistive joint systems, including printed statement of VOC content.
- .6 Material Safety Data Sheets for each product delivered to job-site.
- .7 Field quality-control test reports.

1.7 INSTALLER QUALIFICATIONS

- .1 Installer Qualifications: A firm with one of its primary services offered being firestopping, who is experienced in installing firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- .2 Installation Responsibility: Assign installation of firestop systems and fire-resistive joint systems in Project to a single qualified installer.
 - .3 Source Limitations: Obtain firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
 - .4 Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section *Project Management and Coordination*.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- .1 Deliver firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
 - .2 Store and handle materials for firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- 1.9 PROJECT CONDITIONS
- .1 Existing Conditions: Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
 - .2 Environmental Limitations: Do not install firestop systems when ambient or substrate temperatures are outside limits permitted by firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
 - .3 Protection: During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.
 - .4 Ventilation: Ventilate firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
 - .5 Flammability: Do not use materials that contain flammable solvents.
 - .6 Scheduling:
 - .1 Schedule installation of cast-in-place firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
 - .2 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- 1.10 COORDINATION
- .1 Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.
 - .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestop systems.
 - .3 Notify Owner's inspecting agency at least seven days in advance of firestop system installations; confirm dates and times on days preceding each series of installations.

- .4 Do not cover up firestop system installations that will become concealed behind other construction until time as been given to the Owner for the opportunity to review each installation, and has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- .1 Products: Subject to compliance with requirements, provide one of the firestop systems indicated for each application that are produced by one of the following manufacturers:
 - .1 Hilti.
 - .2 3M.
 - .3 Tremco.

2.2 FIRE STOP SYSTEMS, GENERAL

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.
 - .2 VOC Content: Provide firestopping that complies with the following limits for VOC content:
 - .1 Architectural Sealants: 250 g/L.
 - .2 Sealant Primers for Nonporous Substrates: 250 g/L.
 - .3 Sealant Primers for Porous Substrates: 775 g/L.
 - .3 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
 - .4 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
 - .5 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
 - .6 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
 - .7 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
 - .8 Sealants for vertical joints: non-sagging.

2.3 THROUGH-PENETRATION FIRESTOP SYSTEMS

- .1 Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- .2 Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 *Performance Requirements* Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

- .1 Permanent forming/damming/backing materials, including the following:
 - .1 Slag-/rock-wool-fiber insulation.
 - .2 Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - .3 Fire-rated form board.
 - .4 Fillers for sealants.
- .2 Temporary forming materials.
- .3 Substrate primers.
- .4 Collars.
- .5 Steel sleeves.

2.4 FIRE-RESISTIVE JOINT SYSTEMS

- .1 Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- .2 Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 *Performance Requirements* Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.5 MIXING

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

2.6 IDENTIFICATION

- .1 Fire Stop Labels: metal or plastic, no bigger than 40 x 75 mm in size.
 - .1 Include the following information on labels:
 - .1 The words *Warning - Firestop System - Do Not Disturb. Notify Building Management of Any Damage.*
 - .2 Firestop system designation of applicable testing and inspecting agency.
 - .3 Date of installation.
 - .4 Through-penetration firestop system manufacturer's name.
 - .2 Vertical fire separations: conventional latex spray paint, bright red colour.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
 - .1 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Surface Cleaning: Clean out openings immediately before installing firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - .1 Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestop systems.
 - .2 Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.
 - .3 Remove laitance and form-release agents from concrete.
 - .2 Priming: Prime substrates where recommended in writing by firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
 - .3 Masking Tape: Use masking tape to prevent firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.
- 3.3 COORDINATION
- .1 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
 - .2 Responsible trade is to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.
- 3.4 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION
- General: Install through-penetration firestop systems to comply with Part 1 *Performance Requirements* Article, Part 1 *Quality Assurance* Article, and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- .1 Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - .1 After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
 - .2 Install fill materials for firestop systems by proven techniques to produce the following results:
 - .1 Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - .2 Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - .3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- 3.5 FIRE-RESISTIVE JOINT SYSTEM INSTALLATION
- .1 General: Install fire-resistive joint systems to comply with Part 1 *Performance Requirements* Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

- .2 Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- .3 Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - .1 Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - .2 Apply fill materials so they contact and adhere to substrates formed by joints.
 - .3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.6 FIELD QUALITY CONTROL

- .1 Inspection and Certification by Manufacturer's Representative:
 - .1 Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until Manufacturer's representative determines completed work shows compliance with requirements.
 - .2 Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- .2 Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- .3 Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- .4 Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.
 - .1 Have the manufacture's representative Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
 - .2 Have manufacturer's representative undertake destructive testing on a minimum of 10 suspect fire stop installations or 3 percent of the total number of installations, whichever is greater; or where there are insufficient suspect installations then, randomly selected installations. If more than 25% of the tests are below contract requirements, undertake destructive testing on an additional 3% of the installations. If then more than 12.5% of the total number of tests is below contract requirements, remove all firestopping installations throughout the project and reinstall new throughout, at no additional cost to the Owner, and repeat destructive testing procedures all over again.
 - .3 Reinstate those areas that have undergone destructive testing.
 - .4 Based on results of destructive testing, undertake any remedial action to other fire stop installations that are recommended by the manufacturer's representative to insure compliance with the Contract requirements.
 - .5 Reinspect reinstated work and remedial work.
 - .6 When all reinstated and remedial work is completed and reinspected, have manufacturer's representative provide the following signed certification:
 - .1 *This is to certify that I have reviewed the Contract Documents and have reviewed each and every individual firestop installation installed under this Contract, and I am of the opinion that for each installation it is of the appropriate type and it has been installed in accordance with the manufacturer's installation instructions.*
- .5 Inspections by Authorities Having Jurisdiction:
 - .1 Keep areas of work accessible until inspection by applicable code authorities.

- .6 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- 3.7 ADJUSTING AND CLEANING
 - .1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.
 - .2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.
- 3.8 IDENTIFICATION
 - .1 Identify firestop systems with preprinted metal or plastic labels, 40 x 65 mm. Attach labels permanently to surfaces adjacent to and within 150 mm of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
 - .1 The words *Warning - Firestop System - Do Not Disturb. Notify Building Management of Any Damage.*
 - .2 Contractor's name, address, and phone number.
 - .3 Firestop system designation of applicable testing and inspecting agency.
 - .4 Date of installation.
 - .5 Through-penetration firestop system manufacturer's name.
 - .6 Installer's name.
- 3.9 IDENTIFICATION OF VERTICAL FIRE SEPARATIONS
 - .1 Identify all vertical fire separations using spray paint and 25 mm stencilled lettering.
 - .2 Wording:
 - .1 For non-rated fire separations *This partition designed as a non-rated fire separation.*
 - .2 For ¾ hour rated fire separations *This partition designed as a ¾ hour fire separation.*
 - .3 For 1 hour rated fire separations *This partition designed as a 1 hour fire separation.*
 - .4 For 2 hour rated fire separations *This partition designed as a 2 hour fire separation.*
 - .3 Placement:
 - .1 Rooms with finished ceilings: Place label above finished ceiling within 50 mm of where the wall intersects the floor/roof deck above..
 - .2 M&E, storage, and industrial rooms with no finished ceilings: Place label within 50 mm of where the wall intersect the floor/roof deck above.
 - .3 Finished spaces with no ceilings; Review with Engineer for location of labelling prior to starting work.
 - .4 Spray lettering on either side of vertical fire separation. Repeat lettering every 10 metres on each side of separation, with a minimum of one set of labelling for every segment of fire separation. Insure lettering is level and in alignment with each other.
- 3.10 CLEANING AND PROTECTING
 - .1 Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by firestop system manufacturers and that do not damage materials in which openings occur.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Silicone joint sealants.
 - .2 Urethane joint sealants.
 - .3 Polysulfide joint sealants.
 - .4 Latex joint sealants.
 - .5 Solvent-release-curing joint sealants.
 - .6 Preformed joint sealants.
 - .7 Acoustical joint sealants.
 - .8 Security grade sealants used inside secure blocks inside detention facilities.

- .2 Types of items you will not find described in this Section:
 - .1 Masonry control and expansion joint fillers and gaskets.
 - .2 Building expansion joints.
 - .3 Sealing joints in fire-resistance-rated construction.
 - .4 Structural and other glazing sealants.
 - .5 Plastic glazing sealants.
 - .6 Sealing perimeter joints and penetrations at gypsum veneer plastering
 - .7 Sealing perimeter joints at gypsum board.
 - .8 Sealing tile joints.
 - .9 Sealing edge mouldings at perimeters with acoustical sealant at acoustical panel ceilings and acoustical tile ceilings.
 - .10 Sealing joints in pavements, walkways, and curbing.

1.2 SUBMITTALS

- .1 Product Data: For each joint-sealant product indicated.

- .2 Samples for Initial Selection: Manufacturer's colour charts consisting of strips of cured sealants showing the full range of colours available for each product exposed to view.

- .3 Joint-Sealant Schedule: Include the following information:
 - .1 Joint-sealant application, joint location, and designation.
 - .2 Joint-sealant manufacturer and product name.
 - .3 Joint-sealant formulation.
 - .4 Joint-sealant colour.

- .4 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

- .5 Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

- .1 Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

- .2 Mock-ups: Install sealant in mock-ups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

- .3 Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- .1 Do not proceed with installation of joint sealants under the following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 5 deg C.
 - .2 When joint substrates are wet.
 - .3 Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - .4 Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

- .1 Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - .1 Warranty Period: Two years from date of Substantial Completion.
- .2 Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - .1 Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - .2 Disintegration of joint substrates from natural causes exceeding design specifications.
 - .3 Mechanical damage caused by individuals, tools, or other outside agents.
 - .4 Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- .1 Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- .2 VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when:
 - .1 Architectural Sealants: 250 g/L.
 - .2 Sealant Primers for Nonporous Substrates: 250 g/L.
 - .3 Sealant Primers for Porous Substrates: 775 g/L.
- .3 Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - .1 Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- .4 Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

- .5 Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- .6 Colours of Exposed Joint Sealants: As selected by Owner's Representative from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- .1 Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
- .2 Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
- .3 Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- .4 Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- .5 Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
- .6 Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.
- .7 Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
- .8 Multicomponent, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade P, Class 100/50, for Use T.
- .9 Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- .10 Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.3 URETHANE JOINT SEALANTS

- .1 Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
- .2 Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
- .3 Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- .4 Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use T.
- .5 Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

- .6 Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
 - .7 Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
 - .8 Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
 - .9 Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 - .10 Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
 - .11 Immersible, Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.
 - .12 Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.
 - .13 Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type M, Grade P, Class 25, for Use T and I.
- 2.4 LATEX JOINT SEALANTS
- .1 Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
- 2.5 SOLVENT-RELEASE-CURING JOINT SEALANTS
- .1 Acrylic-Based Joint Sealant: ASTM C 1311.
 - .2 Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
- 2.6 SECURITY SEALANTS
- .1 Pick-Proof Sealant Two Part: high-strength, high-modulus, non-sag epoxy gel adhesive:
 - .1 Meeting or exceeding the following:
 - .1 Consistency: 0 (no flow).
 - .2 Shore D: 90.
 - .3 Pot Life: 35 minutes at 77 25 degrees C.
 - .4 Bond Strength, 2-Day Cure: 15.4 MPa per ASTM C 882.
 - .5 Bond Strength, 14-Day Cure: 17.0 MPa per ASTM C 882.
 - .6 Water Absorption: 0.63 percent per ASTM D 570.
 - .7 Linear Coefficient of Shrinkage: 0.0007 percent.
 - .8 Compressive Strength: 77.5 MPa per ASTM D 695.
 - .9 Compressive Modulus: 1,725 MPa per ASTM D 695.
 - .10 Elongation at Break: 2.56 percent per ASTM D 638.
 - .11 Shear Strength: 24.5 MPa per ASTM D 732.
 - .12 Flexural Strength: 38.5 MPa minimum, per ASTM D 790.
 - .2 Consisting of:
 - .1 Component A: Modified epoxy resin adhesive of epichlorohydrin bisphenol type A, containing suitable viscosity control agents and pigments.

- .2 Component B: Reaction product of a selected blend of amines with an epoxy resin of epichlorohydrin bisphenol type A, containing suitable viscosity control agents, pigments and accelerators.
- .3 Mixing Ratio: 2:1 by volume, Component A to Component B.
- .3 Acceptable Material:
 - .1 Sonocrete Epogel by Sonneborn, www.chemrex.com, tel 1.800.433.9517.
 - .2 Alternative Products: Approved by addendum in accordance with the General Instructions to Bidders.

2.7 PREFORMED JOINT SEALANTS

- .1 Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
- .2 Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 160 kg/cu. m and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

2.8 ACOUSTICAL JOINT SEALANTS

- .1 Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.9 JOINT SEALANT BACKING

- .1 General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- .2 Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O, (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- .3 Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

- .1 Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- .2 Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- .3 Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - .1 Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - .2 Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - .1 Concrete.
 - .2 Masonry.
 - .3 Unglazed surfaces of ceramic tile.
 - .4 Exterior insulation and finish systems.
 - .3 Remove laitance and form-release agents from concrete.
 - .4 Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - .1 Metal.
 - .2 Glass.
 - .3 Porcelain enamel.
 - .4 Glazed surfaces of ceramic tile.
- .2 Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- .3 Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- .1 General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- .2 Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- .3 Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - .1 Do not leave gaps between ends of sealant backings.
 - .2 Do not stretch, twist, puncture, or tear sealant backings.
 - .3 Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- .4 Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- .5 Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - .1 Place sealants so they directly contact and fully wet joint substrates.
 - .2 Completely fill recesses in each joint configuration.
 - .3 Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- .6 Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - .1 Remove excess sealant from surfaces adjacent to joints.
 - .2 Use tooling agents that are approved in writing by sealant manufacturer and that do not discolour sealants or adjacent surfaces.
 - .3 Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - .4 Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - .5 Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - .1 Use masking tape to protect surfaces adjacent to recessed tooled joints.
- .7 Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
 - .1 Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 - .2 Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 10 mm . Hold edge of sealant bead 6 mm inside masking tape.
 - .3 Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 - .4 Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- .8 Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- .9 Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

- .1 Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- .1 Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- .1 Joint-Sealant Colour: As selected by Owner's Representative from manufacturer's full range of colours.
- .2 For police detachment projects use only Security Sealants inside cell block.
- .3 Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - .1 Joint Locations:
 - .1 Isolation and contraction joints in cast-in-place concrete slabs.
 - .2 Tile control and expansion joints.
 - .3 Joints between different materials listed above.
 - .4 Other joints as indicated.
 - .2 Joint Sealant: any one of the following:
 - .1 Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing; Single component, pourable, traffic grade, neutral curing.
 - .2 Urethane Joint Sealant: Single component, nonsag, traffic grade; Single component, pourable, traffic grade; Multicomponent, nonsag, traffic grade, Class 50; Multicomponent, nonsag, traffic grade, Class 25.
 - .3 Preformed Joint Sealant: Preformed foam sealant.
- .4 Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
 - .1 Joint Locations:
 - .1 Joints in pedestrian plazas.
 - .2 Joints in swimming pool decks.
 - .3 Other joints as indicated.
 - .2 Joint Sealant: any one of the following:
 - .1 Urethane Joint Sealant: Immersible, single component, nonsag, traffic grade; Immersible, single component, pourable, traffic grade; Immersible, multicomponent, nonsag, traffic grade; Immersible, multicomponent, pourable, traffic grade.
- .5 Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - .1 Joint Locations:
 - .1 Construction joints in cast-in-place concrete.
 - .2 Joints between plant-precast architectural concrete units.
 - .3 Control and expansion joints in unit masonry.
 - .4 Joints in dimension stone cladding.
 - .5 Joints in glass unit masonry assemblies.
 - .6 Joints in exterior insulation and finish systems.
 - .7 Joints between metal panels.
 - .8 Joints between different materials listed above.

- .9 Perimeter joints between materials listed above and frames of doors windows and louvers.
- .10 Control and expansion joints in ceilings and other overhead surfaces.
- .11 Other joints as indicated.
- .2 Joint Sealant: any one of the following:
 - .1 Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50; Single component, nonsag, neutral curing, Class 50; Single component, nonsag, acid curing; Multicomponent, nonsag, neutral curing.
 - .2 Urethane Joint Sealant: Single component, nonsag, Class 100/50; Single component, nonsag, Class 50; Multicomponent, nonsag, Class 50.
 - .3 Preformed Joint Sealant: Preformed silicone; Preformed foam.
- .6 Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - .1 Joint Locations:
 - .1 Isolation joints in cast-in-place concrete slabs.
 - .2 Control and expansion joints in stone flooring.
 - .3 Control and expansion joints in brick flooring.
 - .4 Control and expansion joints in tile flooring.
 - .5 Other joints as indicated.
 - .2 Joint Sealant: any one of the following:
 - .1 Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing; Single component, pourable, traffic grade, neutral curing; Multicomponent, pourable, traffic grade, neutral curing.
 - .2 Urethane Joint Sealant: Single component, nonsag, traffic grade; Single component, pourable, traffic grade; Multicomponent, nonsag, traffic grade, Class 50.
 - .3 Preformed Joint Sealant: Preformed foam.
- .7 Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - .1 Joint Locations:
 - .1 Control and expansion joints on exposed interior surfaces of exterior walls.
 - .2 Perimeter joints of exterior openings where indicated.
 - .3 Tile control and expansion joints.
 - .4 Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - .5 Joints on underside of plant-precast structural concrete beams and planks.
 - .6 Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - .7 Other joints as indicated.
 - .2 Joint Sealant: any one of the following:
 - .1 Latex.
 - .2 Acrylic based.
 - .3 Butyl rubber based.
- .8 Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - .1 Joint Sealant Location:
 - .1 Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - .2 Tile control and expansion joints where indicated.
 - .3 Other joints as indicated.
 - .2 Joint Sealant: Any one of the following:
 - .1 Silicone Joint Sealant: Mildew resistant, single component, nonsag, neutral curing; Single component, nonsag, mildew resistant, acid curing.
- .9 Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - .1 Joint Location:
 - .1 Acoustical joints where indicated.

- .2 Other joints as indicated.
- .2 Joint Sealant: Acoustical.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Steel frame products including frames, transom frames (glazed or paneled), sidelight and window assemblies, fire-rated and non-rated.
 - .2 Steel panels, fixed or removable, flush or rebated, similar in construction to steel doors, for use in steel frame product.
 - .3 Steel doors, swing type, flush, with or without embossed face sheets, with or without glazed or louvered openings, fire-rated, with or without temperature rise ratings, and non-rated.
- .2 Types of items you will not find described in this Section:
 - .1 Unit Masonry for embedding anchors for hollow metal work into masonry construction.
 - .2 Hollow metal doors and frames manufactured from stainless steel.
 - .3 Detention Doors and Frames.
 - .4 Sound Control Door Assemblies for packaged, acoustical hollow metal door and frame assemblies with STC ratings of 35 or more.
 - .5 Door Hardware.
 - .6 Field painting hollow metal doors and frames.
 - .7 Lead-lined, hollow metal doors and frames.
 - .8 Electrical connections including conduit and wiring for door controls and operators.

1.2 DEFINITIONS

- .1 Minimum Thickness: Minimum thickness of base metal without coatings.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- .2 Shop Drawings: Include the following:
 - .1 Elevations of each door design.
 - .2 Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - .3 Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - .4 Locations of reinforcement and preparations for hardware.
 - .5 Details of each different wall opening condition.
 - .6 Details of anchorages, joints, field splices, and connections.
 - .7 Details of accessories.
 - .8 Details of mouldings, removable stops, and glazing.
 - .9 Details of conduit and preparations for power, signal, and control systems.
- .3 Other Action Submittals:
 - .1 Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- .4 Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labelled assemblies.

1.4 QUALITY ASSURANCE

- .1 Except as otherwise specified, comply with requirements of Canadian Manufacturing Standards for Steel Doors and Frames published by the Canadian Steel Door and Frame Manufacturers' Association.
- .2 Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- .3 Fire-Rated Door Assemblies: Assemblies complying with CAN4-S104-M that are listed and labelled by a qualified testing agency, for fire-protection ratings indicated.
 - .1 Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labelled fire-rated door assemblies except for size.
- .4 Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with CAN4-S104-M that are listed and labelled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated. Label each individual glazed lite.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - .1 Provide additional protection to prevent damage to finish of factory-finished units.
- .2 Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- .3 Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 102 mm high wood blocking. Do not store in a manner that traps excess humidity.
 - .1 Provide minimum 6 mm space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

- .1 Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- .1 Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel
 - .1 Commercial grade steel to ASTM A924-97 (M-97), galvanized to ASTM A653-97 (M-97), Commercial Steel (CS), Type B, A40 (ZF120) minimum unless otherwise noted.
 - .2 Minimum steel thicknesses shall be in accordance with Appendix 1 of the CSDMA, *Recommended Specifications for Commercial Steel Door and Frame Products*.

.2 Door Core Materials

- .1 Honeycomb: Structural small cell 25.4 mm maximum kraft paper 'honeycomb'. Weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum, sanded to required thickness.
- .2 Fibreglass: Loose batt type, density 24 kg/m³ minimum, conforming to ASTM C553 or ASTM C592.
- .3 Polystyrene: Rigid extruded, fire retardant, closed cell board, Type 1, density: 16 to 32 kg/m³, thermal values: RSI 1.06 (R 6.0) minimum, conforming to ASTM C578.
- .4 Polystyrene: Rigid extruded fire retardant, closed cell board. Density; 16 to 32 kg/m³, thermal values; RSI 1.0 (R 6.0) minimum, Type 1, in accordance with ASTM C578.
- .5 Polyisocyanurate: Rigid foam. closed cell, faced board, thermal value: RSI 2.17 (R12.3) minimum, conforming to ASTM C1289

2.2 MISCELLANEOUS

.1 Primers

- .1 Rust inhibitive touch-up only.

.2 Door Silencers

- .1 Single stud rubber/neoprene type.

.3 Exterior Top Caps

- .1 Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

.4 Frame Thermal Breaks

- .1 Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

.5 Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

.6 Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

.7 Grout: ASTM C 476, except with a maximum slump of 102 mm, as measured according to ASTM C 143/C 143M.

.8 Glazing: Comply with requirements in Division 08 Section *Glazing*.

.9 Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 0.4 mm dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibres, sulphur components, and other deleterious impurities.

2.3 FABRICATION – GENERAL

.1 Manufacturer door and frame products in accordance with the CSDMA's, *Recommended Dimensional Standards for Commercial Steel Doors and Frames*.

.2 Selected Door and Frame Requirements, unless noted otherwise (uno)

Item	Location		
	Interior, Unless noted otherwise	Exterior, Unless noted otherwise	Steel Stiffened, where noted
Steel Coating	A40 (ZF120) minimum; uno.	A40 (ZF120) minimum, uno. Provide G90 (Z275) coating where noted.	A40 (ZF120) minimum, uno. Provide G90 (Z275) coating where noted.
Doors			
Duty / Min. Steel Thickness	Medium duty / 1.3 mm (18 gauge nominal); uno.	Heavy duty / 1.6 mm (16 gauge nominal); uno.	Extra heavy duty / 2.0 mm (14 gauge nominal), uno.
Design	Flush panel, uno.	Flush panel, uno.	Flush panel, uno
Core,	Stiffened, insulated and sound deadened with hon- eycomb core laminated under pressure to each face sheet; uno.	Stiffened, insulated and sound deadened with poly- styrene or polyisocyanurate core laminated under pres- sure to each face sheet; uno.	Internally reinforced with continuous interlocking steel stiffeners at 150 mm on centre, securely welded to each face sheet at 150 mm on centre maximum, with voids between stiffen- ers filled and sound dead- ened with 24 kg/m3 loose batt type fibreglass materi- al.
Longitudinal Seams	Mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam; uno.	Mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam; uno.	Continuously welded the full height of the door filled and ground smooth with no visible seams.
Caps	None, uno.	PVC, uno. Provide steel caps where noted.	Steel cap.
Thermally Broken?	No	No, uno.	No.
Frames			
Duty / Min. Steel Thickness	Medium duty / 1.3 mm (18 gauge nominal); uno. Standard duty / 1.0 mm (20 gauge nominal) for hollow core doors.	Heavy duty / 1.6 mm (16 gauge nominal); uno.	Heavy duty / 1.6 mm (16 gauge nominal); uno.
Construction	Full face, punch-mitred, or saw mitred welded con- struction; uno.	Full face welded construc- tion.	Full face welded construc- tion.
Thermally Broken?	No	No, uno.	No.

2.4 FABRICATION - FRAME PRODUCTS

.1 General

- .1 Provide frame mortised, blanked, reinforced, drilled, and tapped at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- .2 Protect mortised cut-outs with steel guard boxes except for dry wall applications.
- .3 Reinforce frame where required, for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware.
- .4 Provide anchorage appropriate to floor, wall, and frame construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike

- jamb. For rebate opening heights up to and including 1520 mm provide two anchors, and an additional anchor for each additional 760 mm of height or fraction thereof, except as indicated below. Frames in previously placed concrete, masonry, or structural steel shall be provided with anchors located not more than 150 mm from the top and bottom of each jamb, and intermediate anchors at 660 mm on centre maximum. Fasteners for such anchors shall be provided by others.
- .5 Provide minimum reinforcing, anchor and other component gauges in accordance with Table 1 of the CSDMA, *Recommended Specifications for Commercial Steel Door and Frame Products*.
 - .6 Prepare each door opening for single stud rubber door silencers, three 3 for single
 - .7 Provide fire-rated frame products for those openings requiring fire protection. Provide frames, transom and sidelight assemblies listed for conformance with CAN4-S104. Provide window assemblies listed for conformance with CAN4-S106. Ensure all fire-rated frame products bear the label of, and be listed by a nationally recognized testing agency having a factory inspection service. Labelling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and identify the manufacturer. Construct fire-rated frame products as listed for labelling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.
 - .8 For each grade frame indicated from a steel sheet having a minimum thickness of:
 - .1 Standard Duty grade frames: 1.0 mm
 - .2 Medium Duty grade frames: 1.3 mm
 - .3 Heavy Duty and Extra Heavy Duty grade frames: 1.6 mm
- .2 Welded Type
- .1 Accurately mitre or mechanically join frame products.
 - .2 Ensure frame product perimeter corner joints shall be as defined in Appendix 2 of the CSDMA, *Recommended Specifications for Commercial Steel Door and Frame Products*, and as follows
 - .1 Profile welded; punch-mitred - continuously welded on the profile faces, rabbets, returns and soffit intersections, or saw-mitred - continuously welded on the profile faces, rabbets, returns, stops and soffit intersections. Punch or saw-mitred, at the manufacturer's discretion. All profile welded frame product exposed faces shall be filled and ground to a smooth, uniform, seamless surface.
 - .2 Face welded; continuously welded on the profile faces, with exposed faces filled and ground to a smooth, uniform, seamless surface.
 - .3 Tack welded; welded on the faces and returns, with exposed hairline joint intersections.
 - .3 Ensure joints at mullions, sills and center rails are:
 - .1 Coped accurately, butted and tightly fitted.
 - .2 At intersecting flush profile faces, securely welded, filled and ground to a smooth, uniform, seamless surface.
 - .3 At intersecting recessed profile faces, securely welded to concealed reinforcements, with exposed hairline face seams.
 - .4 At all other intersecting profile elements have exposed hairline face seams.
 - .4 Welding: to CSA W59.
 - .5 Ensure a floor anchor is securely attached to the inside of each jamb profile where frame product is to be installed prior to the adjacent partition. Provide each floor anchor s with two holes for securing to the floor. For conditions that do not permit the use of a floor anchor, substitute with an additional wall anchor, located within 150 mm of the base of the jamb.
 - .6 Weld in two temporary jamb spreaders per door opening to maintain proper alignment during shipment and handling. Do not be used for installation.
 - .7 Form glazing stops from steel channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

- .8 When required due to site access or due to shipping limitations, fabricate frame product for large openings in sections as designated on the submittal drawings, with splice joints for field assembly and welding.
- .9 Prior to shipment, mark each frame product with an identification number as shown on submittal drawings.
- .3 Knocked-Down Type
 - .1 Ship knocked-down type frames unassembled.
 - .2 Ensure frames have mechanical joints which inter-lock securely and provide functionally satisfactory performance when assembled and installed in accordance with the manufacturer's published instructions.
 - .3 Where frame product is to be installed prior to the adjacent partition, securely attach a floor anchor to the inside of each jamb profile. Provide each floor anchor with two 2 holes for securing to the floor. For conditions that do not permit the use of a floor anchor, substitute with an additional wall anchor, located within 150 mm of the base of the jamb.
 - .4 Prior to shipment, mark each frame product with an identification number as shown on submittal drawings.
- 2.5 FABRICATION - DOORS
 - .1 General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with requirements of Canadian Manufacturing Standards for Steel Doors and Frames published by the Canadian Steel Door and Frame Manufacturers' Association except as noted.
 - .1 Longitudinal Edge Profile:
 - .1 Vertical Edges for Single-Acting Doors: Manufacturer's standard.
 - .2 Vertical Edges for Double-Acting Doors: Round vertical edges with 54 mm radius.
 - .2 Provide doors mortised, blanked, reinforced, drilled and tapped at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
 - .3 Factory prepare holes 12.7 mm diameter and larger, except for mounting and through-bolt holes.. Factory-prepare holes less than 12.7 mm when required for the function of the device (for knob, lever, cylinder, thumb or turn pieces) or when these holes over-lap function holes.
 - .4 Reinforce doors where required for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware.
 - .5 Provide top and bottom of doors with inverted, recessed, welded steel channels.
 - .6 Provide minimum reinforcing and component gauges in accordance with Table 1 of the CSDMA, *Recommended Specifications for Commercial Steel Door and Frame Products*.
 - .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
 - .8 Provide fire-rated doors for those openings requiring fire protection. Provide products listed for conformance with CAN4-S104. Provide fire-rated doors bearing label of, and be listed by a nationally recognized testing agency having a factory inspection service. Labelling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Construct fire-rated doors as listed for labelling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.
 - .9 Prior to shipment, mark each door with an identification number as shown on the submittal drawings.
 - .10 For each grade door indicated form both face sheets for doors from a steel sheet having a minimum thickness of:
 - .1 Standard Duty grade doors: 1.0 mm
 - .2 Medium Duty grade doors: 1.3 mm
 - .3 Heavy Duty grade doors: 1.6 mm
 - .4 Extra Heavy Duty grade doors: 2.0 mm
- 2.6 HOLLOW METAL PANELS
 - .1 Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal doors.

2.7 FRAME ANCHORS

.1 Jamb Anchors:

- .1 Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 1.0 mm thick, with corrugated or perforated straps not less than 50 mm wide by 250 mm long; or wire anchors not less than 4.5 mm thick.
- .2 Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 1.0 mm thick.
- .3 Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
- .4 Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 9.5 mm diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

.2 Floor Anchors: Formed from same material as frames, not less than 1.0 mm thick, and as follows:

- .1 Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
- .2 Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 50 mm height adjustment. Terminate bottom of frames at finish floor surface.

2.8 STOPS AND MOULDINGS

- .1 Mouldings for Glazed Lites in Doors: Minimum 0.8 mm thick, fabricated from same material as door face sheet in which they are installed.
- .2 Fixed Frame Mouldings: Formed integral with hollow metal frames, a minimum of 16 mm high unless otherwise indicated.
- .3 Loose Stops for Glazed Lites in Frames: Minimum 0.8 mm thick, fabricated from same material as frames in which they are installed.
- .4 Terminated Stops: Where indicated on interior door frames, terminate stops 152 mm above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

- .1 Provide terminated stops only where indicated.

2.9 LOUVERS

- .1 Provide louvers for interior doors, where indicated, with blades or baffles formed of 0.5 mm thick, cold-rolled steel sheet set into 0.8 mm thick steel frame.
 - .1 Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - .2 Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labelled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.10 ACCESSORIES

- .1 Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- .2 Ceiling Struts: Minimum 6.4 mm thick by 25.4 mm wide steel.
- .3 Grout Guards: Formed from same material as frames, not less than 0.4 mm thick.

2.11 FABRICATION

- .1 Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- .2 Hollow Metal Doors:
 - .1 Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - .2 Glazed Lites: Factory cut openings in doors.

- .3 Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 19 mm beyond edge of door on which astragal is mounted.
- .3 Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - .1 Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - .2 Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - .3 Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - .4 Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - .5 Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - .6 Jamb Anchors: Provide number and spacing of anchors as follows:
 - .1 Masonry Type: Locate anchors not more than 457 mm from top and bottom of frame. Space anchors not more than 813 mm o.c. and as follows:
 - .1 Two anchors per jamb up to 1524 mm high.
 - .2 Three anchors per jamb from 1524 to 2286 mm high.
 - .3 Four anchors per jamb from 2286 to 3048 mm high.
 - .4 Four anchors per jamb plus 1 additional anchor per jamb for each 610 mm or fraction thereof above 3048 mm high.
 - .2 Stud-Wall Type: Locate anchors not more than 457 mm from top and bottom of frame. Space anchors not more than 813 mm o.c. and as follows:
 - .1 Three anchors per jamb up to 1524 mm high.
 - .2 Four anchors per jamb from 1524 to 2286 mm high.
 - .3 Five anchors per jamb from 2286 to 2438 mm high.
 - .4 Five anchors per jamb plus 1 additional anchor per jamb for each 610 mm or fraction thereof above 2438 mm high.
 - .5 Two anchors per head for frames above 1066 mm wide and mounted in metal-stud partitions.
 - .3 Compression Type: Not less than two anchors in each jamb.
 - .4 Postinstalled Expansion Type: Locate anchors not more than 152 mm from top and bottom of frame. Space anchors not more than 660 mm o.c.
- .7 Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - .1 Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - .2 Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- .4 Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- .5 Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cut-outs, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section *Door Hardware*.
 - .1 Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - .2 Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 - .3 Coordinate locations of conduit and wiring boxes for electrical connections with Electrical sections.

- .6 Stops and Mouldings: Provide stops and mouldings around glazed lites indicated. Form corners of stops and mouldings with butted or mitred hairline joints.
 - .1 Single Glazed Lites: Provide fixed stops and mouldings welded on secure side of hollow metal work.
 - .2 Multiple Glazed Lites: Provide fixed and removable stops and mouldings so that each glazed lite is capable of being removed independently.
 - .3 Provide fixed frame mouldings on outside of exterior and on secure side of interior doors and frames.
 - .4 Provide loose stops and mouldings on inside of hollow metal work.
 - .5 Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- .2 Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- .2 Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

- .1 Squareness: Plus or minus 1.6 mm, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
- .2 Alignment: Plus or minus 1.6 mm, measured at jambs on a horizontal line parallel to plane of wall.
- .3 Twist: Plus or minus 1.6 mm, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
- .4 Plumbness: Plus or minus 1.6 mm, measured at jambs on a perpendicular line from head to floor.

- .3 Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- .1 General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- .2 Hollow Metal Frames: Install hollow metal frames of size and profile indicated.
 - .1 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - .1 At fire-protection-rated openings, install frames according to NFPA 80.
 - .2 Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - .3 Install frames with removable glazing stops located on secure side of opening.
 - .4 Install door silencers in frames before grouting.
 - .5 Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - .6 Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - .7 Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 - .2 Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

- .1 Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- .3 Metal-Stud Partitions: Solidly pack mineral-fibre insulation behind frames.
- .4 Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- .5 Concrete Walls: Solidly fill space between frames and concrete with grout, but only when specifically noted. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- .6 In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- .7 In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- .8 Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- .9 Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - .1 Squareness: Plus or minus 1.6 mm, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - .2 Alignment: Plus or minus 1.6 mm, measured at jambs on a horizontal line parallel to plane of wall.
 - .3 Twist: Plus or minus 1.6 mm, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - .4 Plumbness: Plus or minus 1.6 mm, measured at jambs at floor.
- .3 Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - .1 Non-Fire-Rated Standard Steel Doors:
 - .1 Jambs and Head: 3 mm plus or minus 1.6 mm.
 - .2 Between Edges of Pairs of Doors: 3 mm plus or minus 1.6 mm.
 - .3 Between Bottom of Door and Top of Threshold: Maximum 9.5 mm.
 - .4 Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 19 mm.
 - .2 Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- .4 Glazing: Comply with installation requirements in Division 08 Section *Glazing* and with hollow metal manufacturer's written instructions.
 - .1 Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 230 mm o.c. and not more than 50 mm o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
 - .1 Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - .2 Remove grout and other bonding material from hollow metal work immediately after installation.
 - .3 Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Access doors and frames for walls and ceilings.
 - .2 Floor access doors and frames, insulated and non-insulated.
 - .3 Insulated attic access hatches, without access ladder.
- .2 Types of items you will not find described in this Section:
 - .1 Mortise or rim cylinder locks and master keying for access doors in walls and ceilings.
 - .2 Connection of floor door drainage couplings to drains.
 - .3 Blocking out openings for access doors and frames in concrete.
 - .4 Anchoring and grouting access door frames set in masonry construction.
 - .5 Roof hatches.
 - .6 Suspended acoustical tile ceilings.
 - .7 Heating and air-conditioning duct access doors.
- .3 Precedent
 - .1 This spec section shall take precedent over product specifications for similar access doors and frames found in Mechanical and Electrical Divisions for locations outlined in this Spec.

1.3 SUBMITTALS

- .1 Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- .2 Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

- .1 Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- .2 Fire-Rated Access Doors and Frames: Units complying with CAN4-S104-M that are identical to access door and frame assemblies tested for fire-test-response characteristics and that are listed and labeled by ULC or another testing and inspecting agency acceptable to authorities having jurisdiction:
- .3 Size Variations: Obtain Owner's Representative's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- .1 Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical (including but not limited to all concealed valves, balancing arms and controls, fire flaps, and fire

dampers), electrical (including but not limited to all concealed junction boxes, controls), or other concealed work, and indicate in the schedule specified in *Submittals* Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- .1 Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- .2 Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with ZF180 zinc-iron-alloy (galvannealed) coating or Z180 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- .3 Drywall Beads: Edge trim formed from 0.76-mm zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 STAINLESS-STEEL MATERIALS

- .1 Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 or 316. Remove tool and die marks and stretch lines or blend into finish.
 - .1 Finish: Manufacturer's standard.

2.3 ACCESS DOORS AND GRAMES IN GENERAL

- .1 Provide fire rated door assemblies when installed in fire rated assemblies.
 - .1 Closing: automatic closing type.
 - .2 Ratings:
 - .1 45 minute assembly: 45 minute door rating.
 - .2 1 hour assembly: 45 minute door rating.
 - .3 1.5 hour assembly: 1 hour door rating.
 - .4 2 hour assembly: 1 ½ hour door rating.

2.4 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- .1 Door: Minimum 1.5 mm thick sheet metal.
- .2 Frame: Minimum 1.5 mm thick sheet metal
- .3 Hinges: one of the following:
 - .1 Spring-loaded, concealed-pin type.
 - .2 Continuous piano.
- .4 Latch: Cam latch; slam latch; or self-latching bolt operated by one of the following:
 - .1 Hex head wrench.
 - .2 Pinned hex head wrench.
 - .3 Spanner head wrench.
- .5 Doors in finished gypsum board wall and ceiling assemblies not otherwise having a tile finish.
 - .1 Type: Flush access doors and trimless frames
 - .2 Fabricated from one of the following:
 - .1 Steel sheet.

- .2 Metallic-coated steel sheet.
 - .3 Stainless-steel sheet.
 - .3 Door: Set flush with surrounding finish surfaces.
 - .4 Frame: With drywall bead flange.
 - .5 Rating: Fire rated when installed in fire rated assemblies.
 - .1 Automatic Closer: Spring type.
 - .6 Doors in wall assemblies having a tiled finish.
 - .1 Type: Recessed access doors and trimless frames.
 - .2 Fabricated from one of the following:
 - .1 Steel sheet.
 - .2 Metallic-coated steel sheet.
 - .3 Stainless-steel sheet.
 - .3 Locations: Wall access doors.
 - .4 Door: In the form of a pan recessed 25 mm for gypsum board and tile infill.
 - .5 Frame: With drywall bead for gypsum board surfaces.
 - .7 Doors in all other assemblies.
 - .1 Type: Flush access doors and frames with exposed trim.
 - .2 Materials: Fabricated from:
 - .1 Stainless-steel sheet.
 - .3 Door: Set flush with exposed face flange of frame.
 - .4 Frame: With 25 mm or 32 mm wide, surface-mounted trim.
- ## 2.5 FLOOR ACCESS DOORS AND FRAMES
- .1 Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.
 - .2 Aluminum Floor Door: Single-leaf opening. Extruded-aluminum angle frame with 6.4 mm thick, diamond-pattern, aluminum tread plate door; non-watertight; loading capacity to support 7.2-kN/sq. m pedestrian live load.
 - .1 Locations: When hatch is installed in non-fire rated floor assemblies.
 - .3 Steel Angle-Frame Floor Door: Single-leaf opening. Galvanized structural-steel frame with 4.8 or 6.4 mm thick, diamond-pattern, galvanized structural-steel tread plate door; non-watertight; loading capacity to support 7.2 kN/sq. m pedestrian live load.
 - .1 Fire-Resistance Rating: Not less than that indicated.
 - .2 Finish painted in yellow with wording *FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE*.
 - .3 Locations: When hatch is installed in fire-rated floor assemblies.
 - .4 Watertight Aluminum Floor Door: Single-leaf opening. Extruded-aluminum gutter frame with DN 40 drainage coupling and 6.4-mm- thick, diamond-pattern, aluminum tread plate door; watertight; loading capacity to support 7.2-kN/sq. m pedestrian live load.
 - .1 Locations: Only if a water tight hatch is indicated, and then only in non-fire-rated floor assemblies.
 - .5 Watertight Steel Gutter-Frame Floor Door: Single-leaf opening. Galvanized structural-steel channel frame forming gutter with DN 40 drainage coupling and 4.8- or 6.4-mm- thick, diamond-pattern, galvanized structural-steel tread plate door; watertight; loading capacity to support 7.2-kN/sq. m pedestrian live load.
 - .1 Fire-Resistance Rating: Not less than that indicated.
 - .2 Finish painted in yellow with wording *FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE*.
 - .3 Locations: Only if a water tight hatch is indicated, and then only in fire rated floor assemblies.

- .6 Hardware: Provide the following:
 - .1 Hinges: Heavy-duty, aluminum butt hinges with stainless-steel pins.
 - .2 Latch: Stainless-steel slam latch.
 - .3 Lock: Keyed deadlock bolt
 - .4 Hardware Material: Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners.
- .7 Insulation: Urethane with liner pan.
 - .1 Locations: When hatch is installed in insulated floor assemblies.

2.6 INSULATED ATTIC ACCESS HATCHES

- .1 Access Hatch: pre-fabricated attic access hatch consisting of door frame and trim, complete with steel door with polyurethane core for manual lifting, complete with magnetic weather stripping, 550 x 900 mm nominally.

2.7 FABRICATION

- .1 General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- .2 Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- .3 Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 - .1 Exposed Flanges: Nominal 25 to 38 mm wide around perimeter of frame.
 - .2 For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 - .3 Provide mounting holes in frames for attachment of units to metal or wood framing.
 - .4 Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- .4 Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- .5 Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - .1 For cylinder lock, furnish two keys per lock and key all locks alike.
 - .2 For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- .6 Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Comply with manufacturer's written instructions for installing access doors and frames.
- .2 Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

.3 Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 INSULATED ATTIC ACCESS HATCH

.1 Ensure structural framing is used to create the rough opening for the hatch. Secure hatch to the structural framing as per manufacturer requirements.

.2 Seal the ceiling's air/vapour barrier to frame of attic access hatch. Fill void between frame and adjacent framing with spray foam sealant.

3.3 ADJUSTING AND CLEANING

.1 Adjust doors and hardware after installation for proper operation.

.2 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Commercial door hardware for the following:
 - .1 Swinging doors.
 - .2 Non-fire-rated sliding doors.
 - .3 Other doors to the extent indicated.
 - .2 Cylinders for doors specified in other Sections.
 - .3 Electrified door hardware.
- .2 Types of items you will not find described in this Section:
 - .1 Commercial door hardware for the following:
 - .1 Non-fire-rated folding doors.
 - .2 Astragals provided as part of fire-rated labelled assemblies and for door silencers provided as part of hollow-metal frames.
 - .3 Door silencers provided as part of aluminum frames.
 - .4 Astragals and integral intumescent seals provided as part of fire-rated labelled flush wood door assemblies.
 - .5 Astragals and integral intumescent seals provided as part of fire-rated labelled stile and rail wood door assemblies.
 - .6 Access door hardware.
 - .7 Door hardware provided as part of overhead door assemblies.
 - .8 Door hardware provided as part of overhead grille assemblies.
 - .9 Door silencers provided as part of hollow-metal detention frames.
 - .10 Hinges and gasketing provided as part of sound-rated door assemblies.
 - .11 Specialized entrance door hardware for aluminum-framed entrances and storefronts
 - .12 Specialized entrance door hardware for all-glass entrances and storefronts.
 - .13 Specialized entrance door hardware for automatic entrances
 - .14 Specialized entrance door hardware for intensive care unit/critical care unit (ICU/CCU) entrances.
 - .15 Detention door hardware.
 - .16 Door hardware for doors in wire mesh partitions.
 - .17 Plastic door protection units that match wall protection units.
 - .18 Radiation protection for lead-lined astragals provided as part of fire-rated labelled assemblies.
 - .19 Connections to electrical power system and for low-voltage wiring work.
 - .20 Access control devices installed at door openings and provided as part of a security access system.
 - .21 Detection devices installed at door openings and provided as part of an intrusion detection system.
 - .22 Connections to building fire alarm system.
- .3 Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
 - .1 Cylinders for locks specified in other Sections.

1.2 SUBMITTALS

- .1 Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- .2 Shop Drawings: Details of electrified door hardware, indicating the following:
 - .1 Wiring Diagrams: Power, signal, and control wiring. Include the following:
 - .1 System schematic.

- .2 Point-to-point wiring diagram.
- .3 Riser diagram.
- .4 Elevation of each door.
- .2 Detail interface between electrified door hardware and fire alarm, access control, security, and building control systems.
- .3 Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- .3 Qualification Data: For Architectural Hardware Consultant.
- .4 Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- .5 Warranty: Special warranty specified in this Section.
- .6 Other Action Submittals:
 - .1 Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - .1 Format: Comply with scheduling sequence and vertical format in DHI's *Sequence and Format for the Hardware Schedule*. Double space entries, and number and date each page.
 - .2 Content: Include the following information:
 - .1 Identification number, location, hand, fire rating, and material of each door and frame.
 - .2 Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - .3 Complete designations of every item required for each door or opening including name and manufacturer.
 - .4 Fastenings and other pertinent information.
 - .5 Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - .6 Explanation of abbreviations, symbols, and codes contained in schedule.
 - .7 Mounting locations for door hardware.
 - .8 Door and frame sizes and materials.
 - .9 Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - .1 Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
 - .10 List of related door devices specified in other Sections for each door and frame.
 - .3 Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
 - .2 Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- 1.3 QUALITY ASSURANCE
 - .1 Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

- .1 Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Owner's Representative, and Owner about door hardware and keying.
 - .2 Installer shall have warehousing facilities in Project's vicinity.
 - .3 Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - .4 Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- .2 Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 - .1 Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant who is experienced in providing consulting services for electrified door hardware installations.
 - .3 Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
 - .1 Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
 - .4 Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - .5 Electrified Door Hardware: Listed and labelled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - .6 Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section *Project Management and Coordination*. Review methods and procedures related to electrified door hardware including, but not limited to, the following:
 - .1 Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 - .2 Review sequence of operation for each type of electrified door hardware.
 - .3 Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - .4 Review required testing, inspecting, and certifying procedures.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- .1 Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 - .2 Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
 - .3 Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
 - .4 Deliver keys and permanent cores, when specified, to Owner by registered mail or overnight package service.
 - .1 Obtain name and mailing address from Owner's Representative.
- 1.5 COORDINATION

- .1 Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- .2 Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- .3 Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system.
- .4 Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.6 WARRANTY

- .1 Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.
 - .1 Failures include, but are not limited to, the following:
 - .1 Structural failures including excessive deflection, cracking, or breakage.
 - .2 Faulty operation of operators and door hardware.
 - .3 Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - .2 Warranty Period: Three years from date of Substantial Completion, except as follows:
 - .1 Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
 - .2 Exit Devices: Two years from date of Substantial Completion.
 - .3 Manual Closers: 10 years from date of Substantial Completion.
 - .4 Concealed Floor Closers: 10 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

- .1 Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- .2 Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

1.8 EXTRA MATERIALS

- .1 Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - .1 Door Hardware: None required.
 - .2 Electrical Parts: None required.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- .1 General: Provide door hardware for each door to comply with requirements in this Section.

- .1 Door Hardware Sets: Provide quantity, item, size, finish or colour indicated, and products complying with BHMA standard referenced.
 - .2 Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - .2 Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 *Door Hardware Groups* Article or on drawings. Products are identified by using door hardware designations, as follows:
 - .1 Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 Door Hardware Groups Article.
 - .2 References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
 - .3 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - .1 Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- ## 2.2 HINGES, GENERAL
- .1 Quantity: Provide the following, unless otherwise indicated:
 - .1 Two Hinges: For doors with heights up to 1524 mm.
 - .2 Three Hinges: For doors with heights 1549 to 2286 mm.
 - .3 Four Hinges: For doors with heights 2311 to 3048 mm.
 - .4 For doors with heights more than 3048 mm, provide 4 hinges, plus 1 hinge for every 750 mm of door height greater than 3048 mm.
 - .2 Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
 - .3 Hinge Weight: Unless otherwise indicated, provide the following:
 - .1 Entrance Doors: Heavy-weight hinges.
 - .2 Doors with Closers: Antifriction-bearing hinges.
 - .3 Interior Doors: Standard-weight hinges.
 - .4 Hinge Base Metal: Unless otherwise indicated, provide the following:
 - .1 Exterior Hinges: Stainless steel, with stainless-steel pin.
 - .2 Interior Hinges: Steel, with steel pin .
 - .3 Hinges for Fire-Rated Assemblies: Steel, with steel pin.
 - .5 Hinge Options: Where indicated in door hardware sets or on Drawings:
 - .1 Hospital Tips: Slope ends of hinge barrel.
 - .2 Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
 - .3 Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out swinging exterior doors .
 - .4 Corners: Square.
 - .6 Electrified Functions for Hinges: Comply with the following:
 - .1 Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
 - .2 Monitoring: Concealed electrical monitoring switch.
 - .3 Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

- .7 Fasteners: Comply with the following:
 - .1 Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - .2 Wood Screws: For wood doors and frames.
 - .3 Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 - .4 Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors, wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 HINGES

- .1 Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's *Certified Product Directory*.
- .2 Template Hinge Dimensions: BHMA A156.7.
- .3 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - .3 Stanley Commercial Hardware; Div. of The Stanley Works (STH).
 - .4 Or approved alternate.

2.4 CONTINUOUS HINGES

- .1 Standard: BHMA A156.26, Grade 1 .
 - .1 Listed under Category N in BHMA's *Certified Product Directory*.
- .2 General: Minimum 3.0 mm thick, hinge leaves with minimum overall width of 102 mm; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
 - .1 Fire Pins: Steel pins to hold labelled fire doors in place if required by tested listing.
- .3 Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge.
 - .1 Base Metal for Exterior Hinges: Stainless steel.
 - .2 Base Metal for Interior Hinges: Aluminium.
 - .3 Base Metal for Hinges for Fire-Rated Assemblies: Steel.
 - .4 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - .3 Stanley Commercial Hardware; Div. of The Stanley Works (STH).
 - .4 Or approved alternate.
- .4 Continuous, Gear-Type Hinges: Extruded-aluminium, pinless, geared hinge leaves; joined by a continuous extruded-aluminium channel cap; with concealed, self-lubricating thrust bearings.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - .3 Pemko Manufacturing Co. (PEM).
 - .4 Or approved alternate.

2.5 LOCKS AND LATCHES, GENERAL

- .1 Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with local accessibility regulations

- .1 Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 22 N.
- .2 Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 67 N to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- .3 Electrified Locking Devices: BHMA A156.25.
- .4 Lock Trim:
 - .1 Levers: Cast.
 - .1 **<Insert model number and description.>**
 - .2 Escutcheons (Roses): Cast.
 - .3 Dummy Trim: Match lever lock trim and escutcheons.
 - .4 Lockset Designs: **<Insert name(s) of manufacturer(s) and product name(s) designating lockset design(s) that other manufacturers must match>** or, if sets are provided by another manufacturer, provide designs that match those designated.
- .5 Lock Throw: Comply with testing requirements for length of bolts required for labelled fire doors, and as follows:
 - .1 Bored Locks: Minimum 13 mm latch bolt throw.
 - .2 Mortise Locks: Minimum 19 mm latch bolt throw.
 - .3 Deadbolts: Minimum 25 mm bolt throw.
- .6 Rebated Meeting Doors: Provide special rebated front and strike on locksets for rebated meeting stiles.
- .7 Backset: 70 mm, unless otherwise indicated.
- .8 Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
 - .1 Strikes for Bored Locks and Latches: BHMA A156.2.
 - .2 Strikes for Mortise Locks and Latches: BHMA A156.13.
 - .3 Strikes for Interconnected Locks and Latches: BHMA A156.12.
 - .4 Strikes for Auxiliary Deadlocks: BHMA A156.5.
 - .5 Flat-Lip Strikes: For locks with three-piece antifriction latchbolt, as recommended by manufacturer.
 - .6 Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - .7 Aluminium-Frame Strike Box: Manufacturer's special strike box fabricated for aluminium framing.

2.6 MECHANICAL LOCKS AND LATCHES

- .1 Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 - .1 Bored Locks: BHMA A156.2.
 - .2 Mortise Locks: BHMA A156.13.
 - .3 Interconnected Locks: BHMA A156.12.
- .2 Bored Locks: BHMA A156.2, Grade 1 ; Series 4000. Listed under Category F in BHMA's *Certified Product Directory*.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Best Access Systems; Div. of The Stanley Works (BAS).
 - .2 Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
 - .3 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .4 Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
 - .5 Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
 - .6 Or approved alternate.

- .3 Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1 ; Series 1000. Listed under Category F in BHMA's *Certified Product Directory*.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Best Access Systems; Div. of The Stanley Works (BAS).
 - .2 Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
 - .3 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .4 Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
 - .5 Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
 - .6 Or approved alternate

- .4 Interconnected Locks: BHMA A156.12, Grade 1 ; Series 5000. Listed under Category F in BHMA's *Certified Product Directory*.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).

2.7 AUXILIARY LOCKS AND LATCHES

- .1 Auxiliary Locks: BHMA A156.5, Grade 1 . Listed under Category E in BHMA's *Certified Product Directory*.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Best Access Systems; Div. of The Stanley Works (BAS).
 - .2 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .3 Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
 - .4 Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
 - .5 Or approved alternate.

2.8 ELECTROMECHANICAL LOCKS

- .1 General: Grade 1for type of lock indicated; motor or solenoid driven.
- .2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Best Access Systems; Div. of The Stanley Works (BAS).
 - .2 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .3 Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
 - .4 Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
 - .5 Or approved alternate.

2.9 EXIT LOCKS AND EXIT ALARMS

- .1 Exit Locks: BHMA A156.29, Grade 1, surface mounted, battery powered, housed in metal case; with red-and-white lettering reading *EMERGENCY EXIT PUSH TO OPEN--ALARM WILL SOUND*. Include the following features:
 - .1 Low-battery alert.
 - .2 Outside key control.
 - .3 Audible alarm that sounds when unauthorized use of door occurs.
 - .4 Silent alarm with remote signal capability for connection to remote indicating panel.
- .2 Stand-Alone Exit Alarms: BHMA A156.29, Grade 1, surface mounted on door. Include the following features:
 - .1 Low-battery alert.
 - .2 Outside key control.
 - .3 Automatic rearming after authorized use, with adjustable time delay.
 - .4 Remote signal capability for connection to remote indicating panel.

- .3 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Detex Corporation (DTX).
 - .2 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .3 Or approved alternate.

2.10 DOOR BOLTS

- .1 Bolt Throw: Comply with testing requirements for length of bolts required for labelled fire doors, and as follows:
 - .1 Half-Round Surface Bolts: Minimum 22 mm throw.
 - .2 Interlocking Surface Bolts: Minimum 24 mm throw.
 - .3 Fire-Rated Surface Bolts: Minimum 25 mm throw; listed and labelled for fire-rated doors.
 - .4 Dutch-Door Bolts: Minimum 19 mm throw.
 - .5 Mortise Flush Bolts: Minimum 19 mm throw.
- .2 Dustproof Strikes: BHMA A156.16, Grade 1.
- .3 Surface Bolts: BHMA A156.16, Grade 1 .
 - .1 Flush Bolt Heads: Minimum of 13 mm diameter rods of brass, bronze, or stainless steel with minimum 305 mm long rod for doors up to 2134 mm in height. Provide longer rods as necessary for doors exceeding 2134 mm.
 - .2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Glynn-Johnson; an Ingersoll-Rand Company (GJ).
 - .2 Hager Companies (HAG).
 - .3 IVES Hardware; an Ingersoll-Rand Company (IVS).
 - .4 Stanley Commercial Hardware; Div. of The Stanley Works (STH).
 - .5 Or approved alternate.
- .4 Manual Flush Bolts: BHMA A156.16, Grade 1 ; designed for mortising into door edge.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Glynn-Johnson; an Ingersoll-Rand Company (GJ).
 - .2 Hager Companies (HAG).
 - .3 IVES Hardware; an Ingersoll-Rand Company (IVS).
 - .4 Stanley Commercial Hardware; Div. of The Stanley Works (STH).
 - .5 Or approved alternate.
- .5 Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1 ; designed for mortising into door edge.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Glynn-Johnson; an Ingersoll-Rand Company (GJ).
 - .2 Hager Companies (HAG).
 - .3 IVES Hardware; an Ingersoll-Rand Company (IVS).
 - .4 Or approved alternate.

2.11 EXIT DEVICES

- .1 Exit Devices: BHMA A156.3, Grade 1 . Listed under Category G in BHMA's *Certified Product Directory*.
- .2 Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with local accessibility regulations.
 - .1 Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 22 N.

- .3 Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 67 N to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
 - .4 Panic Exit Devices: Listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
 - .5 Fire Exit Devices: Devices complying with NFPA 80 that are listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
 - .6 Removable Mullions: BHMA A156.3.
 - .7 Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
 - .8 Dummy Push Bar: Non-functioning push bar matching functional push bar.
 - .1 Operation: Movable.
 - .9 Outside Trim:
 - .1 Material and finish to match locksets, unless otherwise indicated.
 - .2 Heavy-duty commercial grade exterior trim based on style to match design for locksets and latchsets; unless otherwise indicated.
 - .10 Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors, and fire-rated wood doors.
 - .11 Electronic Exit Bars: Non-latching electronic releasing device activated by an adjustable capacitance sensor, with no moving parts; listed and labelled as panic exit hardware. Fabricate bar from extruded aluminium, and provide door and frame transfer device and 4.9 m of cord to route wiring off the door frame.
 - .12 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
 - .2 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .3 Von Duprin; an Ingersoll-Rand Company (VD).
 - .4 Or approved alternate.
- 2.12 LOCK CYLINDERS
- .1 Standard Lock Cylinders: BHMA A156.5, Grade 1 .
 - .2 Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - .1 Number of Pins: Seven.
 - .2 Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 - .3 Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - .4 Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - .1 High-Security Grade: BHMA A156.5, Grade 1A, listed and labelled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).
 - .3 Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

- .1 Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.
- .4 Construction Keying: Comply with the following:
 - .1 Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- .5 Manufacturer: Same manufacturer as for locks and latches.

2.13 KEYING

- .1 Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
 - .1 Existing Buildings: Master key or grand master key locks to Owner's existing system.
 - .2 New Buildings: Provide master key system.
- .2 Keys: Nickel silver.
 - .1 Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - .1 Notation: *DO NOT DUPLICATE*.
 - .2 Quantity: In addition to one extra key blank for each lock, provide the following:
 - .1 Cylinder Change Keys: Three.
 - .2 Master Keys: Five.
 - .3 Grand Master Keys: Five.
 - .4 Great-Grand Master Keys: Five.

2.14 KEY CONTROL SYSTEM

- .1 Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150percent of the number of locks.
 - .1 Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.15 ELECTRIC STRIKES

- .1 Standard: BHMA A156.31, Grade 1 .
- .2 General: Use fail-secure electric strikes with fire-rated devices, unless otherwise noted.
- .3 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Adams Rite Manufacturing Co. (ARM).
 - .2 Folger Adam Security Inc.; an ASSA ABLOY Group company (FAS).
 - .3 HES, Inc.; an ASSA ABLOY Group company (HES).
 - .4 Locknetics; an Ingersoll-Rand Company (LSE).
 - .5 Rutherford Controls Int'l. Corp. (RCI).
 - .6 Von Duprin; an Ingersoll-Rand Company (VD).
 - .7 Or approved alternate.

2.16 OPERATING TRIM

- .1 Standard: BHMA A156.6.

- .2 Materials: Fabricate from stainless steel, unless otherwise indicated.
- .3 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 IVES Hardware; an Ingersoll-Rand Company (IVS).
 - .3 Or approved alternate.

2.17 CLOSERS

- .1 Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with local accessibility regulations.
 - .1 Comply with the following maximum opening-force requirements:
 - .1 Interior, Non-Fire-Rated Hinged Doors: 22.2 N applied perpendicular to door.
 - .2 Sliding or Folding Doors: 22.2 N applied parallel to door at latch.
 - .3 Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - .2 Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 133 N to set door in motion and not more than 67 N to open door to minimum required width.
 - .3 Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
 - .4 Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
 - .5 Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.
 - .6 Power-Assist Closers: As specified in Division 08 Section *Automatic Door Operators* for access doors for people with disabilities or where listed in the door hardware sets.
 - .7 Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - .8 Surface Closers: BHMA A156.4 . Listed under Category C in BHMA's *Certified Product Directory*. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
 - .2 LCN Closers; an Ingersoll-Rand Company (LCN).
 - .3 Norton Door Controls; an ASSA ABLOY Group company (NDC).
 - .4 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .5 Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
 - .6 Or approved alternate.
 - .9 Concealed Closers: BHMA A156.4, Grade 1 . Listed under Category C in BHMA's *Certified Product Directory*.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
 - .2 LCN Closers; an Ingersoll-Rand Company (LCN).
 - .3 Norton Door Controls; an ASSA ABLOY Group company (NDC).
 - .4 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

- .5 Or approved alternate.
- .10 Closer Holder Release Devices: BHMA A156.15. Listed under Category C in BHMA's *Certified Product Directory*.
 - .1 Life-Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by smoke detection system or loss of power.
 - .2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
 - .2 DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
 - .3 LCN Closers; an Ingersoll-Rand Company (LCN).
 - .4 Norton Door Controls; an ASSA ABLOY Group company (NDC).
 - .5 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - .6 Or approved alternate.
- .11 Coordinators: BHMA A156.3.
- 2.18 PROTECTIVE TRIM UNITS
 - .1 Size: 38 mm less than door width on push side and 13 mm less than door width on pull side, by height specified in door hardware sets.
 - .2 Fasteners: Manufacturer's standard machine or self-tapping screws.
 - .3 Metal Protective Trim Units: BHMA A156.6; bevelled top and 2 sides; fabricated from the following material:
 - .1 Material: 1.3 mm thick stainless steel.
 - .2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 IVES Hardware; an Ingersoll-Rand Company (IVS).
 - .3 Or approved alternate.
- 2.19 STOPS AND HOLDERS
 - .1 Stops and Bumpers: BHMA A156.16, Grade 1 .
 - .1 Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
 - .2 Mechanical Door Holders: BHMA A156.16, Grade 1 .
 - .3 Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1 .
 - .4 Combination Overhead Stops and Holders: BHMA A156.8, Grade 1 .
 - .5 Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's *Certified Product Directory*.
 - .1 Coordinate with fire detectors and interface with fire alarm system for labelled fire door assemblies.
 - .6 Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 16 by 19 mm; fabricated for drilled-in application to frame.
 - .7 Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 13 mm; fabricated for drilled-in application to frame.
 - .8 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- .1 DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
- .2 Glynn-Johnson; an Ingersoll-Rand Company (GJ).
- .3 Hager Companies (HAG).
- .4 IVES Hardware; an Ingersoll-Rand Company (IVS).
- .5 SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
- .6 Stanley Commercial Hardware; Div. of The Stanley Works (STH).
- .7 Or approved alternate.

2.20 DOOR GASKETING

- .1 Standard: BHMA A156.22. Listed under Category J in BHMA's *Certified Product Directory*.
- .2 General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
 - .1 Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - .2 Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
 - .3 Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- .3 Air Leakage: Not to exceed 0.000774 cu. m/s per m of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- .4 Smoke-Labelled Gasketing: Assemblies complying with NFPA 105 that are listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
 - .1 Provide smoke-labelled gasketing on 20-minute-rated doors and on smoke-labelled doors.
- .5 Fire-Labelled Gasketing: Assemblies complying with NFPA 80 that are listed and labelled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- .6 Sound-Rated Gasketing: Assemblies that are listed and labelled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- .7 Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- .8 Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- .9 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 National Guard Products (NGP).
 - .3 Pemko Manufacturing Co. (PEM).
 - .4 Zero International (ZRO).
 - .5 Or approved alternate.

2.21 THRESHOLDS

- .1 Standard: BHMA A156.21. Listed under Category J in BHMA's *Certified Product Directory*.
- .2 Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with local accessibility regulations

- .1 Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 13 mm high.
- .3 Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 13 mm high.
- .4 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 National Guard Products (NGP).
 - .3 Pemko Manufacturing Co. (PEM).
 - .4 Zero International (ZRO).
 - .5 Or approved alternate.

2.22 SLIDING DOOR HARDWARE

- .1 Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following offering products that may be incorporated into the Work include, but are not limited to, the following:
 - .1 Hager Companies.
 - .2 Stanley Commercial Hardware; Div. of The Stanley Works.
 - .3 Or approved alternate.
 - .2 Horizontal Sliding Door Hardware: Grade 1; rated for door weight, but not less than 205 kg.
 - .1 Material: Wrought steel.
 - .2 Rail: Box without mounting brackets.
 - .3 Rail Supports: Double sidewall style.
 - .1 Provide intermediate, end, and splice type track supports as required by rail configuration and door weight indicated.
 - .4 Hanger Configuration: Four-wheel truck hanger assembly with drop bolt.
 - .1 Wheel Assembly: Steel wheels with ball bearings.
 - .5 Accessories:
 - .1 Guide rail and guide rail brackets as required by rail configuration.
 - .2 Flush pull, minimum 100 by 140 by 19 mm, mortised into door.
 - .3 End guide and stop.
 - .4 Parallel door floor guides.
 - .5 Bumper shoe, minimum 1.5 mm thickness.

2.23 MISCELLANEOUS DOOR HARDWARE

- .1 Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labelled for use with fire alarm systems.
- .2 Monitor Strikes: Cast strike with toggle.
- .3 Auxiliary Hardware: BHMA A156.16, Grade 1 .
 - .1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - .1 Hager Companies (HAG).
 - .2 Stanley Commercial Hardware; Div. of The Stanley Works (STH).
 - .3 Or approved alternate.

2.24 FABRICATION

- .1 Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Owner's Representative.
 - .1 Manufacturer's identification is permitted on rim of lock cylinders only.
- .2 Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- .3 Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminium fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - .1 Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - .2 Steel Machine or Wood Screws: For the following fire-rated applications:
 - .1 Mortise hinges to doors.
 - .2 Strike plates to frames.
 - .3 Closers to doors and frames.
 - .3 Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
 - .1 Surface hinges to doors.
 - .2 Closers to doors and frames.
 - .3 Surface-mounted exit devices.
 - .4 Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - .5 Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, *Recommended Fasteners for Wood Doors*.

2.25 FINISHES

- .1 Standard: BHMA A156.18, as indicated in door hardware sets.
- .2 Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- .3 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labelled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- .2 Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Steel Doors and Frames: Comply with DHI A115 Series.
 - .1 Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- .2 Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

- .1 Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - .1 Standard Steel Doors and Frames: *DHI's Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.*
 - .2 Wood Doors: *DHI WDHS.3, Recommended Locations for Architectural Hardware for Wood Flush Doors.*
- .2 Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - .1 Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - .2 Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- .3 Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- .4 Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Owner's Representative.
 - .1 Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- .5 Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section *Joint Sealants*.

3.4 FIELD QUALITY CONTROL

- .1 Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - .1 Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- .1 Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door

control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

- .1 Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
- .2 Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
- .3 Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 75 mm from the latch, measured to the leading edge of the door.

- .2 Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- .1 Clean adjacent surfaces soiled by door hardware installation.
- .2 Clean operating items as necessary to restore proper function and finish.
- .3 Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 HARDWARE GROUPS

- .1 Refer to schedule on drawings.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Low-energy door operators for swinging doors.
- .2 Types of items you will not find described in this Section:
 - .1 Power door operators for swinging doors.
 - .2 Power-assist door operators for swinging doors.
 - .3 Automatic entrances for sliding, swinging, and folding entrances packaged with automatic door operators.
 - .4 Manual ICU/CCU entrance packages.

1.3 DEFINITIONS

- .1 Double Egress Doors: A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
- .2 Double Swing Doors: A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single swing door.

1.4 SUBMITTALS

- .1 Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation and safety devices. Include operating characteristics, electrical characteristics, and furnished accessories.
- .2 Shop Drawings: For automatic door operators. Include plans, elevations, sections, details, and attachments to other work.
 - .1 Indicate required clearances, method of field assembly, components, and location and size of each field connection.
 - .2 Include locations and elevations of entrances showing activation and safety devices.
 - .3 Wiring Diagrams: For power, signal, and activation- and safety-device wiring.
 - .4 Include plans, elevations, sections, details, and attachments to other work for guide rails.
- .3 Product Certificates: For each operator for fire-rated door assemblies, signed by product manufacturer. Certify that operator is listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.
- .4 Field quality-control reports.
- .5 Maintenance Data: For automatic door operators, including activation and safety devices, to include in maintenance manuals.
- .6 Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- .1 Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
 - .1 Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- .2 Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.
- .3 Electrical Components, Devices, and Accessories: Listed and labelled as defined in National Electrical Code of Canada by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- .4 Exit-Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

1.6 PROJECT CONDITIONS

- .1 Field Measurements: Verify actual dimensions of door frames by field measurements before fabrication of exposed covers for automatic door operators.

1.7 COORDINATION

- .1 Templates: Obtain and distribute, to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
- .2 Electrical System Roughing-in: Coordinate layout and installation of automatic door operators, including activation and safety devices, with connections to power supplies and to access-control system.

1.8 WARRANTY

- .1 Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
 - .1 Failures include, but are not limited to, the following:
 - .1 Faulty or sporadic operation of automatic door operator, including activation and safety devices.
 - .2 Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 - .2 Warranty Period: Two years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- .1 Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic door operator Installer. Include planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
 - .1 Perform maintenance, including emergency callback service, during normal working hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - .1 Besam Automated Entrance Systems, Inc.; an ASSA ABLOY Group company.
 - .2 DORMA Architectural Hardware.
 - .3 DORMA Automatics.
 - .4 Horton Automatics; a division of Overhead Door Corporation.
 - .5 Stanley Access Technologies; Division of The Stanley Works.

2.2 MATERIALS

- .1 Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:
 - .1 Sheet: ASTM B 209M.
 - .2 Extrusions: ASTM B 221M.
- .2 Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in manufacturer's standard thickness.
- .3 Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.3 AUTOMATIC DOOR OPERATORS, GENERAL

- .1 General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
 - .1 Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
 - .2 Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load as prescribed for locality in the National Building Code of Canada.
- .2 Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
- .3 Hinges: See Division 08 Section *Door Hardware* for type of hinge for each door that door operator shall accommodate.
- .4 Cover for Surface-Mounted Operators: Fabricated from 3.2 mm thick extruded or formed aluminum ; continuous over full width of operator-controlled door opening; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
- .5 Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

- .6 Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.

2.4 LOW-ENERGY DOOR OPERATORS

- .1 Standard: BHMA A156.19.
- .2 Performance Requirements:
 - .1 Opening Force if Power Fails: Not more than 67 N required to release a latch if provided, not more than 133 N required to manually set door in motion, and not more than 67 N required to fully open door.
 - .2 Entrapment Protection: Not more than 67 N required to prevent stopped door from closing or opening.
- .3 Configuration: Operator to control single swinging door unless otherwise noted .
 - .1 Traffic Pattern: Two way.
 - .2 Operator Mounting: Surface, unless otherwise noted.
- .4 Operation: Power opening and power-assisted spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
- .5 Operating System: Electromechanical.
- .6 Microprocessor Control Unit: Solid-state controls.
- .7 Features:
 - .1 Adjustable opening and closing speed.
 - .2 Adjustable opening and closing force.
 - .3 Adjustable backcheck.
 - .4 Adjustable hold-open time from zero to 30 seconds.
 - .5 Adjustable time delay.
 - .6 Adjustable acceleration.
 - .7 Obstruction recycle.
 - .8 On-off/hold-open switch to control electric power to operator; key operated.
 - .9 .
- .8 Exposed Finish: Finish exposed components with finish matching door and frame.

2.5 FABRICATION

- .1 Factory fabricate automatic door operators to comply with indicated standards.
- .2 Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.
- .3 Form aluminum shapes before finishing.
- .4 Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

2.6 ACCESSORIES

- .1 Signage: As required by cited BHMA standard for the type of operator.
 - .1 Application Process: Door manufacturer's standard process.
 - .2 Provide sign materials with instructions for field application when operators are installed.

2.7 GENERAL FINISH REQUIREMENTS

- .1 Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.
- .2 Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- .3 Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- .4 Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- .1 Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- .2 Colour Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
- .3 Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.
- .2 Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 General: Install complete automatic door operators according to manufacturer's written instructions, including activation and safety devices, control wiring, and remote power units if any; connection to the building's power supply; and signage.
 - .1 Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - .2 Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
 - .3 Low-Energy Door Operator Installation Standard: BHMA A156.19.
- .2 Power Connection: See Division 26 Sections for connection to electrical power distribution system.

- .3 Access-Control System: Connect operators to access-control system if specified and then in accordance with Division 28 Section *Access Control*.
- .4 Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 ADJUSTING

- .1 Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - .1 Adjust operators on exterior doors for weather tight closure.
 - .2 After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
 - .3 Readjust automatic door operators after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
 - .4 Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 DEMONSTRATION

- .1 Engage a certified inspector to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION

PART 1

GENERAL

1.1

SECTION INCLUDES

- .1 Moisture testing of substrates.
- .2 Surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to limits defined under MPI Repainting Maintenance Manual requirements.
- .3 Specific pre-treatments noted herein or specified in the MPI Repainting Maintenance Manual.
- .4 Sealing/touch-up, spot priming, and/or full priming surfaces for repainting in accordance with MPI Repainting Maintenance Manual requirements.
- .5 Provision of safe and adequate ventilation as required where toxic and/or volatile/flammable materials are being used over and above temporary ventilation supplied by others.

1.2

REFERENCES

- .1 Maintenance Repainting Manual by the Master Painters Institute (MPI), including Identifiers, Evaluation, Systems, Preparation and Approved Product List.
- .2 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .3 National Fire Code of Canada.

1.3

QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. Provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in repainting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with applicable trade regulations.
- .3 Conform to latest MPI requirements for interior repainting work including cleaning, preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the latest edition of the MPI Approved Product List and shall be from a single manufacturer for each system used.
- .5 Paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Maintenance Repainting Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Owner's Representative.

- .7 Standard of Acceptance: When viewed using final lighting source surfaces shall indicate the following:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
 - .2 Ceilings: No defects visible from floor at 45° to surface.
 - .3 Final coat to exhibit uniformity of colour and sheen across full surface area.
- 1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS
 - .1 Provide paint products meeting MPI "Environmentally Friendly" E2 or E3 ratings based on VOC (EPA Method 24) content levels.
- 1.5 SCHEDULING OF WORK
 - .1 Submit work schedule for various stages of painting to Owner's Representative for approval. Submit schedule a minimum of two (2) working days in advance of proposed operations.
 - .2 Paint occupied facilities in accordance with approved schedule. Schedule operations to approval of Owner's Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.
 - .3 Obtain written authorization from Owner's Representative for changes in work schedule.
 - .4 Schedule repainting operations to prevent disruption by other trades if applicable and by occupants in and about the building.
- 1.6 SUBMITTALS
 - .1 Submit full range colour sample chips for review and selection. Indicate where colour availability is restricted.
 - .2 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used.
 - .3 Submit WHMIS MSDS - Material Safety Data Sheets for paint and coating materials to be used.
 - .4 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use (i.e. materials and location).
 - .2 Manufacturer's product number.
 - .3 Colour code numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).
 - .5 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating, with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm birch plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

- .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .6 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
- 1.7 QUALITY CONTROL
 - .1 Provide a mock-up in accordance with requirements of Section 01 45 00 - Quality Control to Owner's Representative.
 - .2 Prepare and repaint mock-up designated interior room, surface or item to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Maintenance Repainting Manual standards for review and approval.
 - .3 When approved, repainted room, surface and/or item shall become acceptable standard of finish quality and workmanship for similar on-site interior repainting work.
- 1.8 DELIVERY, HANDLING AND STORAGE
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver and store materials in original containers, sealed, with labels intact.
 - .3 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
 - .4 Remove damaged, opened and rejected materials from site.
 - .5 Observe manufacturer's recommendations for storage and handling.
 - .6 Store materials and equipment in a secure, dry, well-ventilated area with temperature range between 7°C to 30°C. Store materials and supplies away from heat generating devices and sensitive products above minimum temperature as recommended by manufacturer.
 - .7 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Owner's Representative. After completion of operations, return areas to clean condition to approval of Owner's Representative.
 - .8 Remove paint materials from storage in quantities required for same day use.
 - .9 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
 - .10 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

- .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

- .1 Ventilate enclosed spaces.
- .2 Perform no repainting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application and until paint has cured sufficiently.
- .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
- .4 Provide temporary ventilating and heating equipment where permanent facilities are not available.
- .5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

- .1 Unless specifically pre-approved by Owner's Representative and applied product manufacturer, perform no repainting work when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 Relative humidity is above 85% or when dew point is less than 3°C variance between air/surface temperature.
 - .5 Rain or snow is forecast to occur before paint has thoroughly cured.
 - .6 It is foggy, misty, raining or snowing at site.
- .2 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except use a simple "cover patch test" on concrete floors to be repainted.
- .3 Perform no repainting work when maximum moisture content of substrate exceeds:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
- .4 Test painted concrete, masonry and plaster surfaces for alkalinity as required.

.3 Application Requirements:

- .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when ventilation conditions are such that airborne particles will not affect quality of finished surface.
- .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
- .3 Apply paint when previous coat of paint is dry or adequately cured, unless otherwise pre-approved by the specific coating manufacturer.

- .4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
- .5 Do not apply paint when:
 - .1 Temperature is expected to drop below 10°C before paint has thoroughly cured.
 - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
 - .3 Surface to be painted is wet, damp or frosted.
- .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
- .7 Schedule repainting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
- .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by Owner's Representative.
- .6 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .7 Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

- .10 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .11 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project.
- .2 Paint materials for repaint systems shall be products of a single manufacturer.
- .3 Low odour products: whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour. Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Paints, coatings, thinners, solvents, cleaners and other fluids used in repainting, shall:
 - .1 Be water-based, water soluble, water clean-up.
 - .2 Be non-flammable.
 - .3 Not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
 - .4 Be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .5 Be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .6 Be manufactured in a manner where matter generating a 'Biochemical Oxygen Demand' (BOD) in undiluted production plant effluent discharged to a natural watercourse or a sewage treatment facility lacking secondary treatment does not exceed 15 mg/L.
 - .7 Be manufactured in a manner where the total suspended solids (TSS) content in undiluted production plant effluent discharged to a natural watercourse or a sewage treatment facility lacking secondary treatment does not exceed 15 mg/L.
- .5 Paints and coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .6 Paints and coatings must not be formulated or manufactured with formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .7 Water-borne paints and stains, and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

- .1 Owner's Representative will provide Colour Schedule after Contract award.
- .2 Selection of colours will be from manufacturers full range of colours.

- .3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .4 Second coat in a three coat repaint system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed with Owner's Representative written permission.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or such organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in strict accordance with paint manufacturer' instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Owner's Representative.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI gloss / sheen standard values:

Gloss Level Category	Units @ 60°	Units @ 85°
G1 - matte finish	0 to 5	maximum 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	minimum 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of repainted surfaces shall be as specified herein.

2.5 INTERIOR PAINTING SYSTEMS

- .1 The following paint formulas requires a two coat finish as indicated in the MPI Repainting Maintenance Manual.
- .2 RIN 2.1 - Asphalt Surfaces: (zone/traffic marking on interior drive and parking areas, etc.).
 - .1 RIN 2.1B - Alkyd Zone/Traffic Marking.
- .3 RIN 3.1 - Concrete Vertical Surfaces: (including soffits).
 - .1 RIN 3.1A - Latex G4 finish.
- .4 RIN 3.2 - Concrete Horizontal Surfaces: (floors and stairs, etc.).

- .1 RIN 3.2A - Latex Floor Enamel G4.
- .5 RIN 4.1 - Clay Masonry Units: (pressed and extruded brick).
 - .1 RIN 4.1A - Latex G4 finish.
- .6 RIN 4.2 - Concrete Masonry Units: (Concrete Block and Concrete Brick).
 - .1 RIN 4.2A - Latex G4 finish.
- .7 RIN 5.1 - Structural Steel and Metal Fabrications.
 - .1 RIN 5.1K - 2 Component Epoxy finish.
- .8 RIN 5.3 - Galvanized Metal: (High Contact/High Traffic Areas (Doors, Frames, Railings, Pipes, Handrails, etc.). Low Contact/Low traffic areas (Overhead Decking, Pipes, Ducts, etc.)
 - .1 RIN 5.3C - Alkyd G5 finish.
- .9 RIN 6.2 - Dimension Lumber: (Columns, Beams, Exposed Joists, Underside of Decking, etc.)
 - .1 RIN 6.2A - Latex G4 (over latex primer).
- .10 RIN 6.3 - Dressed Lumber: (Including Doors, Door and Window Frames, Mouldings, etc.)
 - .1 RIN 6.3A - Latex G5 finish.
- .11 RIN 6.4 - Wood Panelling and Casework: (Partitions, Panels, Shelving, Millwork, etc.).
 - .1 RIN 6.4B - Latex G4 finish.
- .12 RIN 6.5 - Wood Floors and Stairs: (Including Hardwood Flooring).
 - .1 RIN 6.5A - Alkyd Floor Enamel G4 (over primer).
- .13 RIN 9.2 - Plaster and Gypsum Board: (gypsum wallboard, drywall, "sheet rock type material", etc.,
 - .1 RIN 9.2A - Latex G5 (over latex sealer) for walls.
 - .2 RIN 9.2A - Latex G1 (over latex sealer) for ceilings.
- .14 RIN 10.1 - Canvas and Cotton Coverings:
 - .1 RIN 10.1B - Alkyd G5 finish.

PART 3 EXECUTION

3.1 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Maintenance Repainting Manual requirements except where otherwise specified.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Prior to commencing work, thoroughly examine site conditions and existing interior substrates to be repainted. Report in writing to Owner's Representative damages, defects, or unsatisfactory or unfavourable conditions or surfaces that will adversely affect this work.

- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Owner's Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Concrete: 12%.
 - .2 Clay and Concrete Block/Brick: 12%.
 - .3 Wood: 15%.
- .4 No repainting work shall commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency. Commencement of work shall not be held to imply acceptance of surfaces except as qualified herein.
- .5 Degree of surface deterioration (DSD) shall be assessed using MPI Identifiers and Assessment criteria indicated in the MPI Maintenance Repainting Manual. MPI DSD ratings and descriptions are as follows:

Condition	Description
DSD-0	Sound Surface (includes visual (aesthetic) defects that do not affect film's protective properties).
DSD-1	Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes scratches, etc.).
DSD-2	Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, staining, etc.).
DSD-3	Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
DSD-4	Substrate Damage (repair or replacement of surface required by others).

3.3 PROTECTION

- .1 Protect existing surfaces and adjacent fixtures and furnishings from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Owner's Representative.
- .2 Cover or mask windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- .3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .4 Protect factory finished products and equipment.
- .5 Protect general public and building occupants in and about the building.
- .6 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and surface mounted equipment, fittings and fastenings prior to undertaking re-painting operations. Items shall be securely stored and re-installed after painting is completed.
- .7 Move and cover furniture and portable equipment as necessary to carry out repainting operations. Replace as painting operations progress.

- .8 As repainting operations progress, place "WET PAINT" signs in occupied areas to approval of Owner's Representative.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare interior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and to dry thoroughly. Allow sufficient drying time and test surfaces using an electronic moisture meter before commencing work.
 - .5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
 - .6 Many water-based paints cannot be removed with water once dried. Minimize the use of kerosene or such organic solvents to clean up water-based paints.
- .2 Where required, pressure wash exterior surfaces prior to repainting in accordance with MPI standards for type of surfaces and recommended pressures to ensure complete removal of loose paint, stains, dirt, and foreign matter. This work to be carried out by qualified tradesman experienced in pressure water cleaning. Use of spray equipment such as water hose cleaning will not be considered satisfactory unless specified herein. Allow sufficient drying time and test surfaces using an electronic moisture meter before commencing work.
- .3 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminants from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.
- .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .5 Do not apply paint until prepared surfaces have been accepted by Owner's Representative.
- .6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.5 APPLICATION

- .1 Method of application to be as approved by Owner's Representative. Apply paint by brush, roller, air sprayer, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

- .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
 - .3 Spray Application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application by either continuous mechanical agitation or intermittent agitation frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Back roll spray applications and brush out runs and sags immediately.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
 - .4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Owner's Representative.
 - .5 Apply paint coats in a continuous manner and allow surfaces to dry and properly cure between coats for minimum time period as recommended by manufacturer. Minimum dry film thickness of coats shall not be less than that recommended by the manufacturer. Repaint thin spots or bare areas before next coat of paint is applied.
 - .6 Sand and dust between coats to remove visible defects.
 - .7 Repaint surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
 - .8 Repaint top, bottom, and vertical edges of doors to be repainted.
 - .9 Repaint inside of cupboards and cabinets as specified for outside surfaces.
 - .10 Repaint closets and alcoves to match existing, unless otherwise scheduled or noted.
- 3.6 MECHANICAL / ELECTRICAL EQUIPMENT
- .1 Unless otherwise noted, repainting shall also include exposed to view / previously painted mechanical and electrical equipment and components (panels, conduits, piping, hangers, ductwork, etc.).
 - .2 Touch up scratches and marks and repaint such mechanical and electrical equipment and components with colour, and sheen finish to match existing unless otherwise noted or scheduled.
 - .3 Do not paint over name plates or instruction labels.
 - .4 Leave unfinished exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish.

- .5 Keep sprinkler heads free of paint.
- .6 Do not paint interior transformers and substation equipment.
- 3.7 FIRE SEPARATIONS
 - .1 Contractor to stencil on both sides of fire rated partitions the fire rating for that assembly (i.e.: 1 HR FIRE SEPARATION).
 - .2 Stenciled fire ratings to be minimum 100 mm high RED letters, minimum 150 mm above finished ceilings, and minimum 2400 mm o.c. along partition.
- 3.8 FIELD QUALITY CONTROL
 - .1 Field inspection of exterior painting operations to be carried out by Owner's Representative.
 - .2 Advise Owner's Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
 - .3 Co-operate with Owner's Representative and provide access to areas of work.
- 3.9 CLEAN-UP
 - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
 - .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
 - .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
 - .4 Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction and as noted herein.
 - .5 Painting equipment shall be cleaned in leak-proof containers that will permit particulate matter to settle out and be collected. Sediment remaining from cleaning operations shall be recycled or disposed of in a manner acceptable to authorities having jurisdiction.
 - .6 Paint and coatings in excess of repainting requirements shall be recycled as noted herein.
- 3.10 RESTORATION
 - .1 Clean and re-install hardware items removed before undertaken painting operations.
 - .2 Remove protective coverings and warning signs as soon as practical after operations cease.
 - .3 Remove paint splashings on affected exposed surfaces. Remove smears and spatter immediately as operations progress, using compatible solvent.

- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Owner's Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Owner's Representative.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Non-load-bearing steel framing members for the following applications:
 - .1 Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - .2 Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
 - .2 Sheet steel security linear panel.
- .2 Types of items you will not find described in this Section:
 - .1 Wind-bearing steel stud framing.
 - .2 Insulation.
 - .3 Head-of-wall joint systems installed with non-load-bearing steel framing.
 - .4 Non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- .1 Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to CAN/ULC-S101 by an independent testing agency.
- .2 STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- .1 Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - .1 Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - .2 Protective Coating: G60 Coating with equivalent corrosion resistance of ASTM A 653/A 653M, Z120, hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- .1 Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 1.59 mm diameter wire, or double strand of 1.21 mm diameter wire.
- .2 Hanger Attachments to Concrete:

- .1 Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - .2 Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
 - .3 Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 4.12 mm diameter.
 - .4 Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 1.37 mm and minimum 12.7 mm wide flanges.
 - .5 Furring Channels (Furring Members):
 - .1 Cold-Rolled Channels: 1.37 mm bare-steel thickness, with minimum 12.7 mm wide flanges, 19.1 mm deep.
 - .2 Steel Studs: ASTM C 645.
 - .1 Minimum Base-Metal Thickness: 0.45 mm.
 - .2 Depth: As indicated on Drawings.
 - .3 Hat-Shaped, Rigid Furring Channels: ASTM C 645, 22.2 mm deep.
 - .1 Minimum Base Metal Thickness: 0.45 mm.
 - .4 Resilient Furring Channels: 12.7 mm deep members designed to reduce sound transmission.
 - .1 Configuration: Asymmetrical or hat shaped.
- 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES
- .1 Steel Studs and Runners: ASTM C 645.
 - .1 Minimum Base-Metal Thickness: 0.45 mm.
 - .2 Depth: As indicated on Drawings.
 - .2 Slip-Type Head Joints: At underside of floor and roof decks and underside of structural framing, provide one of the following:
 - .1 Single Long-Leg Runner System: ASTM C 645 top runner with 50.8 mm deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 305 mm of the top of studs to provide lateral bracing.
 - .2 Double-Runner System: ASTM C 645 top runners, inside runner with 50.8 mm deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - .3 Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - .3 Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - .4 Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - .1 Minimum Base-Metal Thickness: 0.79 mm.
 - .5 Cold-Rolled Channel Bridging: 1.37 mm bare-steel thickness, with minimum 12.7 mm wide flanges.
 - .6 Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - .7 Resilient Furring Channels: 12.7 mm deep, steel sheet members designed to reduce sound transmission.

- .8 Cold-Rolled Furring Channels: 1.37 mm bare-steel thickness, with minimum 12.7 mm wide flanges.

2.4 SHEET METAL SECURITY LINEAR PANEL

- .1 Linear Panel: sheet metal of 1.99 mm minimum bare metal thickness, commercial quality consisting of one of the following:
 - .1 Zinc coated sheet steel to ASTM A 653/A 653M, with Z275 designation zinc coating;
 - .2 Aluminum-zinc alloy coated sheet steel to ASTM A 792/A 792M, grade 33 or 37 with AZ150 coating, regular spangle surface, not chemically treated for paint finish.

2.5 AUXILIARY MATERIALS

- .1 General: Provide auxiliary materials that comply with referenced installation standards.
 - .1 Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
 - .2 Isolation Strip at Exterior Walls: Provide the following:
 - .1 Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 3.2 mm thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
 - .1 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- .2 Coordination with Sprayed Fire-Resistive Materials, if material is used on this project:
 - .1 Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 600 mm o.c.
 - .2 After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- .1 Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 - .1 Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- .2 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- .3 Install bracing at terminations in assemblies.

- .4 Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- .1 Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- .2 Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- .3 Suspend hangers from building structure as follows:
 - .1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - .1 Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - .2 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - .1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - .3 Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - .4 Do not connect or suspend steel framing from ducts, pipes, or conduit.
 - .4 Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
 - .5 Installation Tolerances: Install suspension systems that are level to within 3 mm in 3.6 m measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- .1 Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- .2 Install studs so flanges within framing system point in same direction.
- .3 Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - .1 Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - .2 Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - .1 Install two studs at each jamb, unless otherwise indicated.
 - .2 Frame around door openings intended for doors greater than 90 kg in weight using studs having minimum thickness of 0.79 mm
 - .3 Install cripple studs at head adjacent to each jamb stud, with a minimum 12.7 mm clearance from jamb stud to allow for installation of control joint in finished assembly.
 - .4 Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

- .3 Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- .4 Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - .1 Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated.
- .5 Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- .6 Curved Partitions:
 - .1 Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - .2 Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 150 mm o.c.

- .4 Direct Furring:
 - .1 Screw to wood framing.
 - .2 Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 610 mm o.c.

- .5 Installation Tolerance: Install each framing member so fastening surfaces vary not more than 3 mm from the plane formed by faces of adjacent framing.

- 3.6 SHEET METAL SECURITY LINEAR PANEL
 - .1 Install sheet metal security linear panels in locations indicated.
 - .2 Prepare sheet metal security linear panel with 9.5 mm holes for installation, plug welded to the room-exterior side of metal studs vertically or screw-fasten to the room-exterior side of wood studs; at 400 mm o.c. and horizontally at 300 mm o.c. maximum.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Interior gypsum board.
 - .2 Tile backing panels.
 - .3 Cementitious backer units (cement board).

- .2 Types of items you will not find described in this Section:
 - .1 Exterior gypsum board for ceilings and soffits.
 - .2 Cement board as a substrate for exterior cement board stucco system.
 - .3 Load-bearing steel framing that supports gypsum board.
 - .4 Wood framing and furring that supports gypsum board.
 - .5 Gypsum sheathing.
 - .6 Insulation and vapour retarders installed in assemblies that incorporate gypsum board.
 - .7 Fire Stop Systems for head-of-wall assemblies that incorporate gypsum board.
 - .8 Non-structural framing and suspension systems that support gypsum board.
 - .9 Metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - .10 Gypsum base for veneer plaster and for other components of gypsum-veneer-plaster finishes.
 - .11 Primers applied to gypsum board surfaces.

1.2 SUBMITTALS

- .1 Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- .1 Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to CAN/ULC-S101 by an independent testing agency.

- .2 STC -Rated Assemblies: For STC-rated assemblies provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.4 STORAGE AND HANDLING

- .1 Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

- .1 Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

- .2 Do not install interior products until installation areas are enclosed and conditioned.

- .3 Do not install panels that are wet, those that are moisture damaged, and those that are mould damaged.
 - .1 Indications that panels are wet or moisture damaged include, but are not limited to, discolouration, sagging, or irregular shape.

- .2 Indications that panels are mould damaged include, but are not limited to, fuzzy or splotchy surface contamination and discolouration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

- .1 Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD (Also referred on drawings as **GYP BD**)

- .1 General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - .1 Regular Type.
 - .2 Type X.
 - .3 Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - .4 Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - .5 Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
 - .6 Moisture- and Mould-Resistant Type: With moisture- and mould-resistant core and surfaces, regular type and Type X gypsum board.

2.3 TILE BACKING PANELS (Also referred on drawings as **TILE BACKER**)

- .1 Glass-Mat, Water-Resistant Backing Board: Any of the following:
 - .1 Complying with ASTM C 1178/C 1178M.
 - .1 Product: Subject to compliance with requirements, provide *DensShield Tile Guard* by G-P Gypsum; or approved alternate.
 - .2 Product: Subject to compliance with requirements, provide *GlasRoc Tile Backer Regular* by CertainTeed; or approved alternate.
 - .2 Complying with ASTM C1177/C 1177M.
 - .1 Product: Subject to compliance with requirements, provide *DensArmor Plus Interior Guard* by G-P Gypsum; or approved alternate.

2.4 CEMENTITIOUS BACKER UNITS (Also referred on drawings as **CBU** or **Cement Board**)

- .1 Cementitious Backer Units: ANSI A118.9.
 - .1 Thickness: As indicated on Drawings.

2.5 TRIM ACCESSORIES

- .1 Interior Trim: ASTM C 1047.
 - .1 Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 - .2 Shapes:
 - .1 Corner bead.
 - .2 Bullnose bead.
 - .3 LC-Bead: J-shaped; exposed long flange receives joint compound.
 - .4 L-Bead: L-shaped; exposed long flange receives joint compound.
 - .5 U-Bead: J-shaped; exposed short flange does not receive joint compound.

- .6 Expansion (control) joint.
- .7 Curved-Edge Corner bead: With notched or flexible flanges.
- .8 Other profiles as indicated or required.

2.6 JOINT TREATMENT MATERIALS

- .1 General: Comply with ASTM C 475/C 475M.
- .2 Joint Tape:
 - .1 Interior Gypsum Wallboard: Paper.
 - .2 Tile Backing Panels: As recommended by panel manufacturer.
- .3 Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - .1 Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - .2 Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - .1 Use setting-type compound for installing paper-faced metal trim accessories.
 - .3 Fill Coat: For second coat, use setting-type, sandable topping compound.
 - .4 Finish Coat: For third coat, use setting-type, sandable topping compound.
 - .5 Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- .4 Joint Compound for Tile Backing Panels:
 - .1 Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
- .5 Joint Compound for Cementitious Backer Units:
 - .1 Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- .1 General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- .2 Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- .3 Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - .1 Use screws complying with ASTM C 954 for fastening panels to steel members from 0.84 to 2.84 mm thick.
 - .2 For fastening cementitious backer units, use non-corrosive screws of type and size recommended by panel manufacturer.
- .4 Acoustical Sealant: As specified in Division 07 Section *Joint Sealants*.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

.2 Examine panels before installation. Reject panels that are wet, moisture damaged, and mould damaged.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

.1 Comply with ASTM C 840.

.2 Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

.3 Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1.5 mm of open space between panels. Do not force into place.

.4 Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

.5 Form control and expansion joints with space between edges of adjoining gypsum panels.

.6 Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

.1 Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 0.7 sq. m in area.

.2 Fit gypsum panels around ducts, pipes, and conduits.

.3 Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 6.4 to 9.5 mm wide joints to install sealant.

.7 Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 6.4 to 12.7 mm wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

.8 Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

.9 Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

.10 STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

.1 Install interior gypsum board in the following locations:

.1 Regular Type: Apply on vertical surfaces, unless otherwise indicated.

.2 Type X: Apply where required for fire-resistance-rated assembly.

- .3 Flexible Type: Apply in double layer at curved assemblies.
 - .4 Ceiling Type: Apply at ceiling and horizontal surfaces.
 - .5 Abuse-Resistant Type: Apply where indicated on Drawings.
 - .6 Moisture- and Mould-Resistant Type: Apply to inside of all exterior walls, in janitor's closets, in locker rooms, and in shower areas, provided the surface does not serve as a substrate for tile; and other locations indicated on Drawings.
- .2 Single-Layer Application:
- .1 On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - .2 On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - .1 Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - .2 At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - .3 On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - .4 Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- .3 Multilayer Application:
- .1 On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 400 mm minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - .2 On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - .3 On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - .4 Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- .4 Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- .5 Curved Surfaces:
- .1 Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 300-mm- long straight sections at ends of curves and tangent to them.
 - .2 For double-layer construction, fasten base layer to studs with screws 400 mm o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 300 mm o.c.
- 3.4 APPLYING TILE BACKING PANELS
- .1 Install tile backing panels in the following locations:
 - .1 Regular type: As substrate for tile finishes, except as noted.
 - .1 Use Type X as substrate for tile finish where required for fire-resistance-rated assembly.
 - .2 Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions. Install with 6.4 mm gap where panels abut other construction or penetrations.

- .3 Where tile backing panels about other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- 3.5 APPLY CEMENTITIOUS BACKER UNITS
 - .1 Install cementitious backer units in the following locations:
 - .1 Only at locations specifically indicated to receive cementitious backer units.
 - .2 Cementitious Backer Units: install to ANSI A108.11.
- 3.6 INSTALLING TRIM ACCESSORIES
 - .1 General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 - .2 Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Engineer for visual effect.
 - .3 Interior Trim: Install in the following locations:
 - .1 Corner bead: Use at outside corners.
 - .2 Bullnose Bead: Use where indicated.
 - .3 LC-Bead: Use at exposed panel edges.
 - .4 Curved-Edge Corner bead: Use at curved openings.
- 3.7 FINISHING GYPSUM BOARD
 - .1 General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 - .2 Prefill open joints and damaged surface areas.
 - .3 Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
 - .4 Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - .1 Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - .2 Level 2: Panels that are substrate for tile.
 - .3 Level 3: Where indicated on Drawings.
 - .4 Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - .1 Primer and its application to surfaces are specified in other Division 09 Sections.
 - .5 Level 5: Where indicated on Drawings.
 - .1 Primer and its application to surfaces are specified in other Division 09 Sections.
 - .5 Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
 - .6 Cementitious Backer Units: Finish according to manufacturer's written instructions.
- 3.8 PROTECTION
 - .1 Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- .2 Remove and replace panels that are wet, moisture damaged, and mould damaged.
 - .1 Indications that panels are wet or moisture damaged include, but are not limited to, discolouration, sagging, or irregular shape.
 - .2 Indications that panels are mould damaged include, but are not limited to, fuzzy or splotchy surface contamination and discolouration.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Acoustical ceiling panels.
 - .2 Exposed suspension systems for ceilings, having narrow and wide capped steel faces.
- .2 Types of items you will not find described in this Section:
 - .1 Exposed suspension systems having extra-wide faces.
 - .2 Exposed face suspension systems of aluminum construction.
 - .3 Clean room suspension systems.
 - .4 Ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.
 - .5 Acoustical Metal Pan Ceilings.
 - .6 Linear Metal Ceilings.
 - .7 Suspended Decorative Grids.
- .3 Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.2 DEFINITIONS

- .1 AC: Articulation Class.
- .2 CAC: Ceiling Attenuation Class.
- .3 LR: Light Reflectance coefficient.
- .4 NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated.
- .2 Samples for Initial Selection: For components with factory-applied colour finishes.
- .3 Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - .1 Acoustical Panel: Set of 150 mm square Samples of each type, colour, pattern, and texture.
 - .2 Exposed Suspension System Members, Mouldings, and Trim: Set of 300 mm long Samples of each type, finish, and colour.
- .4 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- .5 Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- .1 Source Limitations:

- .1 Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
- .2 Suspension System: Obtain each type through one source from a single manufacturer.

- .2 Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - .1 Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per CAN/ULC-S101 by ULC or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - .1 Fire-Resistance Ratings: Indicated by design designations from ULC's *Fire Resistance Directory* or from the listings of another testing and inspecting agency.
 - .2 Identify materials with appropriate markings of applicable testing and inspecting agency.
 - .2 Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with CAN/ULC S102:
 - .1 Flame Spread Rating: 25 or less.
 - .2 Smoke-Developed Rating: 50 or less.

- .3 Mock-ups: Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .1 Approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

- .4 Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section *Project Management and Coordination*.

- 1.5 DELIVERY, STORAGE, AND HANDLING
 - .1 Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
 - .2 Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
 - .3 Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

- 1.6 PROJECT CONDITIONS
 - .1 Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - .1 Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

- 1.7 COORDINATION
 - .1 Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

- 1.8 EXTRA MATERIALS
 - .1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - .1 Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- .1 Recycled Content
 - .1 Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
- .2 Acoustical Panel Standard
 - .1 Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- .3 Acoustical Panel Colours and Patterns
 - .1 Match appearance characteristics indicated for each product type.
 - .2 Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Owner's Representative from each manufacturer's full range that comply with requirements indicated for type, pattern, colour, light reflectance, acoustical performance, edge detail, and size.
- .4 Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment
 - .1 For acoustical panels indicated, treat with manufacturer's standard antimicrobial formulation that inhibits fungus, mould, mildew, and gram-positive and gram-negative bacteria and showing no mould, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- .1 General
 - .1 Provide panels complying with ASTM E 1264 for type, form, and pattern indicated and as outlined below.
 - .2 Fire Rating
 - .1 Required when installed in a fire rated assembly.
 - .3 Colour
 - .1 White, unless otherwise noted.
 - .4 Edge Detail
 - .1 Square edge, unless otherwise noted.
 - .5 Thickness
 - .1 15 mm unless otherwise indicated or required for fire rating.
 - .6 Modular Size
 - .1 610 x 610 and 610 x 1220 mm as implied by grid shown on drawings.
 - .7 Flame Spread Rating: 25 or less.
 - .8 Smoke Developed: 50 or less.
- .2 Acoustical Panel **AP1**; if required (typical)
 - .1 Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 - .2 Pattern: CD (perforated small holes and fissured).
 - .3 Light Reflectance (LR): Not less than 0.80.
 - .4 Noise Reduction Coefficient (NRC): Range of 0.55 to 0.65
 - .5 Ceiling Attenuation Class (CAC): Not less than 35.
 - .6 Thickness: 15mm
 - .7 Colour: White

- .8 Acceptable Products:
 - .1 "USG Radar Basic, Item No. 2110" (610 x 610) by USG CGC or approved alternate.
 - .2 "USG Radar Basic, Item No. 2310" (610 x 1220) by USG CGC or approved alternate.
- .3 Acoustical Panel **AP2**; if required (high performance for open office environments)
 - .1 Type and Form: Type XII, glass-fibre base with membrane-faced overlay; Form 2, cloth.
 - .2 Pattern: E (lightly textured).
 - .3 Light Reflectance (LR): Not less than 0.90.
 - .4 Noise Reduction Coefficient (NRC): Not less than 0.95.
 - .5 Thickness: 25 mm
- .4 Acoustical Panels **AP3, AP4, AP5**...; if required
 - .1 Refer to drawings.
- 2.3 METAL SUSPENSION SYSTEMS, GENERAL
 - .1 Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - .2 Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
 - .3 Finishes and Colours, General: Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - .1 High-Humidity Finish: Comply with ASTM C 635 requirements for *Coating Classification for Severe Environment Performance* where high-humidity finishes are indicated.
 - .4 Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, *Direct Hung*, unless otherwise indicated.
 - .1 Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - .1 Type: any one of the following:
 - .1 Cast-in-place
 - .2 Postinstalled expansion
 - .3 Postinstalled bonded anchors.
 - .2 Corrosion Protection: any one of the following:
 - .1 Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - .2 Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - .3 Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - .2 Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
 - .5 Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

- .1 Material: any one of the following:
 - .1 Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - .2 Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - .3 Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
- .6 Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- .7 Angle Hangers: Angles with legs not less than 22 mm wide; formed with 1 mm thick, galvanized steel sheet complying with ASTM A 653/A 653M, Z275 coating designation; with bolted connections and 8 mm diameter bolts.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- .1 Use wide-face suspension system unless otherwise indicated.
 - .1 Use narrow-face suspension system only when specifically indicated.
- .2 Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, Z180, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, Z180 coating designation, with prefinished, cold-rolled, 24 mm wide, aluminum caps on flanges.
 - .1 Fire Rating: required when installed in a fire rated assembly.
 - .2 Structural Classification: Intermediate-duty system.
 - .3 Face Design: Flat, flush.
 - .4 Cap Finish: Painted white, unless otherwise noted.
- .3 Narrow-Face, Steel-Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than Z90 coating designation, with prefinished, cold-rolled, 15 mm wide metal caps on flanges.
 - .1 Fire Rating: required when installed in a fire rated assembly.
 - .2 Structural Classification: Intermediate-duty system.
 - .3 Face Design: Flat, flush.
 - .4 Cap Finish: Painted white, unless otherwise noted.

2.5 METAL EDGE MOLDINGS AND TRIM

- .1 Roll-Formed, Sheet-Metal Edge Mouldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard mouldings; formed from sheet metal of same material, finish, and colour as that used for exposed flanges of suspension system runners.
 - .1 Provide manufacturer's standard edge mouldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - .2 For lay-in panels with reveal edge details, provide stepped edge moulding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - .3 For circular penetrations of ceiling, provide edge mouldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

- .1 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- .1 General: Install acoustical panel ceilings to comply with ASTM C 63, per manufacturer's written instructions and CISCA's *Ceiling Systems Handbook*.
 - .1 Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- .2 Suspend ceiling hangers from building's structural members and as follows:
 - .1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - .2 Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - .3 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - .4 Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - .5 Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - .6 When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - .7 Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - .8 Space hangers not more than 1200 mm o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 200 mm from ends of each member.
 - .9 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- .3 Install edge mouldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - .1 Screw attach mouldings to substrate at intervals not more than 400 mm o.c. and not more than 75 mm from ends, levelling with ceiling suspension system to a tolerance of 3.2 mm in 3.6 m. Mitre corners accurately and connect securely.
 - .2 Do not use exposed fasteners, including pop rivets, on mouldings and trim.
- .4 Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- .5 Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge mouldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - .1 Arrange directionally patterned acoustical panels as follows:
 - .1 Install panels with pattern running in one direction parallel to long axis of space.

- .2 For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and mouldings.
- .3 For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
- .4 For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
- .5 Paint cut edges of panel remaining exposed after installation; match colour of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
- .6 Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- .1 Clean exposed surfaces of acoustical panel ceilings, including trim, edge mouldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touch-up of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Resilient Base
 - .1 Typical
 - .2 Contoured resilient base.
 - .2 Resilient stair accessories
 - .1 One piece resilient stair tread and riser
 - .3 Resilient moulding accessories.
- .2 Types of items you will not find described in this Section:
 - .1 Resilient sheet floor coverings.
 - .2 Linoleum floor coverings.
 - .3 Resilient floor tile.
 - .4 Resilient floor coverings designed to control electrostatic discharge.
 - .5 Resilient floor coverings for use in athletic-activity or support areas.

1.2 SUBMITTALS

- .1 Product Data: For each type of product indicated.
- .2 Samples for Initial Selection: For each type of product indicated.
- .3 Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 300 mm long, of each resilient product colour, texture, and pattern required.

1.3 QUALITY ASSURANCE

- .1 Mock-ups: Provide resilient products with mock-ups specified in other Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 10 deg C or more than 32 deg C.

1.5 PROJECT CONDITIONS

- .1 Maintain ambient temperatures within range recommended by manufacturer, but not less than 21 deg C or more than 35 deg C, in spaces to receive resilient products during the following time periods:
 - .1 48 hours before installation.
 - .2 During installation.
 - .3 48 hours after installation.
- .2 Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 13 deg C or more than 35 deg C.
- .3 Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

- .1 Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - .1 Furnish not less than 3 linear m for every 150 linear m or fraction thereof, of each type, colour, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE - TYPICAL

- .1 Refer to drawings to determine if resilient base is required and if so, the required locations.
- .2 Resilient Base Standard: to ASTM F 1861.
 - .1 Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 - .2 Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
 - .3 Style:
 - .1 Cove (base with toe): unless otherwise indicated.
 - .2 Straight (flat or toeless), at carpet flooring locations.
 - .4 Minimum Thickness
 - .1 3.2 mm.
 - .5 Height
 - .1 102 mm, unless otherwise indicated.
 - .6 Lengths
 - .1 Coils in manufacturer's standard length.
 - .7 Outside Corners
 - .1 Job formed or preformed.
 - .8 Inside Corners
 - .1 Job formed or preformed.
 - .9 Colours and Patterns
 - .1 As selected by Owner's Representative from full range of industry colours if not specifically indicated in the *Interior Finishes Legend*.

2.2 CONTOURED RESILIENT BASE

- .1 Refer to drawings to determine if contoured resilient base is required and if so, the required locations.
- .2 Contoured resilient base to replicated moulded wood base profiles, to ASTM F-1861, Type TP, Group 1 (solid) Standard.
- .3 Colours and Profiles
 - .1 As selected by Owner's Representative from full range of manufacturer's colours and profiles if not specifically indicated in the *Interior Finishes Legend*.

2.3 RESILIENT STAIR ACCESSORIES

- .1 Refer to drawings to determine if resilient stair accessories are required and if so, the required locations.
- .2 Resilient Stair Treads: to ASTM F 2169.
 - .1 Material
 - .1 Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic); unless otherwise noted.

- .2 Surface Design
 - .1 Class 1, Smooth (flat): to be used only when specifically indicated
 - .2 Class 2, Pattern: choose any one of the following patterns, unless otherwise noted on drawings.
 - .1 Raised disc design
 - .2 Raised-square design
 - .3 Raised-chevron design
 - .4 Raised-diamond design
 - .5 Raised-rib design
 - .3 Nosing
 - .1 Complete with contrasting colour, embedded abrasive strips, unless otherwise indicated.
 - .2 Square profile, adjustable to cover angles between 60 and 90 degrees, unless otherwise indicated.
 - .3 Height: as required to completely cover stair nosing.
 - .4 Riser
 - .1 Integral with thread cover, full height of stair riser.
 - .5 Thickness
 - .1 6 mm and tapered to back edge.
 - .6 Size
 - .1 Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
 - .3 Stringers
 - .1 Same thickness as risers; height and length after cutting to fit risers and treads and to cover stair stringers.
 - .2 Produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
 - .4 Colours and Patterns
 - .1 As selected by Owner's Representative from full range of industry colours if not specifically indicated in the *Interior Finishes Legend*.
- 2.4 RESILIENT MOULDING ACCESSORY
- .1 Description
 - .1 Cap for cove carpet
 - .2 Cap for cove resilient floor covering
 - .3 Carpet edge for glue-down applications
 - .4 Nosing for carpet
 - .5 Nosing for resilient floor covering
 - .6 Reducer strip for resilient floor covering
 - .7 Joiner for tile and carpet
 - .8 Transition strips.
 - .2 Material
 - .1 Rubber.
 - .3 Profile and Dimensions
 - .1 As required, absolute minimal height.
 - .4 Colours and Patterns
 - .1 As selected by Owner's Representative from full range of industry colours if not specifically indicated in the *Interior Finishes Legend*.
- 2.5 INSTALLATION MATERIALS

- .1 Trowelable Levelling and Patching Compounds
 - .1 Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- .2 Adhesives
 - .1 Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - .2 Use adhesives that comply with the following limits for VOC content:
 - .1 Cove Base Adhesives: Not more than 50 g/L.
 - .2 Rubber Floor Adhesives: Not more than 60 g/L.
- .3 Stair-Tread-Nose Filler
 - .1 Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- .2 Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- .2 Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - .1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - .2 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - .3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - .4 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- .3 Fill cracks, holes, and depressions in substrates with trowelable levelling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- .4 Do not install resilient products until they are same temperature as the space where they are to be installed.
 - .1 Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- .5 Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- .1 Comply with manufacturer's written instructions for installing resilient base.
- .2 Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- .3 Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- .4 Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- .5 Do not stretch resilient base during installation.
- .6 On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- .7 Preformed Corners: Install preformed corners before installing straight pieces.
- .8 Job-Formed Corners:
 - .1 Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discolouration (whitening) at bends.
 - .2 Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

- .1 Comply with manufacturer's written instructions for installing resilient accessories.
- .2 Resilient Stair Accessories:
 - .1 Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - .2 Tightly adhere to substrates throughout length of each piece.
 - .3 For treads installed as separate, equal-length units, install to produce a flush joint between units.
- .3 Resilient Moulding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- .1 Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- .2 Perform the following operations immediately after completing resilient product installation:
 - .1 Remove adhesive and other blemishes from exposed surfaces.
 - .2 Sweep and vacuum surfaces thoroughly.
 - .3 Damp-mop surfaces to remove marks and soil.
- .3 Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- .4 Cover resilient products until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Types of items described in this Section:
 - .1 Solid vinyl floor tile.
 - .2 Rubber floor tile.
 - .3 Vinyl composition floor tile.
- .2 Types of items not described in this Section:
 - .1 Resilient terrazzo floor tile.
 - .2 Resilient base, reducer strips, and other accessories installed with resilient floor coverings.
 - .3 Resilient sheet floor coverings.
 - .4 Linoleum floor coverings.
 - .5 Resilient floor coverings designed to control electrostatic discharge.
 - .6 Resilient floor coverings for use in athletic-activity or support areas.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated.
- .2 Sustainability Submittals:
 - .1 For adhesives, sealants, and chemical-bonding compounds, including printed statement of VOC content.
- .3 Samples for Initial Selection: For each type of floor tile indicated.
- .4 Samples for Verification: Full-size units of each colour and pattern of floor tile required.
- .5 Qualification Data: For qualified Installer.
- .6 Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- .1 Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
- .2 Mock-ups: Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .1 Build mock-ups for floor tile including resilient base and accessories.
 - .1 Size: Minimum 9.3 sq. m for each type, colour, and pattern in locations directed by Owner's Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 10 deg C or more than 32 deg C. Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- .1 Maintain ambient temperatures within range recommended by manufacturer, but not less than 21 deg C or more than 35 deg C, in spaces to receive floor tile during the following time periods:
 - .1 48 hours before installation.
 - .2 During installation.
 - .3 48 hours after installation.
- .2 Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 13 deg C or more than 35 deg C.
- .3 Close spaces to traffic during floor tile installation.
- .4 Close spaces to traffic for 48 hours after floor tile installation.
- .5 Install floor tile after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- .1 Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - .1 Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, colour, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 SOLID VINYL FLOOR TILE

- .1 Tile Standard: ASTM F 1700.
 - .1 Class:
 - .1 Class I, monolithic vinyl tile, unless otherwise indicated.
 - .2 Class II, surface-decorated vinyl tile, only when indicated.
 - .3 Class III, printed film vinyl tile, only when indicated.
 - .2 Type:
 - .1 Type A, smooth surface, unless otherwise indicated.
 - .2 Type B, embossed surface, when specifically indicated.
- .2 Thickness: 3.2 mm unless otherwise indicated.
- .3 Size: 305 by 305 mm unless otherwise indicated.
 - .1 Heat welded.
 - .2 Chemically bonded.
- .4 Colours and Patterns: Refer to drawings for additional tile requirements, colours, and patterns.

2.2 RUBBER FLOOR TILE

- .1 Tile Standard: ASTM F 1344
 - .1 Class and Type: any one of the following if not otherwise indicated.
 - .1 Class I-A, homogeneous rubber tile, solid colour
 - .2 Class I-B, homogeneous rubber tile, through mottled
 - .3 Class II-A, laminated rubber tile, solid-colour wear layer
 - .4 Class II-B, laminated rubber tile, mottled wear layer.
 - .2 Hardness: Manufacturer's standard hardness.
 - .3 Wearing Surface:
 - .1 Smooth, unless otherwise indicated.
 - .2 Textured, only when specifically indicated.
 - .3 Moulded pattern, only when specifically indicated.
 - .1 Moulded-Pattern Figure: any one of the following if not otherwise indicated.
 - .1 Raised discs.
 - .2 Raised squares.
 - .3 Raised diamonds.
 - .4 Thickness: 3.2 mm.
 - .5 Size: 610 by 610 mm unless otherwise indicated.
 - .6 Colours and Patterns: Refer to drawings for additional tile requirements, colours, and patterns.
- 2.3 VINYL COMPOSITION FLOOR TILE
 - .1 Tile Standard: ASTM F 1066
 - .1 Class: any one of the following if not indicated on the drawings.
 - .1 Class 1, solid-colour tile
 - .2 Class 2, through-pattern tile
 - .3 Class 3, surface-pattern tile, only when specifically indicated.
 - .2 Wearing Surface:
 - .1 Smooth, unless otherwise indicated.
 - .2 Embossed, when specifically indicated.
 - .3 Thickness: 3.2 mm.
 - .4 Size: 305 by 305 mm.
 - .5 Colours and Patterns: Refer to drawings for additional tile requirements, colours, and patterns.
- 2.4 INSTALLATION MATERIALS
 - .1 Trowelable Levelling and Patching Compounds
 - .1 Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
 - .2 Adhesives
 - .1 Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - .2 Use adhesives that comply with the following limits for VOC content:

- .1 VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
- .2 Rubber Floor Adhesives: Not more than 60 g/L.
- .3 Floor Polish
 - .1 Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- .2 Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- .2 Concrete Substrates: Prepare according to ASTM F 710.
 - .1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - .2 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - .3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - .4 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- .3 Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- .4 Fill cracks, holes, and depressions in substrates with trowelable levelling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- .5 Do not install floor tiles until they are same temperature as space where they are to be installed.
 - .1 Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- .6 Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

- .1 Comply with manufacturer's written instructions for installing floor tile.
- .2 Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - .1 Lay tiles square with room axis unless otherwise indicated.

- .3 Match floor tiles for colour and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - .1 Lay tiles with grain running in one direction, unless otherwise indicated.
- .4 Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- .5 Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- .6 Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- .7 Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of colour and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- .8 Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- .1 Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- .2 Perform the following operations immediately after completing floor tile installation:
 - .1 Remove adhesive and other blemishes from exposed surfaces.
 - .2 Sweep and vacuum surfaces thoroughly.
 - .3 Damp-mop surfaces to remove marks and soil.
- .3 Protect floor tile products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- .4 Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 - .1 Apply three coat(s), unless specifically not recommended by flooring manufacturer.
- .5 Cover floor tile until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Types of items described in this Section:
 - .1 Surface preparation and the application of paint systems on the following interior substrates:
 - .1 Concrete.
 - .2 Clay masonry.
 - .3 Concrete masonry units (CMU).
 - .4 Steel.
 - .5 Galvanized metal.
 - .6 Aluminum (not anodized or otherwise coated).
 - .7 Wood.
 - .8 Gypsum board.
 - .9 Plaster.
 - .10 Spray-textured ceilings.
 - .11 Cotton or canvas insulation covering.
 - .2 Types of items you will not find described in this Section:
 - .1 Wood stains and transparent finishes.
 - .2 Shop priming of metal substrates with primers specified in this Section.
 - .3 Shop priming carpentry with primers specified in this Section.
 - .4 Factory finishing of steel doors and frames and of wood doors; where specified.
 - .5 Gypsum board spackling.
 - .6 Special-use coatings.
 - .7 Intumescent painting.
 - .8 Surface preparation and the application of paint systems on exterior substrates.
 - .9 Surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
 - .3 Scope of Work of this Contract
 - .1 While drawings and schedules identify locations for some finishes, the scope of work entails painting all of the following interior surfaces:
 - .1 All surfaces explicitly noted to be painted.
 - .2 All surfaces scheduled to be covered with wall coverings.
 - .3 All unfinished surfaces that are either exposed-to-view or semi-exposed-to-view and not otherwise scheduled to receive another type of finish, excluding finished hardwood; unless otherwise noted.
 - .2 Specifically, do not paint any of the following surfaces:
 - .1 Grating.
 - .2 Concrete floors, unless specifically indicated.
 - .3 Stainless steel.
 - .4 Aluminum handrail and aluminum stair and ladder components.
 - .5 PVC, rubber, copper, bronze or brass surfaces.

1.2 DEFINITIONS

- .1 Concealed Surface: A surface that cannot be seen because the view from any angle is obstructed by an immovable object.
- .2 Exposed and semi-exposed surface: Any surface that is not a concealed surface.

- .3 Finish: a final surface treatment intended to enhance the appearance of a substrate or protect it from the adverse effects of its environmental, or both, and includes but is not limited to paint, stains, coatings, laminates, tiles, fabrics and carpets.
 - .1 Primer finish is not considered a finish.
 - .4 Unfinished Surface: A surface having no Finish.
- 1.3 SUBMITTALS
- .1 Product Data: For each type of product indicated.
 - .2 Samples for Verification: For each type of paint system and in each colour and gloss of topcoat indicated.
 - .1 Submit Samples on rigid backing, 200 mm square.
 - .2 Step coats on Samples to show each coat required for system.
 - .3 Label each coat of each Sample.
 - .4 Label each Sample for location and application area.
 - .3 Product List: For each product indicated, include the following:
 - .1 Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - .4 Sustainability Submittal:
 - .1 Product Data for paints, including printed statement of VOC content and chemical components.
- 1.4 QUALITY ASSURANCE
- .1 MPI Standards:
 - .1 Products: Complying with MPI standards indicated and listed in *MPI Approved Products List*.
 - .2 Preparation and Workmanship: Comply with requirements in *MPI Architectural Painting Specification Manual* for products and paint systems indicated.
 - .2 Mock-ups: While paint colours may be specifically indicated in the documents, still proceed with mock-ups. Apply benchmark samples of each paint system indicated and each colour and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - .1 Owner's Representative will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - .1 Wall and Ceiling Surfaces: Provide samples of at least 9 sq. m.
 - .2 Other Items: Owner's Representative will designate items or areas required.
 - .2 Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - .3 Final approval of colour selections will be based on benchmark samples.
 - .1 If preliminary colour selections are not approved, apply additional benchmark samples of additional colours selected by Owner's Representative at no added cost to Owner.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- .1 Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 7 deg C.
 - .1 Maintain containers in clean condition, free of foreign materials and residue.
 - .2 Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- .1 Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 10 and 35 deg C.
- .2 Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 3 deg C above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- .1 Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - .1 Quantity: Furnish an additional 5 percent, but not less than 3.8 L of each material and colour applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- .1 Material Compatibility:
 - .1 Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - .2 For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- .2 VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colourants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - .1 Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - .2 Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - .3 Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - .4 Floor Coatings: VOC not more than 100 g/L.
 - .5 Shellacs, Clear: VOC not more than 730 g/L.
 - .6 Shellacs, Pigmented: VOC not more than 550 g/L.
 - .7 Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - .8 Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - .9 Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - .10 Floor Coatings: VOC not more than 100 g/L.
 - .11 Shellacs, Clear: VOC not more than 730 g/L.
 - .12 Shellacs, Pigmented: VOC not more than 550 g/L.
 - .13 Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - .14 Dry-Fog Coatings: VOC content of not more than 400 g/L.
 - .15 Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 - .16 Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
- .3 Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - .1 Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

- .2 Restricted Components: Paints and coatings shall not contain any of the following:
 - .1 Acrolein.
 - .2 Acrylonitrile.
 - .3 Antimony.
 - .4 Benzene.
 - .5 Butyl benzyl phthalate.
 - .6 Cadmium.
 - .7 Di (2-ethylhexyl) phthalate.
 - .8 Di-n-butyl phthalate.
 - .9 Di-n-octyl phthalate.
 - .10 1,2-dichlorobenzene.
 - .11 Diethyl phthalate.
 - .12 Dimethyl phthalate.
 - .13 Ethylbenzene.
 - .14 Formaldehyde.
 - .15 Hexavalent chromium.
 - .16 Isophorone.
 - .17 Lead.
 - .18 Mercury.
 - .19 Methyl ethyl ketone.
 - .20 Methyl isobutyl ketone.
 - .21 Methylene chloride.
 - .22 Naphthalene.
 - .23 Toluene (methylbenzene).
 - .24 1,1,1-trichloroethane.
 - .25 Vinyl chloride.

 - .4 Colours: Refer to *Interior Finishes Legend*. When no colour is identified, then selected by Owner's Representative.
 - .1 M&E equipment: Assume no colour coding required unless otherwise indicated in mechanical and electrical specification sections.
 - .2 Where no colour is identified, Owner's Representative shall chose up to a combination of 8 colours in each suite. Colours can be a combination of main and accent colours in each room.

 - .5 Gloss Levels: As determined by Owner's Representative.
- 2.2 BLOCK FILLERS
- .1 Interior/Exterior Latex Block Filler: MPI #4.
 - .1 VOC Content: E Range of E3.
- 2.3 PRIMERS/SEALERS
- .1 Interior Latex Primer/Sealer: MPI #50.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .2 Interior Alkyd Primer/Sealer: MPI #45.
 - .1 VOC Content: E Range of E2.
 - .3 Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.
- 2.4 METAL PRIMERS

- .1 Alkyd Anticorrosive Metal Primer: MPI #79.
 - .1 VOC Content: E Range of E2.
 - .2 Quick-Drying Alkyd Metal Primer: MPI #76.
 - .1 VOC Content: E Range of E3.
 - .3 Rust-Inhibitive Primer (Water Based): MPI #107.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .4 Cementitious Galvanized-Metal Primer: MPI #26.
 - .1 VOC Content: E Range of E1.
 - .5 Waterborne Galvanized-Metal Primer: MPI #134.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .6 Vinyl Wash Primer: MPI #80.
 - .1 VOC Content: E Range of E3.
 - .7 Quick-Drying Primer for Aluminum: MPI #95.
 - .1 VOC Content: E Range of E3.
- 2.5 WOOD PRIMERS
- .1 Interior Latex-Based Wood Primer: MPI #39.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
- 2.6 LATEX PAINTS
- .1 Interior Latex (Flat): MPI #53 (Gloss Level 1).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 2.5.
 - .2 Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .3 Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .4 Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.5.
 - .5 Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 4.

- .6 Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 4.
- .7 Institutional Low-Odour/VOC Latex (Flat): MPI #143 (Gloss Level 1).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 5.5.
- .8 Institutional Low-Odour/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 4.5.
- .9 Institutional Low-Odour/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 4.5.
- .10 Institutional Low-Odour/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 5.5.
- .11 High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 6.
- .12 High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 6.
- .13 High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 6.5.
- .14 High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 7.
- .15 Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - .1 VOC Content: E Range of E3.
- .16 Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 - .1 VOC Content: E Range of E3.
- .17 Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - .1 VOC Content: E Range of E3.
- 2.7 ALKYD PAINTS
 - .1 Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
 - .1 VOC Content: E Range of E3.
 - .2 Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).

- .1 VOC Content: E Range of E2.
- .3 Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
 - .1 VOC Content: E Range of E2.
 - .2 Environmental Performance Rating: EPR 3.
- .4 Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
 - .1 VOC Content: E Range of E2.
- 2.8 QUICK-DRYING ENAMELS
 - .1 Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - .1 VOC Content: E Range of E3.
 - .2 Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - .1 VOC Content: E Range of E3.
- 2.9 TEXTURED COATING
 - .1 Latex Stucco and Masonry Textured Coating: MPI #42.
 - .1 VOC Content: E Range of E3.
- 2.10 DRY FOG/FALL COATINGS
 - .1 Latex Dry Fog/Fall: MPI #118.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .2 Waterborne Dry Fall: MPI #133.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
 - .3 Interior Alkyd Dry Fog/Fall: MPI #55.
 - .1 VOC Content: E Range of E3.
- 2.11 ALUMINUM PAINT
 - .1 Aluminum Paint: MPI #1.
 - .1 VOC Content: E Range of E3.
- 2.12 FLOOR COATINGS
 - .1 Interior Concrete Floor Stain: MPI #58.
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 2.
 - .2 Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - .1 VOC Content: E Range of E3.
 - .3 Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - .1 VOC Content: E Range of E2.

- .4 Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - .1 VOC Content: E Range of E3.
 - .2 Environmental Performance Rating: EPR 3.
- .5 Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - .1 VOC Content: E Range of E2.
 - .2 Additives: Manufacturer's standard additive to increase skid resistance of painted surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- .2 Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - .1 Concrete: 12 percent.
 - .2 Masonry (Clay and CMU): 12 percent.
 - .3 Wood: 15 percent.
 - .4 Gypsum Board: 12 percent.
 - .5 Plaster: 12 percent.
- .3 Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- .4 Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - .1 Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- .1 Comply with manufacturer's written instructions and recommendations in *MPI Architectural Painting Specification Manual* applicable to substrates indicated.
- .2 Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - .1 After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - .2 Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- .3 Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - .1 Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- .4 Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- .5 Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

- .6 Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- .7 Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- .8 Aluminum Substrates: Remove surface oxidation.
- .9 Wood Substrates:
 - .1 Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - .2 Sand surfaces that will be exposed to view, and dust off.
 - .3 Prime edges, ends, faces, undersides, and backsides of wood.
 - .4 After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- .10 Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- .11 Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- .12 Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.
- .13 Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- .1 Apply paints according to manufacturer's written instructions.
 - .1 Use applicators and techniques suited for paint and substrate indicated.
 - .2 Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - .3 Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- .2 Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match colour of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- .3 If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, colour, and appearance.
- .4 Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and colour breaks.
- .5 Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - .1 Mechanical Work:
 - .1 Uninsulated metal piping.
 - .2 Uninsulated plastic piping.
 - .3 Pipe hangers and supports.
 - .4 Tanks that do not have factory-applied final finishes.

- .5 Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
- .6 Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- .7 Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- .2 Electrical Work:
 - .1 Galvanized and steel conduits.
 - .2 Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

- .1 At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- .2 After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- .3 Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Owner's Representative, and leave in an undamaged condition.
- .4 At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- .1 Propose paint system for any surfaces not listed. Propose paint system consisting of a minimum of a prime coat, intermediate coat, and topcoat.
- .2 Concrete Substrates, Nontraffic Surfaces:
 - .1 High-Performance Architectural Latex System: MPI INT 3.1C.
 - .1 Prime Coat: Interior latex primer/sealer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.
- .3 Concrete Substrates, Traffic Surfaces:
 - .1 Alkyd Floor Enamel System: MPI INT 3.2B.
 - .1 Prime Coat: Exterior/interior alkyd floor enamel.
 - .2 Intermediate Coat: Exterior/interior alkyd floor enamel.
 - .3 Topcoat: Exterior/interior alkyd floor enamel.
- .4 Clay-Masonry Substrates:
 - .1 High-Performance Architectural Latex System: MPI INT 4.1L.
 - .1 Prime Coat: High-performance Architectural latex matching topcoat.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex .
- .5 CMU Substrates:
 - .1 High-Performance Architectural Latex System: MPI INT 4.2D.
 - .1 Prime Coat: Interior/exterior latex block filler.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex .
- .6 Steel Pipes filled with liquids, including but not limited to sprinkler pipes:
 - .1 Alkyd System: MPI INT 5.1E.

- .1 Prime Coat: Alkyd anticorrosive metal primer.
 - .2 Intermediate Coat: Interior alkyd matching topcoat.
 - .3 Topcoat: Interior alkyd
- .7 Galvanized Metal Pipes filled with liquids, including but not limited to sprinkler pipes:
- .1 Alkyd System: MPI INT 5.3C.
 - .1 Prime Coat: Cementitious galvanized-metal primer.
 - .2 Intermediate Coat: Interior alkyd matching topcoat.
 - .3 Topcoat: Interior alkyd
- .8 Steel Substrates:
- .1 High-Performance Architectural Latex System: MPI INT 5.1R.
 - .1 Prime Coat: Alkyd anticorrosive metal primer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.
- .9 Galvanized-Metal Substrates:
- .1 High-Performance Architectural Latex System: MPI INT 5.3M.
 - .1 Prime Coat: Waterborne galvanized-metal primer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex .
- .10 Aluminum (Not Anodized or Otherwise Coated) Substrates:
- .1 High-Performance Architectural Latex System: MPI INT 5.4F.
 - .1 Prime Coat: Quick-drying primer for aluminum.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.
- .11 Glue-Laminated Beam and Column Substrates:
- .1 High-Performance Architectural Latex System: MPI INT 6.1N.
 - .1 Prime Coat: Interior latex-based wood primer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex .
- .12 Dressed Lumber Substrates: Including Architectural woodwork and doors.
- .1 High-Performance Architectural Latex System: MPI INT 6.3A.
 - .1 Prime Coat: Interior latex-based wood primer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.
- .13 Wood Panel Substrates: Including painted plywood, medium-density fiberboard, and hardboard.
- .1 High-Performance Architectural Latex System: MPI INT 6.4S.
 - .1 Prime Coat: Interior latex-based wood primer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.
- .14 Dimension Lumber Substrates, Nontraffic Surfaces: Including exposed joists and exposed beams.
- .1 High-Performance Architectural Latex System: MPI INT 6.2B.
 - .1 Prime Coat: Interior alkyd primer/sealer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.

- .15 Wood Substrates, Traffic Surfaces:
 - .1 Latex Floor Paint System: MPI INT 6.5G.
 - .1 Prime Coat: Interior alkyd primer/sealer.
 - .2 Intermediate Coat: Interior/exterior latex floor and porch paint.
 - .3 Topcoat: Interior/exterior latex floor and porch paint.

- .16 Gypsum Board Substrates:
 - .1 High-Performance Architectural Latex System: MPI INT 9.2B.
 - .1 Prime Coat: Interior latex primer/sealer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.

- .17 Plaster Substrates:
 - .1 High-Performance Architectural Latex System: MPI INT 9.2B.
 - .1 Prime Coat: Interior latex primer/sealer.
 - .2 Intermediate Coat: High-performance Architectural latex matching topcoat.
 - .3 Topcoat: High-performance Architectural latex.

- .18 Spray-Textured Ceiling Substrates:
 - .1 Latex System: MPI INT 9.1E, spray applied.
 - .1 Prime Coat: Interior latex matching topcoat.
 - .2 Intermediate Coat: Interior latex matching topcoat.
 - .3 Topcoat: Interior latex.

- .19 Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.
 - .1 Latex System: MPI INT 10.1A.
 - .1 Prime Coat: Interior latex matching topcoat.
 - .2 Intermediate Coat: Interior latex matching topcoat.
 - .3 Topcoat: Interior latex.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 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.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.

- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Engineer / Architect.
 - .2 Make changes as required and re-submit as directed by Owner's Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Owner's Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Owner's Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3

QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MATERIALS

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

PART 3 EXECUTION

3.1 PAINTING, REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Submit tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Owner's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Owner's Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 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.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.

- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Owner's Representative.
 - .2 Make changes as required and re-submit as directed by Owner's Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Owner's Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Owner's Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3

QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MATERIALS

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

PART 3 EXECUTION

3.1 PAINTING, REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Perform tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Owner's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Owner's Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 07 92 00 – Joint Sealing.
- .4 Section 22 07 16 – Plumbing Equipment Insulation.
- .5 Section 23 05 53.01 – Mechanical Identification.

1.3 **REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including all Addenda).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533 Standard specification for Calcium Silicate Insulation Block and Pipe.
 - .6 ASTM C547 Standard Specification for Mineral Fibre Pipe Insulation.
 - .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)

- .1 Canadian Environmental Assessment Act (CEAA), c. 37.
- .2 Canadian Environmental Protection Act, (CEPA), c. 33.
- .3 Transportation of Dangerous Goods Act (TDGA), c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets.
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .8 National Energy Code for Buildings (NECB).

1.4 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 ss:
 - .1 CRF: Commercial Rectangular Finish
 - .2 CPF: Commercial Piping Finish.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions to Owner's Representative.

1.6 **QUALITY ASSURANCE**

- .1 Qualifications:
 - .1 Installer: certified in performing work of this Section, and have at least 5 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 29.06 - Health and Safety Requirements.

1.7 **DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Owner's Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Owner's Representative.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.

- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: to ASTM C533.
 - .2 Maximum "k" factor: to 0.075 W/m °C @ 500 °C .
 - .3 Design to permit periodic removal and re-installation.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .5 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket to ASTM C534.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: 0.039 W/m – °C.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants
 - .5 Flame spread index less than 25, and smoke developed index less than 50.
- .6 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

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

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

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

2.7 OUTDOOR VAPOUR RETARDER FINISH

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

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint. Confirm colour with Owner's Representative.
 - .3 Minimum service temperatures: -20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.55 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Indoor: flame spread rating 25, smoke developed rating 50.
 - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 Canvas:
 - .1 220gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Embossed or corrugated.

- .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
- .4 Stainless steel:
 - .1 Type: 304 or type 316.
 - .2 Thickness: 0.25 mm.
 - .3 Finish: Smooth.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 00 - Joint Sealing.

PART 3 **EXECUTION**

3.1 MANUFACTURE'S INSTRUCTIONS

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

3.2 PRE- INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 See Section 22 07 16 – Plumbing Equipment Insulation.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

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

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. Insulate vent pipes 3.0 m from roof penetration.
- .2 TIAC Code: A-2.
 - .1 Insulation securements: 18 ga SS wire or 12 mm x 0.51 mm SS bands at 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Tape at 300 mm oc.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Insulation securements: as per manufacturer's recommendation.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-CA.
- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: 18 ga SS wire or 12 mm x 0.5 mm SS bands at 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 Thickness of insulation to be as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Steam	up to 175	A-3	38	50	65	75	90	90
Domestic HWS		A-3	25	25	25	38	38	38

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			<i>Run out</i>	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Refrigerated Drinking Water		A-3	25	25	25	25	25	25
Domestic CWS		A-3	25	25	25	25	25	25
RWL and RWP		A-3	25	25	25	25	25	25
Roof Drain Body		C-2	25	25	25	25	25	25
Vent Pipe Plumbing		A-3	25	25	25	25	25	25

.7 Finishes:

- .1 Exposed indoors: PVC jacket.
- .2 Exposed in mechanical rooms: PVC jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Outdoors: Water-proof Aluminium, or SS jacket.
- .6 Finish attachments: SS screws or bands, at 150 mm oc. Seals: wing or closed.
- .7 Installation: To appropriate TIAC code CPF/1 through CPF/5.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 - Health and Safety Requirements.
- .3 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .4 Section 01 78 00 - Closeout Submittals.
- .5 Section 01 91 13 - General Commissioning (CX) Requirements
- .6 Section 21 05 01 - Common Work Results - Mechanical.
- .7 Section 22 05 00 – Common Work Results for Plumbing.
- .8 Section 22 07 16 – Plumbing Equipment Insulation.
- .9 Section 22 07 19 – Plumbing Piping Insulation.
- .10 Section 23 05 05 - Installation of Pipework.
- .11 Section 23 05 23.01 - Valves - Bronze.
- .12 Section 23 05 23.02 - Valves - Cast Iron.
- .13 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .14 Section 33 11 16.01 - Incoming Site Water Utility Distribution Piping.

1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 American National Standards Institute/National Sanitation Foundation (ANSI/NSF).
 - .1 ANSI/NSF 61, Drinking Water System Components.
- .3 American Society for Testing and Materials International (ASTM).

- .1 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM A536, Standard Specification for Ductile Iron Castings.
- .3 ASTM B 88M, Standard Specification for Seamless Copper Water Tube (Metric).
- .4 ASTM F 492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe Fittings.
- 4 American Water Works Association (AWWA).
 - .1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .2 AWWA C606, Grooved and Shouldered Joints.
- .5 Canadian Standards Association (CSA International).
 - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .9 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC).
- .10 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA).

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 62 00.01 - Hazardous Materials.
- .4 Closeout Submittals:

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

1.4 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with CEPA , TDGA , Regional and Municipal regulations.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the owner, against defective materials and workmanship for a period of one (1) year from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 PIPING

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

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS2 and larger: roll grooved to CSA B242. Cast bronze to ANSI/ASME B16.18 or wrought copper ANSI/ASME B16.22.
 - .1 Fittings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
- .6 NPS 1 ½ and under: Cast copper, ANSI/ASME B16.18 or wrought copper, ANSI/ASME B16.22; for hard drawn copper tube type L or K, rated for 1300 kPa at ASTM B88.

2.3 JOINTS

- .1 Rubber gaskets, latex-free, 1.6 mm thick: to ANSI/AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy lead free.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket. Gasket to be classified in accordance with ANSI/NSF 61 for potable water service. Couplings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
- .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 GATE VALVES

- .1 NPS2 and under, soldered:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .2 NPS2 and under, screwed:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 – Valves – Cast Iron.
- .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
 - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 – Valves – Cast Iron.

2.5 GLOBE VALVES

- .1 NPS2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lockshield handles: as indicated.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 – Valves – Bronze.
 - .2 Lockshield handles: as indicated.

2.6 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, or renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 – Valves – Cast Iron.

2.7 BALL VALVES

- .1 NPS2 and under:
 - .1 As specified Section 23 05 23.01 – Valves - Bronze.

2.8 BUTTERFLY VALVES

- .1 NPS2 1/2 and over lug:
 - .1 To MSS-SP-67, Class 200, 1.4 MPa.
 - .2 As specified in Section 23 05 23.05 – Butterfly Valves.
- .2 NPS2 1/2 and over, grooved ends:
 - .1 Class 300, 2.1 MPa as specified in Section 23 05 23.05 – Butterfly Valves.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 – Installation of Pipework and by certified journeyman supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Grooved joint couplings and fittings to be installed in accordance with the manufacturer's written installation instructions. Grooved ends to be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets to be verified as suitable for the intended service prior to installation. Gaskets to be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative to provide on-site training for Contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative to periodically visit the jobsite and review installation. Contractor to remove and replace any joints deemed improperly installed.
- .5 Install CWS piping below and away from HWS and HWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .7 Buried Tubing
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 **VALVES**

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 **PRESSURE TESTS**

- .1 Conform to requirements of Section 21 05 01 - Common Work Results-Mechanical.
- .2 Test pressure: greater of 1 ½ times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

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

3.5 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Owner's Representative.
- .2 Coordinate with Section 33 11 16 – Site Water Utility Distribution Piping and Section 33 11 16.01 – Incoming Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality to Owner's Representative.

3.7 START-UP

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

3.8 PERFORMANCE VERIFICATION

- .1 Timing:
 - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 TAB HWR in accordance with Section 23 05 93 - Testing Adjusting and Balancing for HVAC.
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Sterilize HWS and HWR systems for Legionella control.
 - .5 Verify performance of temperature controls.
 - .6 Verify compliance with safety and health requirements.
 - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .8 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .3 Reports:
 - .1 In accordance with Section 01 91 13 – General Commissioning (CX) Requirements: using report forms as specified in Section 01 91 13 – General Commissioning (CX) Requirements.
 - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

PART 1

GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 The installation of drainage waste and vent piping – cast iron and copper.

1.2 RELATED SECTIONS

- .1 Section 01 35 29.06 - Health and Safety Requirements.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .3 Section 23 05 05 - Installation of Pipework.

1.3 REFERENCES

- .1 American Iron and Steel Institute (AISI)
 - .1 AISI 304, Stainless Steel.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B32, Specification for Solder Metal.
 - .2 ASTM B306, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .2 CAN/CSA- B125.3, Plumbing Fittings.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
 - .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 SUBMITTALS:

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: tin-lead, 50:50, type 50A or tin-antimony only 95:5, type TA to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary, storm and vent minimum NPS2, to: CAN/CSA-B70, with one layer of protective coating of butimous.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.
 - .2 Hub and spigot.
 - .1 Neoprene gasket : to CSA B70.
 - .2 Cold caulking compounds.
 - .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 STAINLESS STEEL PIPE AND FITTINGS

- .1 Above ground and buried sanitary, storm and vent, NPS 2 to NPS 10, stainless steel, type AISI 304.
 - .1 Mechanical Joints:
 - .1 Push-fit socket joint with EPDM sealing ring.

PART 3

EXECUTION

3.1 INSTALLATION

- .1 In accordance with Section 23 05 05 – Installation of Pipework and by certified journeyman.
- .2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

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

3.3 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge, etc.) c/w directional arrows every floor or 4.5 m (whichever is less).
- .6 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and installation for plumbing specialties and accessories.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
.2 Section 01 35 29.06 – Health and Safety Requirements.
.3 Section 01 45 00 – Quality Control.
.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
.5 Section 01 78 00 – Closeout Submittals.
.6 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
.1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
.2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
.2 American Water Works Association (AWWA)
.1 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.
.2 AWWA C701, Cold Water Meters-Turbine Type for Customer Service.
.3 AWWA C702, Cold Water Meters-Compound Type.
.3 American National Standards Institute (ANSI)
.1 ANSI Z358.1 Emergency eyewash and shower equipment.
.4 Canadian Standards Association (CSA)
.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
.2 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
.5 Health Canada/Workplace Hazardous Materials Information Systems (WHMIS).
.1 Material Safety Data Sheets (MSDS).
.6 Plumbing and Drainage Institute (PDI)
.1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.

- .2 PDI-WH201, Water Hammer Arresters Standard.
- 1.4 SUBMITTALS
 - .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
 - .2 Indicate dimensions, construction details and materials for specified items.
 - .3 Submit WHMIS MSDS in accordance with Section 02 62 00.01 – Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
 - .3 Shop Drawings:
 - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.
 - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Instructions: submit manufacturer's installation instructions.
 - .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals. Include:
 - .1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- 1.5 QUALITY ASSURANCE
 - .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.
- 1.6 DELIVERY, STORAGE AND HANDLING
 - .1 Waste Management and Disposal:

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging materials in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.
- .5 Fold up metal and plastic banding flatten and place in designated area for recycling.

1.7 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the owner, against defective materials and workmanship for a period of one (1) year from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 FLOOR DRAINS

- .1 Floor drains and trench drains.
 - .1 FD-1: general duty; cast iron body, round adjustable head, 125 mm, sediment basket nickel bronze strainer, integral seepage pan and clamping collar, trap primer connection.
 - .1 Acceptable Product: Zurn ZN-415-B5-P, Jay R. Smith, MIFAB, Blücher, Watts.
 - .2 FD-3: combination funnel floor drain; coated cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral oval funnel, trap primer connection.
 - .1 Acceptable Product: Zurn ZN-415-BF-P, Jay R. Smith, MIFAB, Blücher, Watts.
 - .3 FD-4: planters; coated cast-iron body with integral seepage pan, clamping collar, vertically adjustable nickel-bronze adjustable head strainer, vandal-proof NPS2 perforated dome and standpipe, stainless steel screen, trap primer connection.
 - .1 Acceptable Product: Zurn ZN-350 C-P, Jay R. Smith, MIFAB, Blücher, Watts.

2.2 ROOF DRAINS

- .1 RD-1; Standard coated roof drain with cast iron body 381 mm diameter, with aluminum dome, under-deck clamp to suit roof construction, flashing clamp ring with integral gravel stop.
 - .1 Acceptable Product: Zurn Z-100-C, Jay R. Smith, MIFAB, Watts.
- .2 RD-2: Cornice, sill or canopy drain; cast iron body with 150 mm diameter cast bronze dome or strainer and flashing clamp, under deck clamp.
 - .1 Acceptable Product: Zurn Z-181-C, Jay R. Smith, MIFAB, Watts.
- .3 RD-3: parapet or scupper drain; cast iron body with 303 mm x 305 mm oblique aluminum strainer/grate and flashing clamp.
 - .1 Acceptable Product: Zurn, Z-187, Jay R. Smith, MIFAB, Watts.

- .4 RD-4: inverted roofing system; cast iron body with aluminum dome, under-deck clamp and sump receiver to suit roof construction, with integral gravel stop and stainless steel drainage grid.
 - .1 Acceptable Product: Zurn, Jay R. Smith, MIFAB, Watts.
- 2.3 CLEANOUTS
 - .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
 - .1 Acceptable Product: Zurn, Jay R. Smith, MIFAB, Blücher, Watts.
 - .2 Access covers:
 - .1 Wall access: face or wall type, or stainless steel square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor access: round cast iron body and frame with adjustable secured nickel bronze top.
 - .1 Plugs: bronze with neoprene gasket.
 - .2 Cover for unfinished concrete floors: cast iron round, gasket, vandal-proof screws.
 - .3 Cover for terrazzo finish: polished nickel bronze brass with recessed cover for filling with terrazzo, vandal-proof locking screws.
 - .4 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
 - .5 Cover for carpeted floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.
- 2.4 NON FREEZE WALL HYDRANTS
 - .1 Recessed with integral vacuum breaker, integral backflow preventer, NPS $\frac{3}{4}$ hose outlet, removable operating key, polished bronze finish, encased, non-freeze, anti-siphon, automatic draining, wall clamp, replaceable bronze seat and washer.
 - .2 Acceptable Product: Zurn Z-1300-PB-WC, Jay R. Smith, MIFAB, Watts.
- 2.5 WATER HAMMER ARRESTORS
 - .1 Stainless steel or copper construction, bellows or piston type: to PDI-WH201.
 - .2 Acceptable Product: Zurn, Jay R. Smith, MIFAB, Precision Plumbing Products, Watts.
- 2.6 BACK FLOW PREVENTERS
 - .1 To CSA-B64 Series.
 - .2 Application: domestic service entrance and fire protection system service entrance.
 - .1 Domestic water:

- .1 Reduced pressure principle type consisting of a pressure differential relief valve located between two independently operated spring-loaded centre guided check valves.
- .2 Ductile iron construction with FDA approved fusion epoxy coat inside and out.
- .3 Compound check.
- .4 Single access cover.
- .5 Maximum temperature range: 0.5°C to 60°C.
- .6 Maximum pressure: 1205 kPa.
- .7 CSA certified.
- .8 Acceptable Product: Wilkins Model 375L, Watts, Zurn.
- .2 Fire protection water:
 - .1 Same as above except without compound check and with FM and ULC approval for fire protection service.
 - .2 Acceptable Product: Wilkins Model 975L, Watts, Zurn.
- .3 Application: install on domestic cold water supply to electrode steam humidifier, emergency eyewash and drench shower.
 - .1 Bronze body construction.
 - .2 Internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs.
 - .3 Seats and discs replaceable in both check modules and the relief valve.
 - .4 Assembly to include two resilient seated isolation valves, four resilient seated test cocks, protective wye strainer with 20 mesh screen, union end connections and an air gap drain fitting.
 - .5 Reduced pressure zone type backflow preventer.
 - .6 Acceptable Product: Watts Series U-009QT-S complete with Watts Series 909AG air gap, Wilkins, Zurn.
- .4 Provide backflow preventer test kit as follows:
 - .1 Maximum working pressure: 1205 kPa.
 - .2 Maximum working temperature: 98.8°C.
 - .3 0-103 kPa and 0-15 psig dual scale pressure gauge with 114 mm diameter face, $\pm 2\%$ accuracy.
 - .4 Test valves: two (2) ball valves and one (1) needle valve.
 - .5 Hoses: three (3) one (1) metre test hoses with female threaded swivel coupling.
 - .6 Adapters:
 - .1 Three (3) NPS $\frac{1}{4}$ threaded coupling adapters.
 - .2 Three (3) NPS $\frac{1}{2}$ x NPS $\frac{1}{4}$ bushings.
 - .3 Three (3) NPS $\frac{3}{4}$ x NPS $\frac{1}{4}$ bushings.
 - .7 400 mm long securing strap.
 - .8 Moisture resistant instruction guide.
 - .9 Light weight, shock resistant molded plastic case with foam inserts.

.10 Acceptable Product: Watts No. TK-9A Backflow Preventer Test Kit, Precisions Plumbing Products, MIFAB.

2.7 VACUUM BREAKERS

.1 To CSA-B64 Series.

.2 Atmospheric vacuum breaker, where indicated:

.1 Plain brass body with silicone disc.

.2 Suitable for temperatures up to 82°C.

.3 Maximum operating pressure: 860 kPa.

.4 Size: as indicated.

.5 Acceptable Product: Watts Series 288a, Wilkins, Jay R. Smith, MIFAB.

.3 Hose connection vacuum breaker:

.1 NPS ¾ female hose thread inlet, NPS ¾ male hose thread outlet, brass finish.

2.8 PRESSURE REGULATORS

.1 Capacity: as indicated.

.1 Inlet pressure: 1034 kPa.

.2 Outlet pressure: 413 kPa.

.3 Capacity: as indicated.

.2 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62, strainer and stainless steel strainer screen.

.3 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B, strainer.

.4 Semi-steel spring chambers with bronze trim.

2.9 BACKWATER VALVES

.1 Coated extra heavy cast iron body with bronze seat, bronze flapper and threaded cover.

.2 Access:

.1 Surface access.

.2 Concrete access pit with steel cover, as indicated.

2.10 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.11 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer, pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet, strainer.

2.12 WATER METERS

- .1 Displacement type to AWWA C700, Turbine type to AWWA C701, Compound type to AWWA C702.
- .2 Capacity: flow rate, pressure drop, pipe connections as indicated.
- .3 Accessories: remote readout device, pulse output or 4-20 mA current output.

2.13 TRAP SEAL PRIMERS

- .1 Pressure drop actuated:
 - .1 Brass body construction with inlet opening of ½ male NPT and outlet opening of female ½ NPT.
 - .2 Provide complete with four-hole view built-in air gap to prevent any backflow from trap being fed into the water supply.
 - .3 Provide removable inlet filter screen.
 - .4 Capacity to serve up to four (4) floor drains.
 - .5 Provide complete with trap seal primer distribution unit as follows:
 - .1 Brass body construction.
 - .2 ½ NPT inlet connection.
 - .3 Four (4) 3/8 FPT brass nipple outlet connections.
 - .4 Four (4) 6 mm diameter vent holes in lid to provide air gap and backflow protection.
- .2 Up to 12 floor drains: Electronic trap priming manifold with:
 - .1 Vacuum breaker
 - .2 Pre-set 24 hour time clock
 - .3 Manual override switch
 - .4 120V solenoid valve
 - .5 120V or 3 wire connection.
 - .6 NPS ¾ inlet connection.
 - .7 Calibrated manifold.
 - .8 Water hammer arrestor
 - .9 Mounted in steel cabinet
 - .10 Compression outlet fittings
 - .11 Inlet shut off valve
 - .12 Supplies minimum 59 ml @ 138 kPa.
- .3 TRAP GUARD:
 - .1 All elastomeric normally closed trap guard device utilizes a normally closed seal to prevent evaporation of the trap seal and to protect against sewer gases from backing up into habitable areas. It opens with fluid flow and allows liquid drainage to flow through into the building drain.

- .2 Trap Guards are not to be used unless otherwise noted on plumbing drawings. The use of Trap Guards in lieu of Trap Seal Primers shall be at the discretion of MUN.

2.14 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS2 and under, bronze body, screwed ends, with brass cap, tapped blowoff and plug.
- .3 NPS2½ and over, cast iron body, flanged ends, with bolted cap, tapped blow off connection with bronze ball valve.

2.15 GREASE INTERCEPTORS

- .1 Dura coated interior and exterior fabricated steel low type grease interceptors rated as indicated with grease holding capacity as indicated. Unit shall be supplied complete with internal air relief bypass, bronze cleanout plug and trap seal with removable combination pressure equalizer/flow diffusing baffles, gasketed secured cover.
- .2 Provide optional enzyme port in cover.
- .3 Provide internal or external flow control for field installation. External flow control with orifice sized to suit rated flow as outlined above. External flow control to have inlet/outlet connections as indicated.
- .4 Supply grease interceptor with one (1) year supply of poly-enzyme.
- .5 Grease interceptor shall carry the PDI label.
- .6 Acceptable Product: Zurn Low Profile Grease Interceptor size as indicated, Jay R. Smith, MIFAB, Watts.

2.16 ACID DILUTION DEVICES

- .1 Chemical dilution tank:
 - .1 Chemical dilution tanks to be constructed of seamless natural linear low density polyethylene resins. Tank to have uniform wall thickness and be free of any stresses.
 - .2 Tanks to be provided complete with side inlet/outlet connections.
 - .3 Tanks to be supplied with side plumbing vent connection.
 - .4 Each tank inlet/outlet to accept connection to corrosion resistant drainage piping system utilizing threaded male adaptor and mechanical joint connections.
 - .5 Tanks to be provided with bolted cover complete with vapour tight cover gasket pre-cut to cover bolt hole pattern.
 - .6 Connections: as indicated.
 - .7 Size (total volume, not effective volume):
 - .1 As indicated.
 - .8 Dilution tank overall height and diameter to be as follows:

- .1 As indicated.
- .9 Dilution tank inlet/outlet location on tank will be field determined by Contractor after rough-in of chemical resistant waste piping.
- .10 Acceptable Product: Watts/Orion, PEGAS, Town and Country, Zurn Z9A-NT.
- .2 Chemical dilution tank sediment interceptor:
 - .1 Chemical dilution tank sediment interceptors to be constructed of seamless natural linear low density polyethylene resins. Tanks to have uniform thickness and be free of any stresses.
 - .2 Tanks to be provided complete with side inlet/outlet connections.
 - .3 Tanks to be supplied without plumbing vent connection.
 - .4 Each tank inlet/outlet to accept connection to corrosion resistant drainage piping system utilizing male threaded adaptor and mechanical joint connections.
 - .5 Tanks to be provided complete with bolted cover complete with vapour tight cover gasket pre-cut to cover bolt hole pattern.
 - .6 Connections: as indicated.
 - .7 Sizes (total tank volume, not solids retained in basket):
 - .1 Capacity: as indicated.
 - .8 Sediment interceptor overall height and diameter as indicated.
 - .9 Sediment interceptor inlet/outlet location on tank wall to be field determined by Contractor after rough-in of chemical resistant waste piping.
 - .10 Sediment interceptor to be fully recessed in pre-formed concrete pit constructed by the General Contractor. The General Contractor is to be responsible to supply cover over pit to accommodate pedestrian traffic.
 - .11 Sediment interceptor solids baskets shall consist of a perforated polyethylene liner with 4.7 mm diameter perforations.
 - .12 The General Contractor to be responsible to fabricate and install steel frame structure to support sediment interceptor if required to facilitate connection to dilution tank at proper invert.
 - .13 Acceptable Product: Watts/Orion Sediment Interceptor, PEGAS, Town and Country, Zurn Z9A-SI.
- 2.17 COMBINATION EMERGENCY DRENCH SHOWER/EYEWASH UNIT (BARRIER FREE)
 - .1 Bowl: 254 mm diameter corrosion resistant stainless steel bowl.
 - .2 Shower head: 254 mm diameter corrosion resistant stainless steel shower head.
 - .3 Pipe and fittings: galvanized steel with protective yellow safety coating.
 - .4 Operation:
 - .1 Shower: pull rod with triangular handle.
 - .2 Eyewash: large, highly visible push handle.

- .5 Pipe and Fittings: Schedule 40, stainless steel, complete with orange or yellow polyethylene cover on vertical piping for high visibility and corrosion resistance.
 - .6 Water supply: NPS 1/2.
 - .7 Waste: NPS 1 ¼.
 - .8 Shower valve: chrome-plated NPS 1 stay-open ball valve.
 - .9 Eyewash valve: chrome-plated NPS ½ stay-open ball valve.
 - .10 Eyewash spray head assembly: chrome-plated brass spray head assembly with twin, soft flow, eyewash heads and protective sprayhead covers. Integral flow control to ensure safe, steady flow under varying water supply conditions.
 - .11 Identification sign: 355 mm x 90 mm sign for wall mounting. Sign to read "**EMERGENCY DRENCH SHOWER/EYEWASH UNIT**".
 - .12 Location: as indicated.
 - .13 Acceptable Product: Bradley Model S19-310BF, HAWS, Guardian.
- 2.18 EMERGENCY EYEWASH AND COMBINATION EMERGENCY DRENCH SHOWER/EYEWASH THERMOSTATIC MIXING VALVE
- .1 To ANSI Z358.1.
 - .2 Liquid-filled thermal motor and piston control mechanism with positive shut-off of hot water when cold water supply is lost to prevent scalding.
 - .3 Valve shall allow cold water flow in the event of loss or interruption of the hot water supply or thermostatic failure.
 - .4 Vandal-resistant temperature adjustment.
 - .5 Rough bronze finish.
 - .6 Temperature range: 18°C to 35°C.
 - .7 Accuracy: ±1.67°C.
 - .8 Maximum operating pressure: 860 kPa.
 - .9 Maximum inlet temperature: 82°C.
 - .10 Provide complete with dial thermometer.
 - .11 Check stops on inlet of hot/cold.

- .12 Provide complete with 18 gauge surface mounted stainless steel enclosure. Dimension of enclosure to be 610 mm high x 578 mm wide x 165 mm deep.
 - .13 Capacity: 98.5 L/min at 310 kPa differential pressure with a cold flow bypass capacity of 50.0 L/min at 310 kPa differential pressure.
 - .14 Application: emergency fixtures as indicated.
 - .15 Acceptable Product: Bradley S19-2100-SS, Powers, HAWS, Guardian.
- 2.19 EMERGENCY EYEWASH THERMOSTATIC MIXING VALVE
- .1 Same as thermostatic mixing valve specified in Item 2.18 except for the following:
 - .1 Wall enclosure dimensions to be 318 mm high x 279 mm wide x 165 mm deep.
 - .2 Capacity: 35.6 L/min at 310 kPa differential pressure with a cold flow bypass capacity of 25.7 L/min at 310 kPa differential pressure.
 - .2 Acceptable Product: Bradley S19-2000-SS, Powers, Haws, Guardian, Lawler 911.
- 2.20 EMERGENCY EYEWASH FIXTURE - PEDESTAL MOUNTED (BARRIER FREE)
- .1 Application: as indicated.
 - .2 Bowl: 254 mm diameter corrosion resistant stainless steel bowl.
 - .3 Face spring ring: chrome plated circular spray ring to provide supplemental face spray. Provide complete with flow control to ensure adequate flow from eyewash nozzles and face spray ring.
 - .4 Spray Head Assembly: Chrome plated brass spray head assembly with twin, soft flow, eye wash heads and protective spray head covers. The integral flow control shall ensure safe, steady flow under varying water supply conditions.
 - .5 Valve: chrome plated brass, NPS ½ stay-open ball valve.
 - .6 Operation: hand operated by a large, highly visible safety yellow PVC push handle.
 - .7 Waste: Dome type strainer and NPS 1 ¼ drain fitting furnished.
 - .8 Water Supply: NPS ½.
 - .9 Pipe and fittings: galvanized steel with protective yellow safety coating.
 - .10 Identification sign: 355 mm x 90 mm sign for wall mounting. Sign to read "**EMERGENCY EYEWASH FOUNTAIN**".
 - .11 Acceptable Product: Bradley Model S19-210BF complete with options indicated, HAWS, Guardian.

- 2.21 PIPE WALL AND FLOOR PENETRATION SEAL
- .1 Application:
 - .1 Pipes penetrating exterior concrete walls below grade and concrete floors on grade.
 - .2 Seal material to be EPDM.
 - .3 Pressure plates to be glass-reinforced plastic.
 - .4 Bolts and nuts to be stainless steel 18-8.
 - .5 Suitable temperature range to be -40°C to 121°C.
 - .6 Wall sleeves to be Schedule 40 black iron pipe. Sleeves in exterior walls to be galvanized.
 - .7 Floor sleeves to be Schedule 40 black iron pipe.
 - .8 Wall and floor sleeves to be sufficiently long to mount flush with interior and exterior walls and flush with finished floor of slab-on-grade floors, 50 mm above floor, for floors above grade.
 - .9 Acceptable Product: Metraseal MS Series, Link Seal.
- 2.22 DOMESTIC CLOTHES WASHER SUPPLY FITTING
- .1 To control both hot and cold water simultaneously.
 - .2 "Finger-tip" lever operation.
 - .3 Bronze body construction with NPT ½ copper connections and satin chrome finish.
 - .4 Provide complete with mini water hammer arrestor on hot and cold.
 - .5 Mount in 300 mm x 300 mm x 100 mm deep stainless steel valve box, 16 gauge, #4 finish. Provide less access door and complete with back in box.
 - .6 Acceptable Product: Watts Duo-Cloz Model No. 2-M2-SC complete with Watts Model No. 05-H mini water hammer arrestor on hot and cold and entire assembly mounted in a MIFAB Model MI-VB stainless steel valve box, Precision Plumbing Products, MIFAB.
- 2.23 TEMPERED WATER ASSEMBLY
- .1 Quantity: as indicated
 - .2 Hi/Lo combination assembly mounted in wall mounted (surface) stainless steel cabinet.

- .3 Capacity:
 - .1 High capacity: as indicated @ 310 kPa differential pressure (maximum flow).
 - .2 Low capacity: as indicated @ 34 kPa differential pressure (minimum flow).
- .4 Provide check stops on hot/cold water inlet to each valve.
- .5 Provide a pressure regulating valve that responds to varying flow requirements.
- .6 Each tempered water valve to be thermostatic mixing type with liquid filled thermostatic motors that sense and control water temperature.
- .7 Assembly shall be capable of maintaining water temperature to within 8°C above setpoint within the range of 4°C to 71°C.
- .8 Valves to be bronze body.
- .9 Valves to be ASSE and CSA approved.
- .10 Provide pressure gauges on inlet/outlet of high capacity valve.
- .11 Provide dial thermometer at discharge of tempered water assembly.
- .12 Acceptable Product: Powers Hydroguard Simmons, RADA Mechanical Products Ltd., Lawler Master Controller Or approved equal.

2.24 POTABLE WATER THERMAL EXPANSION TANK

- .1 Quantity: as indicated.
- .2 Application: absorb expanded water from domestic hot water tanks because of the inability to expand back into the Town potable water system due to the presence of a backflow preventer on the incoming water supply to the building.
- .3 ASME Section VIII construction and label.
- .4 FDA approved butyl bladder.
- .5 1NPT stainless steel system connection.
- .6 Standard tire air charging valve connection.
- .7 1033 kPa maximum working pressure.
- .8 Vertical tank, floor mounted.
- .9 Dimensions: as indicated.
- .10 Tank volume: as indicated.

- .11 Acceptance volume: as indicated.
 - .12 Red primer exterior finish.
 - .13 Air pre-charge to be adjusted in field by the Mechanical Contractor to equal the residual cold water pressure on the discharge side of the pressure reducing valve on the domestic water service entrance by the Mechanical Contractor.
 - .14 Acceptable Product: ExpanFlex, Amtrol, Taco, S. A. Armstrong, Bell and Gossett, Zurn, Wilkins Series WXTP, Watts.
- 2.25 COMBINATION EMERGENCY DRENCH SHOWER/EYEWASH UNIT FLOW SWITCH ALARM SYSTEM
- .1 Suitable for connection to drench shower with NPS 1-1/2 inlet piping rated for a flow of 1.89 L/s.
 - .2 System to be fully grounded and electrically insulated from water piping for safety.
 - .3 Power supply: 120/1/60 with 0.5 amp current draw.
 - .4 Electrical connection: Pre-wired 1800 mm long multiple conductor, quick connect, waterproof cable for easy connection to the alarm assembly.
 - .5 Flow Switch: UL listed and CSA approved. Watertight and completely assembled for easy hook-up to alarm assembly.
 - .6 Strobe light: UL Listed and CSA approved. Light intensity to be 258,000 maximum effective candella on horizontal axis. Safety amber-colored glass complete with dust cover. All solid state components with no moving parts for maintenance-free operation.
 - .7 Audible Horn: UL listed, externally adjustable from 78-103 decibels at 3.0 meters. Horn designed to sound away from the injured person.
 - .8 On/Off Switch: Enables horn to be turned off while the strobe light continues to flash and the water flows.
 - .9 Provide complete with one (1) year warranty.
 - .10 Acceptable Product: Bradley Model S19-320, HAWS, Guardian.
- 2.26 EMERGENCY EYEWASH FLOW SWITCH ALARM SYSTEM
- .1 Suitable for connection to emergency eyewash with NPS ½ inlet piping rated for a flow of 0.32 L/s.
 - .2 Alarm horn and strobe light to be wall-mounted above and to side of emergency eyewash. Ensure audible horn points away from injured person.
 - .3 Construction: Same as Item 2.25, except flow switch sized as per Item 2.26.1 above.

- .4 Acceptable Product: Bradley Model S19-320A, HAWS, Guardian.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

3.3 CLEANOUTS

- .1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.
.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.4 NON FREEZE WALL HYDRANTS

- .1 Install 600 mm above finished grade unless otherwise indicated.

3.5 WATER HAMMER ARRESTORS

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

3.6 BACK FLOW PREVENTORS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
.1 Reduced pressure type where backflow would constitute a health hazard.
.2 Double check type where backflow would constitute a nuisance or be aesthetically objectionable or material which would not constitute a health hazard.
.2 Pipe discharge to terminate over nearest drain and or service sink.

3.7 BACKWATER VALVES

- .1 Install in main sewer lines where indicated.
.2 Install in access pit as indicated.

- 3.8 HOSE BIBBS AND SEDIMENT FAUCETS
 - .1 Install at bottom of risers, at low points to drain systems, and as indicated.
- 3.9 TRAP SEAL PRIMERS
 - .1 Install for floor drains and elsewhere, as indicated.
 - .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Owner.
 - .3 Install Type K soft copper tubing to floor drain.
- 3.10 STRAINERS
 - .1 Install with sufficient room to remove basket.
- 3.11 GREASE INTERCEPTORS
 - .1 Install with sufficient space, as indicated, for ease of maintenance.
- 3.12 WATER METERS
 - .1 Install water meter provided by local water authority.
 - .2 Install water meter as indicated.
- 3.13 WATER MAKE-UP ASSEMBLY
 - .1 Install on valved bypass.
 - .2 Pipe discharge from relief valve to nearest floor drain.
- 3.14 CHEMICAL DILUTION TANK
 - .1 Install with sufficient space, as indicated, for ease of maintenance.
- 3.15 CHEMICAL DILUTION TANK SEDIMENT INTERCEPTOR
 - .1 Install with sufficient space, as indicated, for ease of maintenance.
- 3.16 START-UP AND COMMISSIONING
 - .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
 - .2 Timing: Start-up only after:

- .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Water treatment systems operational.
 - .3 Provide continuous supervision during start-up.
- 3.17 TESTING AND ADJUSTING
- .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
 - .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
 - .3 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
 - .4 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
 - .5 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Check operations of flushing features.
 - .3 Check security, accessibility, removeability of strainer.
 - .4 Clean out baskets.
 - .6 Vacuum breakers, backflow preventers, backwater valves:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
 - .3 Verify visibility of discharge from open ports.
 - .7 Roof drains:
 - .1 Check location at low points in roof.
 - .2 Check security, removeability of dome.
 - .3 Adjust weirs to suit actual roof slopes, meet requirements of design.
 - .4 Clean out sumps.
 - .5 Verify provisions for movement of roof systems.
 - .8 Access doors:

- .1 Verify size and location relative to items to be accessed.
- .9 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .10 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .11 Wall, Ground hydrants:
 - .1 Verify complete drainage, freeze protection.
 - .2 Verify operation of vacuum breakers.
- .12 Pressure regulators, PRV assemblies:
 - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .13 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
- .14 Grease interceptors:
 - .1 Activate, using manufacturer's recommended procedures and materials.
- .15 Hose bibbs, sediment faucets:
 - .1 Verify operation and at all low points.
- .16 Hydronic system water Make-up Assembly:
 - .1 Verify operation.

- .17 Water meters:
 - .1 Verify calibration certificate.
- .18 .Dilution Tank:
 - .1 Install as per manufacturer's instructions.
 - .2 Fill with limestone chips.
- .19 Tempered water assemblies:
 - .1 Verify operation of Hi/Lo tempered water assemblies at both high and low flow conditions.
 - .2 Verify proper discharge temperature setpoint for all tempered water assemblies including those serving emergency fixtures.
- .20 Commissioning Reports:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
- .21 Training:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
 - .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section includes:
 - .1 The supply and installation of plumbing fixtures and trim.
- .2 Products installed but not supplied under this section as indicated elsewhere in the contract:
 - .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
 - .2 Equipment installed by others.
 - .1 Connect with unions.
 - .3 Equipment not installed.
 - .1 Capped for future connection by others.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 01 35 29.06 – Health and Safety Requirements
- .4 Section 01 78 00 – Closeout Submittals.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-B45 Series, Plumbing Fixtures.
 - .2 CAN/CSA-B125, Plumbing Fittings.
 - .3 CAN/CSA-B651, Barrier-Free Design.
- .2 Province of Newfoundland and Labrador Building Accessibility Regulations.

1.4 **SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS – Material Safety Data Sheets.
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Indicate, for all fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
- .3 Closeout Submittals:

- .1 Submit maintenance data in accordance with Section 01 78 00 – Closeout Submittals
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing maintenance.
 - .3 List of recommended spare parts.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Waste Management and Disposal.
 - .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .3 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.7 ACCEPTABLE PRODUCT

- .1 Fixtures:
 - American Standard
 - Kindred
 - Franke
 - Fiat
 - AMI Novanni
 - ELKAY
 - Zurn
- .2 Trim:
 - Delta
 - Chicago Faucet
 - Powers Crane
 - Sloan
 - Zurn

1.8 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the owner, against defective materials and workmanship for a period of one (1) year from the date of Substantial Completion.

PART 2 **PRODUCTS**

2.1 **MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: Architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

2.2 **SERVICE SINKS**

- .1 SS-1 Service Sink.
 - .1 Sink: acid-resisting porcelain enamelled cast iron, roll rim, wall mounted with 300 mm high undrilled integral back. Size: 559 x 457 x 300 mm.
 - .1 Acceptable product: American Standard 7692 000, Zurn Z5888.
 - .2 Supply Fitting:
 - .1 203 mm centers cast brass wallmount service sink faucet centers adjustable.
 - .2 Two handle.
 - .3 With integral check stops.
 - .4 Polished chrome plated finish.
 - .5 Heavy duty brass compression structures, ceramic not acceptable.
 - .6 90% flow with first ¼ turn of operation, 180° turn.
 - .7 Positive shutoff even in poor water conditions.
 - .8 Long rigid spout with pail hook, adjustable top/bottom brace.
 - .9 Body mounted angle vacuum breaker – garden hose end outlet on spout.
 - .10 76 mm hooded lever handles -metal-color indexed-vandal resistant screws.
 - .11 Maximum flow 8.35 L/min. at 413 kPa.
 - .12 Acceptable product: Delta 28T2383, Zurn Z843M1-CS.
 - .3 Waste fitting: Chrome plated cast brass outlet strainer, enamelled cast iron trap standard with brass cleanout and adjustable floor flange.
 - .4 Rim guard: stainless steel, continuous on three sides.
- .2 MS-1 Mop sinks
 - .1 Sink: composite material or moulded stone, floor mounted 300 mm high undrilled integral back. Size: 610 x 610 dropped front with stainless steel cap.

- .1 Acceptable product: Fiat TSB3000 or corner TSBC 1610, Stern Williams HL1810, Stern Williams SBC1700.
- .2 Supply Fitting:
 - .1 203 mm centers cast brass wallmount service sink faucet centers adjustable
 - .2 Two handle.
 - .3 With integral check stops.
 - .4 Polished chrome plated finish
 - .5 Heavy duty brass compression structures, ceramic not acceptable.
 - .6 90% flow with first ¼ turn of operation, 180° turn.
 - .7 Positive shutoff even in poor water conditions.
 - .8 Long rigid spout with pail hook, adjustable top/bottom brace.
 - .9 Body mounted angle vacuum breaker – garden hose end outlet on spout.
 - .10 76 mm hooded lever handles -metal-color indexed-vandal resistant screws.
 - .11 Maximum flow 8.35 L/min. at 413 kPa.
 - .12 1400 mm rubber hose
 - .13 Acceptable product: Delta 28T2393.

2.3

STAINLESS STEEL COUNTER-TOP SINKS

- .1 SC-1: single compartment, ledge-back.
 - .1 From 20 gauge, 18-8 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 390 x 380 x 150 mm.
 - .1 Acceptable product: Kindred QSL1515/6, or approved alternate
 - .2 Trim:
 - .1 102 mm center deckmount faucet.
 - .2 Two handle.
 - .3 Cast brass underbody.
 - .4 Chrome plated stainless steel coverplate.
 - .5 Polished chrome plated finish.
 - .6 Heavy duty brass compression structures, ceramic not acceptable.
 - .7 Positive shutoff even in poor water conditions.
 - .8 114 mm bend rigid/swivel gooseneck spout.
 - .9 Flow control aerator 5.7 L/min. vandal resistant.
 - .10 102 mm blade handles -sanitary hoods-metal-color indexed- vandal resistant screws.
 - .11 Acceptable product: Delta 27C4844-TI or approved alternate.
 - .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
 - .4 Shut off valves underneath counter.
- .2 SC-2 : double compartment, ledge back:
 - .1 From 0.9 mm thick type 302 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 790 x 520 x 200 mm.
 - .1 Acceptable product: Franke LBD6408-1, Novanni AMI 20071.
 - .2 Trim:
 - .1 203 mm center deckmount faucet.

- .2 Two handle.
- .3 Cast brass underbody.
- .4 Chrome plated stainless steel coverplate.
- .5 Polished chrome plated finish.
- .6 Heavy duty brass compression structures, ceramic not acceptable.
- .7 90% flow with first ¼ turn of operation, 180° turn.
- .8 Positive shutoff even in poor water conditions.
- .9 203 mm wall form swing spout.
- .10 Flow control aerator 5.7 L/min. vandal resistant.
- .11 102 mm blade handles -sanitary hoods-metal-color indexed-vandal resistant screws.
- .12 Acceptable product: Delta 26T3134, Zurn Z871G4-17F.
- .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
- .4 Shut off valves underneath counter.
- .3 SC-3: Classroom, single compartment, ledge both sides and back.
 - .1 From 1.2 mm thick, 0.18 gauge, Type 304 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 790 x 550 x 200 mm.
 - .1 Acceptable product: Franke LBLRS7008P-1, Novanni AMI 5007.
 - .2 Trim:
 - .1 203 mm center deckmount faucet.
 - .2 Two handle.
 - .3 Cast brass underbody.
 - .4 Chrome plated stainless steel coverplate.
 - .5 Polished chrome plated finish.
 - .6 Heavy duty brass compression structures, ceramic not acceptable.
 - .7 90% flow with first ¼ turn of operation, 180° turn.
 - .8 Positive shutoff even in poor water conditions.
 - .9 Gooseneck 150 mm radius 266 mm height (unmounted) rigid/swivel-vandal resistant (VR) 2.3 mm wall thickness.
 - .10 Flow control aerator 5.7 L/min. Vandal Resistant.
 - .11 102 mm blade handles -sanitary hoods-metal- color indexed-vandal resistant screws.
 - .12 Acceptable product: Delta 26T3934, Zurn Z871B4-17F.
 - .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
 - .4 Shut off valves underneath counter.
- .4 SC-4: Classroom, single compartment, ledge at back and one end.
 - .1 From 1.2 mm thick type 304 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 520 x 470 x 200 mm.
 - .1 Acceptable product: Franke LBLS6408P-1, Novanni AMI 5006AI.
 - .2 Trim:
 - .1 203 mm center deckmount faucet.
 - .2 Two handle
 - .3 Cast brass underbody
 - .4 chrome plated stainless steel coverplate
 - .5 Polished chrome plated finish.

- .6 Heavy duty brass compression structures, ceramic not acceptable.
- .7 90% flow with first ¼ turn of operation, 180° turn.
- .8 Positive shutoff even in poor water conditions.
- .9 Gooseneck 150 mm radius 266 mm height (unmounted) rigid/swivel-vandal resistant (VR) 2.3 mm wall thickness.
- .10 Flow control aerator 5.7 L/min. Vandal Resistant.
- .11 102 mm blade handles -sanitary hoods-metal- color indexed-vandal resistant screws
- .12 Acceptable product: Delta 26T3934, Zurn Z8702BD-PC.
- .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
- .4 Shut off valves underneath counter.
- .5 SC-5: Single compartment, hand wash, ledge back.
 - .1 Thickness 0.9 mm, type 302 stainless steel, self-rimming, exposed surfaces satin finished. Underside gull sound dampened and undercoated, rim seal, 1-hole, NPS 1 ½ waste assembly, 470X460X180 mm.
 - .1 Acceptable product: Franke LBS LBS4607-1, Novanni AMI 1009.
 - .2 Trim
 - .1 Hardwired, 24 vac infrared electronic system, no external adjustments required.
 - .2 Chrome plated one piece cast main body with integral sensor and rigid gooseneck sprout.
 - .3 Adjustable sensing range and timeout.
 - .4 Forged brass solenoid valve.
 - .5 Smooth end laminas flow control in base of spout, 4.2 L/min.
 - .6 Recessed mounting components, thermostatic mixing valve, assembled in 250 mm box with stainless steel cover.
 - .7 Acceptable product: Delta 1500T3378, Zurn Z6920BX-TMV1-CWB-FC-1.0.
 - .3 Waste: tailpiece, cast brass P-trap with cleanout.
 - .4 Shut-off valves underneath counter.

2.4

LAUNDRY TUBS

- .1 LAUT-1 : Single compartment.
 - .1 Moulded stone, baked enamel steel stand, front apron, waste plug with rubber stopper, adjustable tailpiece, cast brass trap with cleanout. Sizes: 560 x 560 mm with 76 L capacity.
 - .1 Acceptable product: FIAT FL-1, Zurn MS2620F.
 - .2 Trim:
 - .1 203 mm centers
 - .2 Centers adjustable
 - .3 Two handles
 - .4 Heavy duty brass wallmount service sink faucet with integral stops.
 - .5 Rough chrome plated finish
 - .6 Pail hook

- .7 Body mounted angle vacuum breaker
- .8 Hose end spout, 8.35 L/min
- .9 Wall brace
- .10 Heavy duty brass compression structures.
- .11 76 mm hooded lever handles.
- .12 Acceptable product: Delta 28T8183-AC, Zurn Z843M1-LS1.
- .3 Shut off valves within reach.
- .2 LAUT-2: double compartment.
 - .1 Molded stone, baked enamel steel stand, front apron, waste plug with rubber stopper, adjustable tailpiece, cast brass trap with cleanout. Sizes: 1146 x 543 mm with 152L capacity each tub.
 - .1 Acceptable product: FIAT DL-1, Zurn MS2620F
 - .2 Trim:
 - .1 203 mm centers
 - .2 Centers Adjustable
 - .3 Two handles
 - .4 Heavy duty brass wallmount service sink faucet with integral stops.
 - .5 Rough chrome plated finish
 - .6 Pail hook
 - .7 Body mounted angle vacuum breaker
 - .8 Hose end spout, 8.35 L/min.
 - .9 Wall brace
 - .10 Heavy duty brass compression structures.
 - .11 76 mm hooded lever handles.
 - .12 Acceptable product: Delta 28T8183-AC, Zurn Z843M1-LS1.
 - .3 Shut off valves within reach.

2.5 **FIXTURE PIPING**

- .1 Hot and cold water supplies to each fixture:
 - .1 Chrome plated flexible supply pipes each with screwdriver handwheel stop, reducers, escutcheon for exposed supplies.
- .2 Waste:
 - .1 Brass P trap with cleanout on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

2.6 **CHAIR CARRIERS**

- .1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

- .2 Wall-hung fixtures: as indicated, measured from finished floor.
- .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651, or Provincial Buildings Accessibility Act and Regulations.

3.2 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Do adjustments prior to pre-commissioning.
- .3 Adjustments.
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .4 Checks.
 - .1 Aerators: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
 - .3 Wash fountains: operation of flow-actuating devices.
- .5 Thermostatic controls.
 - .1 Verify temperature settings, operation of control, limit and safety controls.
- .6 Report verification checks in Commissioning Manual.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 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.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.

- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Owner's Representative.
 - .2 Make changes as required and re-submit as directed by Owner's Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Owner's Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Owner's Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 **QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MATERIALS

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

PART 3 EXECUTION

3.1 PAINTING, REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts. If

dust or dirt is detected prior to startup, vacuum interior of all ducts and air handling units. Prior to vacuuming use video camera to record condition of ductwork. Also use video camera to record condition of ducts after cleaning.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Submit tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Owner's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Owner's Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 01 74 11 – Cleaning.
- .2 Section 01 74 21 – Construction / Demolition Waste Management and Disposal
- .3 Section 07 84 00 – Firestopping.
- .4 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.2 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Owner's Representative.

1.3 **QUALITY ASSURANCE**

- .1 Installers to be certified to journeyperson.

PART 2 **PRODUCTS (NOT USED)**

PART 3 **EXECUTION**

3.1 **CONNECTIONS TO EQUIPMENT**

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
 - .1 Unions are not required in installations using grooved mechanical couplings (The couplings shall serve as unions).
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
- .4 The flexible type grooved joint couplings may be used in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief. Couplings shall be placed in close proximity to the source of the vibration, as per manufacturer's recommendations.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

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

3.4 AIR VENTS

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

3.5 DIELECTRIC WATERWAY FITTINGS AND COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.
- .2 Locations: Where dissimilar metals are joined.
- .3 NPS 2 and under: Isolating waterway fittings, unions or bronze valves.
 - .1 Waterway fittings shall be complete with thermoplastic liner.
- .4 Over NPS 2: Isolating waterway fittings and flanges.
 - .1 Waterway fittings shall be complete with thermoplastic liner.

3.6 PIPEWORK INSTALLATION

- .1 Installation by certified journey person.
- .2 Screwed fittings jointed with Teflon tape or pipe dope as recommended by manufacturer.
- .3 Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions.
 - .1 Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.

- .2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
- .4 Protect openings against entry of foreign material.
- .5 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .6 Assemble piping using fittings manufactured to ANSI standards.
- .7 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .8 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .9 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .10 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .11 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .12 Group piping wherever possible and as indicated.
- .13 Ream pipes, remove scale and other foreign material before assembly.
- .14 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .15 Provide for thermal expansion as indicated.
- .16 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
 - .7 Install butterfly valves on chilled water and related condenser water systems only.
 - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .9 Install ball valves for glycol service.
 - .10 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

- .17 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

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

3.8 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.

- .3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation, or install per manufacturer's recommendation as specified within the associated approval.
- .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant sections of other Divisions.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Owner's Representative, 48 hours minimum prior to performance of pressure tests.
- .2 Pework: Test as specified in relevant sections of other sections or Divisions.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of other Divisions.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Owner's Representative. Work to be carried out in off hours after 5 p.m., weekends or holidays.
- .6 Pay costs for repairs or replacement, retesting, and making good. Owner's Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Owner's Representative.

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Owner's Representative. Work to be carried out off hours after 5 p.m., weekends or holidays.
- .2 Request written approval ten (10) working days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
 - .2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
 - .2 CSAZ7396.1 Medical Gas pipeline Systems – Part 1: Pipelines for medical gases and vacuum.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14, Standard for the Standpipe and Hose Systems.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product data to include paint colour chips, other products specified in this section.
 - .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – 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 61 00 – Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Dispose of unused paint coating material at official hazardous material collections site approved by Owner's Representative.
 - .3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be 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 or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

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

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size # 5.

.2 Equipment in Mechanical Rooms: Use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Owner's Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.

.2 Propane gas: to CSA/CGA B149.1 authority having jurisdiction.

.3 Sprinklers: to NFPA 13.

.4 Standpipe and hose systems: to NFPA 14.

.5 Medical Gas: to CAN/CSA Z7396.1.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

- 4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- 5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- 6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.
- 7 Colours and Legends:
 - .1 Where not listed, obtain direction from Owner's Representative.
 - .2 Colours for legends, arrows, to following table:

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

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

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
River water	Green	RIVER WATER
Sea water	Green	SEA WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam ___kPa	Yellow	___kPa STEAM

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. ___ fuel oil suction	Yellow	# ___ FUEL OIL
No. ___ fuel oil return	Yellow	# ___ FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Compressed air (<700kPa)	Green	COMP. AIR ___ kPa
Compressed air (>700kPa)	Yellow	COMP. AIR ___ kPa
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO2
Instrument air	Green	INSTRUMENT AIR
Control air tubing	To Section 25 05 54 – EMCS: Identification	
Conduit for low voltage control wiring	To Section 25 05 54 – EMCS: Identification	
Medical Gases	To Code	

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.
- .3 Identify system : e.g. Supply AHU-1,Exhaust F-7.

2.7 VALVES, CONTROLLERS

- .1 Brass tags 12 mm diameter with stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in section 25 05 54 – EMCS: Identification. If no EMCS included in project, identification as per this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

2.9 LANGUAGE

- .1 Identification to be 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 all painting specified in Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

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

- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
 - .1 Do not paint, insulate or cover in any way.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S"hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner's Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

- .2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

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

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel certified to AABC, NBC, NEBB or SMACNA to perform TAB to Owner's Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience. TAB contractor shall have a minimum of 5 (five) years experience to AABC, NBC, NEBB or SMACNA.
- .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.
 - .2 National Balancing Council, (NBC) Certified Air Balancing Specifications and Certified Hydronic Balancing Specifications.
 - .3 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems – Testing, Adjusting and Balancing.
- .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 the 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, NBC,

NEBB, or SMACNA), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems 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 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 CO-ORDINATION

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

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Owner's 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 Owner's 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 other Divisions.

1.8 OPERATION OF SYSTEMS DURING TAB

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

1.9 START OF TAB

- .1 Notify Owner's Representative seven (7) working 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 weatherstripping, sealing, caulking.
 - .3 All pressure, leakage, other tests specified elsewhere in other Divisions.
 - .4 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Laboratory HVAC systems: plus 10%, minus 0%.
 - .2 Other HVAC systems: plus 5%, minus 5%.
 - .3 Hydronic systems: plus or minus 10 %.
 - .4 Refrigeration systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Owner's 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 (three) months of TAB. Provide certificate of calibration to Owner's Representative.

1.13 SUBMITTALS

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

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Owner's 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 referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 3 (three) copies of TAB Report to Owner's Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Owner's 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 Owner's Representative.

- .4 Bear costs to repeat TAB as required to satisfaction of Owner's Representative.

1.17 **SETTINGS**

- .1 After TAB is completed to satisfaction of Owner's 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 Owner's Representative.

1.19 **AIR SYSTEMS**

- .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC, NBC or NEBB.
- .2 Do TAB of systems, equipment, components, controls specified in other Divisions.
- .3 Qualifications: personnel performing TAB to be qualified to standards of AABC, NBC or NEBB.
- .4 Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC, NBC or NEBB.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration, amperage and volts for each stage of electrical heating coils.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 **HYDRONIC SYSTEMS**

- .1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.
- .2 Standard: TAB to be to most stringent of TAB standards of AABC, NBC or NEBB.
- .3 Do TAB of systems, equipment, components, controls specified in other Divisions.
- .4 Qualifications: personnel performing TAB to be qualified to standards of AABC, NBC or NEBB.

- .5 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC, NBC or NEBB.
- .6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.
- .7 Locations of equipment measurement: to include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of heat exchangers (primary and secondary sides), boiler, chiller, coil, humidifier, cooling tower, condenser, pump, PRV, control valve, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .8 Locations of systems measurements to include, but not be limited to, following as appropriate: supply and return of primary and secondary loops (main, main branch, branch, sub-branch) of all hydronic systems, inlet connection of make-up water.

1.21 DOMESTIC WATER SYSTEMS

- .1 Meet requirements as specified for hydronic systems.
- .2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: inlet and outlet of heaters, tank, pump, circulator, at controllers, controlled device.
- .3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.22 OTHER SYSTEMS

- .1 Plumbing systems:
 - .1 Standard: National Plumbing Code.
 - .2 TAB procedures:
 - .1 Flush valves: adjust to suit project pressure conditions.
 - .2 Pressure booster systems: test for capacity and pressures under all conditions and at all times.
 - .3 Controlled flow roof drain systems: adjust weirs to suit actual roof conditions, slopes, areas drained.
 - .4 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates. Refer to Section 32 32 13.13 – Packaged Sewage Lift, Wet Well Type.
 - .5 Pressure reducing station.
- .2 Wet pipe sprinkler systems:
 - .1 Standard: NFPA.
 - .2 TAB procedures: Refer to NFPA 13 Sprinkler System.
- .3 Refrigeration systems forming part of HVAC systems:

- .1 Standard: CSA B52 – Mechanical Refrigeration Code.
- .2 TAB procedures: Refer to Standard as follows:
 - .1 Suction Pressure and Temperature.
 - .2 Discharge Pressure and Temperature.
 - .3 Suction Superheat
 - .4 Evaporation Pressure and Temperature.
- .4 Chemical treatment systems:
 - .1 Standard: Section 23 25 00 – HVAC Water Treatment Systems.
 - .2 TAB procedures: refer to Section 23 25 00 – HVAC Water Treatment Systems.

1.23 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
- .2 Laboratory fume hoods:
 - .1 Standard: ASHRAE 110 – Method of Testing Performance of Laboratory Fume Hoods, applicable provincial standard.
 - .2 TAB procedures: as described in standard.
- .3 Building pressure conditions:
 - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter and summer design conditions.
- .4 Zone pressure differences:
 - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with all systems in all possible combinations of normal operating modes.
- .5 Smoke management systems:
 - .1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified in other Divisions.
- .6 Measurement of noise and vibration from equipment specified in Mechanical Division.
 - .1 Standard: 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment and 23 32 48 – Acoustical Air Plenums.
 - .2 Vibration measurements around each piece of rotating equipment.
 - .3 Sound measurements in each octave band around each piece of rotating equipment.
 - .4 Induct sound measurements in each octave band at each fan inlet and discharge.
 - .5 Induct sound measurements in each octave band at each air handling unit intake, return and discharge.
 - .6 Sound measurements in each octave band for each normally occupied room with air handling equipment running.

- .7 Measurement of spatial noise:
 - .1 Standard: Section 23 32 48 – Acoustical Air Plenums.

1.24 POST- OCCUPANCY TAB

- .1 Measure DBT, WBT (or %RH), air velocity, air flow patterns, NC levels, in occupied zone of areas designated by Owner's Representative.
- .2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 3 months of termination of Warranty Period.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1

GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 RELATED SECTIONS:

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 45 00 – Quality Control.
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .5 Section 01 78 00 – Closeout Submittals.

1.3 REFERENCES

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

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Indicate the following:
 - .1 Specifications.
 - .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – 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 61 00 – Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, 0.8 mm up to 450 mm wide, 1.6 mm maximum up to 1200 mm wide, V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon or bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: pin in bronze bushings or self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.

- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Maximum leakage: 2 % at 500 Pa.

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 where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
- .4 Runouts to registers and diffusers: located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Ensure damper operators are observable and accessible.

3.3 **CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Fire and smoke dampers, and fire stop flaps.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.3 **REFERENCES**

- .1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
 - .1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN4-S112, Fire Test of Fire Damper Assemblies.
 - .2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
 - .3 ULC-S505, Fusible Links for Fire Protection Service.

1.4 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Smoke dampers.
 - .3 Fire stop flaps.
 - .4 Operators.
 - .5 Fusible links.

- .6 Design details of break-away joints.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals
- 1.5 QUALITY ASSURANCE**
 - .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Certificates:
 - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.
- 1.6 MAINTENANCE**
 - .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
 - .2 Provide the following:
 - .1 6 fusible links of each type.
- 1.7 DELIVERY, STORAGE, AND HANDLING**
 - .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 **PRODUCTS**

2.1 **FIRE DAMPERS**

- .1 Fire dampers: arrangement Type B or C, blades out of air stream listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Minimum rating 1 ½ hours, dynamically rated.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 Retaining angle iron frame, 40 x 40 x 3 mm, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed to prevent disruption of ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 **SMOKE DAMPERS**

- .1 To be ULC or UL listed and labelled.
- .2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.
- .3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units mounted horizontally in vertical ducts.

- .4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.
- .5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74° C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

- .1 Damper: similar in all respects to smoke dampers specified above.
- .2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

2.4 FIRE STOP FLAPS

- .1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74° C.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.
- .5 Coordinate with installer of firestopping to Section 07 84 00 – Firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 COMMISSIONING

- .1 Commission in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Materials and installation of flexible ductwork, joints and accessories.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 **REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
 - .2 Transportation of Dangerous Goods Act, (TDGA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction.
- .6 Underwriters' Laboratories Inc. (UL).
 - .1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.
- .7 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC-S110, Standard Methods of Tests for Air Ducts.

1.4 **SUBMITTALS**

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

- .2 Product Data: submit WHMIS MSDS in accordance with Section 02 60 00.01 - Hazardous Materials for the following:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.
- .3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.5 **QUALITY ASSURANCE**

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings to 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 29.06 - Health and Safety Requirements.

1.6 **DELIVERY, STORAGE AND HANDLING**

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins 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 CEPA, TDGA, Regional and Municipal regulations.
 - .6 Ensure emptied containers are sealed and stored safely.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.7 **INDOOR AIR QUALITY (IAQ)**

- .1 During construction, meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

PART 2 **PRODUCTS**

2.1 **GENERAL**

- .1 Factory fabricated to CAN/ULC S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 **METALLIC - UNINSULATED**

- .1 Type 1: spiral wound flexible aluminum.
- .2 Performance:
 - .1 Factory tested to 1000 Pa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.3 **METALLIC - INSULATED**

- .1 Type 2: spiral wound flexible aluminum with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl or reinforced mylar/neoprene laminate jacket.
- .2 Performance:
 - .1 Factory tested to 1000 Pa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Thermal loss/gain: 1.3 W/m².°C. mean.

2.4 **NON-METALLIC - UNINSULATED**

- .1 Type 3: non-collapsible, coated mineral base fabric or aluminum foil mylar type, mechanically bonded to, and helically supported by, external steel wire.
- .2 Performance:
 - .1 Factory tested to 1000 Pa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.5 **NON-METALLIC - INSULATED**

- .1 Type 4: non-collapsible, coated mineral base fabric or aluminum foil mylar type mechanically bonded to, and helically supported by, external steel wire with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl or reinforced mylar/neoprene laminate jacket.
- .2 Performance:

- .1 Factory tested to 1000 Pa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.
- .3 Thermal loss/gain: 1.3 W/m².° C mean.

2.6 METALLIC ACOUSTIC INSULATED MEDIUM PRESSURE

- .1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 25 mm thick flexible glass fibre thermal insulation and sleeved by aluminum foil and mylar laminate vapour barrier.

- .2 Performance:

- .1 Factory tested to 3 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.
- .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Duct Diam:	Frequency (Hz)				
	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.7 METALLIC ACOUSTIC INSULATED HIGH PRESSURE

- .1 Type 6: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation and encased in spiral wound flexible aluminum jacket, as indicated.

- .2 Performance:

- .1 Factory tested to 2.5 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.
- .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Duct Diam:	Frequency (Hz)				
	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.8 NON-METALLIC - ACOUSTIC INSULATED

- .1 Type 7: Non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to steel wire with factory applied flexible glass fibre acoustic insulation and encased in aluminum foil and mylar laminate vapour barrier.

- .2 Performance:

- .1 Factory tested to 3 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.
- .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Duct Diam:	Frequency (Hz)				
	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

PART 3 **EXECUTION**

3.1 **DUCT INSTALLATION**

- .1 Install in accordance with: NFPA 90A and NFPA 90B SMACNA.
- .2 Do leakage test in accordance with Section 23 05 94 - Pressure Testing of Ducted Air System.
- .3 Do trial test to demonstrate workmanship.

END OF SECTION

PART 1

GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

- .1 American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.

1.4 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.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .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 33 00 - Submittal Procedures.

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Include:
 - .1 Keys for volume control adjustment
 - .2 Keys for air flow pattern adjustment.

PART 2 PRODUCTS

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators as indicated.
- .4 Colour: standard or as directed by Owner's Representative.
- .5 Acceptable Product: E. H. Price, Titus, Nailor, Carnes, Airvector, Anemostat, Krueger.

2.2 MANUFACTURED UNITS

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

2.3 SUPPLY GRILLES AND REGISTERS

- .1 See Schedule.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 See Schedule.

2.5 DIFFUSERS

- .1 See Schedule.

2.6 LINEAR GRILLES

- .1 See Schedule.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head stainless steel or cadmium plated screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes.
 - .1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
 - .1 Start-up testing and verification of systems
 - .2 Check-out demonstration or proper operation of components.
 - .3 On-site operational tests

1.2 **RELATED SECTIONS**

- .1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .5 Section 25 05 01 - EMCS: General Requirements.

1.3 **DEFINITIONS**

- .1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
- .2 AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - .1 Outage of main power supply in excess of back-up power sources, provided that:
 - .1 Automatic initiation of back-up was accomplished.
 - .2 Automatic shut-down and re-start of components was as specified.
 - .2 Failure of communications link, provided that:
 - .1 Controller automatically and correctly operated in stand-alone mode.
 - .2 Failure was not due to failure of any specified EMCS equipment.
 - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
 - .1 System recorded said fault.
 - .2 Equipment defaulted to fail-safe mode.

- .3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 DESIGN REQUIREMENTS

- .1 Confirm with Owner's Representative that Design Criteria and Design Intents are still applicable.
- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Final Report: submit report to Owner's Representative.
 - .1 Include measurements, final settings and certified test results.
 - .2 Bear signature of commissioning technician and supervisor
 - .3 Report format to be approved by Owner's Representative before commissioning is started.
 - .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals.
 - .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide documentation, O&M Manuals, and training materials of O&M personnel for review by Owner's Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

1.7 COMMISSIONING

- .1 Do commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Carry out commissioning under direction of Owner's Representative and in presence of Owner's Representative and Commissioning Co-ordinator.
- .3 Inform, and obtain approval from, Owner's Representative in writing at least 14 days prior to commissioning or each test. Indicate:
 - .1 Location and part of system to be tested or commissioned.
 - .2 Testing/commissioning procedures, anticipated results.
 - .3 Names of testing/commissioning personnel.
- .4 Correct deficiencies, re-test in presence of Owner's Representative until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Perform tests as required.

1.8 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner's Representative and Commissioning Co-ordinator.

1.9 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 PRODUCTS

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

PART 3 EXECUTION

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Co-ordinator and/or Owner's Representative.

.3 Commission integrated systems using procedures prescribed by Commissioning Co-ordinator and/or Owner's Representative.

.4 Debug system software.

- .5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

- .1 Pre-Installation Testing.
 - .1 General: consists of field tests of equipment just prior to installation.
 - .2 Testing may be on site or at Contractor's premises as approved by Owner's Representative.
 - .3 Configure major components to be tested in same architecture as designed system. Include all required network and control components.
 - .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
 - .5 Additional instruments to include:
 - .1 DP transmitters.
 - .2 VAV supply duct SP transmitters.
 - .3 DP switches used for dirty filter indication and fan status.
 - .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.
 - .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.
 - .8 Owner's Representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".
 - .9 Transmitters above 0.5 % error will be rejected.
 - .10 DP switches to open and close within 2% of setpoint.
- .2 Completion Testing.
 - .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
 - .2 Include following activities:
 - .1 Test and calibrate field hardware including stand-alone capability of each controller.
 - .2 Verify each A-to-D convertor.
 - .3 Test and calibrate each AI using calibrated digital instruments.
 - .4 Test each DI to ensure proper settings and switching contacts.
 - .5 Test each DO to ensure proper operation and lag time.
 - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
 - .7 Test operating software.

- .8 Test application software and provide samples of logs and commands.
- .9 Verify each CDL including energy optimization programs.
- .10 Debug software.
- .11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
- .12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.
- .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner's Representative and Commissioning Co-ordinator and provide:
 - .1 2 technical personnel capable of re-calibrating field hardware and modifying software.
 - .2 Detailed daily schedule showing items to be tested and personnel available.
 - .3 Owner's Representative's acceptance signature to be on executive and applications programs.
 - .4 Commissioning to commence during final startup testing.
 - .5 O&M personnel to assist in commissioning procedures as part of training.
 - .6 Commissioning to be supervised by qualified supervisory personnel and Owner's Representative.
 - .7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
 - .8 Operate systems as long as necessary to commission entire project.
 - .9 Monitor progress and keep detailed records of activities and results.
- .4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
 - .1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
 - .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
 - .2 Test to last at least 30 consecutive 24 hour days.
 - .3 Tests to include:
 - .1 Demonstration of correct operation of monitored and controlled points.
 - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
 - .4 System will be accepted when:
 - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
 - .2 Requirements of Contract have been met.

- .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .6 Correct defects when they occur and before resuming tests.
- .5 Commissioning Co-ordinator and/or Owner's Representative to verify reported results.

3.3 ADJUSTING

- .1 Final adjusting: upon completion of commissioning as reviewed by Owner's Representative set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

- .1 Demonstrate to Commissioning Manager and/or Owner's Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
- .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

1.2 **RELATED SECTIONS**

- .1 The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between other Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 35 29.06 – Health and Safety Requirements.
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .5 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .6 Section 09 91 23 - Interior Painting.
- .7 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
- .8 Section 25 01 12 - EMCS: Training.
- .9 Section 25 05 02 - EMCS: Submittals and Review Process.
- .10 Section 25 05 03 - EMCS: Project Record Documents.
- .11 Section 25 05 54 - EMCS: Identification.
- .12 Section 25 05 60 - EMCS: Field Installation.
- .13 Section 25 08 20 - EMCS: Warranty and Maintenance.
- .14 Section 25 10 01 - EMCS: Local Area Network (LAN).
- .15 Section 25 10 02 - EMCS: Operator Work Station (OWS).
- .16 Section 25 30 01 - EMCS: Building Controllers
- .17 Section 25 30 02 - EMCS: Field Control Devices.
- .18 Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 **REFERENCES**

- .1 American National Standards Institute (ANSI)
- .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
- .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
 - .1 CEA-709.1-B, Control Network Protocol Specification.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA).
 - .2 Canadian Environmental Protection Act (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .8 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA).
- .9 National Electrical Manufacturers Association (NEMA)

1.4 **ACRONYMS, ABBREVIATIONS AND DEFINITIONS**

- .1 Acronyms used in EMCS.
 - .1 AEL - Average Effectiveness Level
 - .2 AI - Analog Input
 - .3 AO - Analog Output
 - .4 BACnet - Building Automation and Control Network
 - .5 BC(s) - Building Controller(s)
 - .6 BECC - Building Environmental Control Centre
 - .7 CAB - Canadian Automated Building (CAB) Protocol
 - .8 CAD - Computer Aided Design
 - .9 CDL - Control Description Logic
 - .10 CDS - Control Design Schematic
 - .11 COSV - Change of State or Value
 - .12 CPU - Central Processing Unit
 - .13 DI - Digital Input
 - .14 DO - Digital Output
 - .15 DP - Differential Pressure
 - .16 ECU - Equipment Control Unit
 - .17 EMCS - Energy Monitoring and Control System

- .18 HVAC - Heating, Ventilation, Air Conditioning
- .19 IDE - Interface Device Equipment
- .20 I/O - Input/Output
- .21 ISA - Industry Standard Architecture
- .22 LAN - Local Area Network
- .23 LCU - Local Control Unit
- .24 MCU - Master Control Unit
- .25 NC - Normally Closed
- .26 NO - Normally Open
- .27 OS - Operating System
- .28 O&M - Operation and Maintenance
- .29 OWS - Operator Work Station
- .30 PC - Personal Computer
- .31 PCI - Peripheral Control Interface
- .32 PCMCIA - Personal Computer Micro-Card Interface Adapter
- .33 PID - Proportional, Integral and Derivative.
- .34 RAM - Random Access Memory
- .35 ROM - Read Only Memory
- .36 SP - Static Pressure
- .37 TCU - Terminal Control Unit
- .38 USB - Universal Serial Bus
- .39 UPS - Uninterruptible Power Supply
- .40 WAN- Wide Area Network

1.5 DEFINITIONS

- .1 Point: may be logical or physical.
 - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
 - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction which related equipment (stop, start) and value or damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical logical point description. For point identifier "area",

"system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system", and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
- .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input)
 - .2 AO (analog output)
 - .3 DI (digital input)
 - .4 DO (digital output)
 - .5 Pulse inputs
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
 - .1 Printouts: to ANSI/IEEE 260.1.
 - .2 Refer also to Section 25 05 54 - EMCS: Identification.

1.6 SYSTEM DESCRIPTION

- .1 Refer to control schematics, sequences of operation and related Divisions of specifications for system architecture.
- .2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
 - .1 Building Controllers.
 - .2 Control devices as listed in I/O point summaries and/or shown on the control drawings.
 - .3 OWS
 - .4 Data communications equipment necessary to affect EMCS data transmission system.
 - .5 Field control devices.
 - .6 Software/Hardware complete with full documentation.
 - .7 Complete operating and maintenance manuals.
 - .8 Training of personnel.
 - .9 Acceptance tests, technical support during commissioning, full documentation.
 - .10 Wiring interface co-ordination of equipment supplied by others.
 - .11 Miscellaneous work as specified in these sections and as indicated.
- .3 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of system.

- .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed prior to installation.
 - .3 Location of controllers as reviewed by Owner's Representative prior to installation.
 - .4 Provide utility and emergency power to EMCS.
 - .5 Metric references: in accordance with CAN/CSA Z234.1.
- .4 Language Operating Requirements:
- .1 Provide English interface to system through operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
 - .3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
 - .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
- .5 Include, in English:
- .1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
 - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS. Point name expansions in English.
 - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.
- .6 The network design to be a fully distributed network, with each primary system having its own locally mounted dedicated controller. Any failure in the network shall **not** in any way affect the control of these primary systems. Connecting hardware points from one system to more than one controller is not acceptable. Any points associated with a system are to be connected to one dedicated controller. Each dedicated controller to have a locally mounted control and display device to allow the operator to view and adjust any point on the controller.
- .7 All wiring associated with the EMCS communication network as well as all control wiring and conduit associated with the EMCS at 50 volts or less. Wire and conduit above 50 volts by Electrical Division.
- .8 BACnet compliance: full compliance to the BACnet standard (ANSA/ASHRAE) 135, BACnet – A Data communication Protocol for Building Automation and Control Networks is mandatory. Down to the field device level, the EMCS system must meet BACnet standards for system architecture and administration, and use open communication protocols and user friendly programming and graphics. Install the EMCS installed to communicate at the supervisory layer to the WAN using the BACnet TCP/IP protocol implemented on Ethernet.

- .9 The EMCS system for this facility to be accessible by designated personnel via the WAN for monitoring and programming purposes. The EMCS contractor to provide all the required hardware, software, gateways, etc. needed to permit connection of the EMCS to the WAN. This shall include all hardware, software, programming, start-up and commissioning required. The contractor to supply and install all the required hardware and software on the WAN file server to allow for this remote operation monitoring and programming to take place. The contractor to supply and install all the required hardware and software on the operator workstation(s) located in the Owner's facilities management department. In addition, a remote dial in access directly to the system shall be provided.
- .10 This contractor to provide all materials and labour required to fully integrate this EMCS system with the Systems Integrator (SI). All points to be made available with all set points being fully adjustable by the integrator. All physical controlled elements to be allowed to be overwritten by the integrator system. Provide all labour required to set-up and commission this integration to ensure it is complete and operational.
- .11 The SI shall assign to the EMCS contractor the series of BACnet instance numbers to be used by the EMCS contractor on this project.
- .12 The EMCS contractor will install all field devices required to conform to the specifications and provide all points to the SI contractor for inclusion in the existing MUN Honeywell front end.
- .13 In addition to those listed, the SI shall provide a list of alarm points to be programmed by the EMCS contractor.
- .14 All graphics development shall be by the SI contractor with input provided from the EMCS contractor.
- .15 Should the SI be aware of points or systems that are missing, the SI shall inform the EMCS contractor and the EMCS contractor shall make these points available.

1.7 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Submittals and Review Process.
- .2 Submit for review:
 - .1 Equipment list and systems manufacturers within ten (10) working days after award of contract.
- .3 Quality Control:
 - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
 - .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
 - .3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 – EMCS: Submittals and Review Process. Label or listing of specified organization is acceptable evidence.

- .4 In lieu of such evidence, submit certificate from testing organization, approved by third party Engineer registered in Canada, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/ specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.
- .7 Existing devices intended for re-use: submit test report.

1.8 QUALITY ASSURANCE

- .1 Have local office for at least 5 years staffed by factory trained personnel capable of installing and providing instruction, routine maintenance and emergency service on systems.
- .2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.
- .3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- .4 Ensure factory qualified supervisory personnel continuously direct and monitor work and attend site meetings.
- .5 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .6 Be able to provide factory trained personnel on site within two (2) working days notice or provide instructions on maintenance and emergency service on system.
- .7 BACnet devices to bear BACnet testing laboratories BTL mark and listed on BACnet manufacturers association web site.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Owner's Representative with "Materials Delivery Schedule" within 2 weeks after award of contract.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic

waste 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, Municipal, and Provincial regulations.
- .7 Label location of salvaged material's storage areas and provide barriers and security devices.
- .8 Ensure emptied containers are sealed and stored safely.
- .9 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative Owner's Representative.
- .10 Fold up metal and plastic banding, flatten and place in designated area for recycling

1.10 **EXISTING CONDITIONS - CONTROL COMPONENTS**

- .1 Utilize existing control wiring and piping as indicated.
- .2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards and specifications.
 - .1 Do not modify original design of existing devices without written permission from Owner's Representative.
 - .2 Provide for new, properly designed device where re-usability of components is uncertain.
- .3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
 - .1 Furnish test report to Owner's Representative within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Owner.
 - .2 Failure to produce test report will constitute acceptance of existing devices by owner.
- .4 Non-functioning items:
 - .1 Provide with report specification sheets or written functional requirements to support findings.
 - .2 Owner will repair or replace existing items judged defective yet deemed necessary for EMCS.
- .5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .6 Assume responsibility for existing controls to be incorporated into EMCS after written receipt of approval from Owner's Representative.
 - .1 Be responsible for items repaired or replaced by Owner.
 - .2 Be responsible for repair costs due to negligence or abuse of equipment repaired or replaced by Owner.
 - .3 Responsibility for existing devices terminates upon final acceptance of EMCS or applicable portions of EMCS as approved by Owner's Representative.
- .7 Remove existing controls not re-used or not required. Place in approved storage for disposition as

directed

PART 2 **PRODUCTS**

2.1 **ACCEPTABLE SYSTEMS, MANUFACTURERS**

- .1 Alerton, Delta, Automated Logic, Honeywell, Johnson Controls, Tridium/Distech.
- .2 Proposed system to have communication capability utilizing BACnet Protocol.
- .3 Panel to be NEMA rated to suit environmental requirements.
- .4 Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.
- .5 Wiring within panels to be contained within properly sized rigid PVC slotted wall wire duct. All wiring within the wire duct to be concealed with a non-slip cover.
- .6 Terminations for the connection of power wiring, communication wiring and field mounted devices to be at properly identified terminal blocks mounted within the control panel.
- .7 All control panels to be provided with an internally mounted 120 volt duplex power receptacle.
- .8 All control panels to be identified with permanently mounted Lamecoid tags to identify the control panel and the systems served by the control panel. Submit schedule of labels with shop drawing submission.
- .9 Provide low voltage transformers in panels or elsewhere as required.
- .10 Provide adaptors between metric and imperial components.
- .11 This EMCS contractor to use BACnet point naming as directed by SI. A detailed point naming convention document will be provided which must be followed. If any pint naming contradicting information is found within this specification, the MUN point naming document shall override.

PART 3 **EXECUTION**

3.1 **MANUFACTURER'S RECOMMENDATIONS**

- .1 Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

3.2 **PAINTING**

- .1 Painting to be in accordance with NEMA, supplemented as follows:
- .2 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

- .3 Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.
- .4 Clean and prime exposed hangers, racks, fastenings, and other support components.
- .5 Paint all unfinished equipment installed indoors to NEMA.

END OF SECTION

PART 1

GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process include review meetings for building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

- .1 The contractor is to ensure that all related work is co-ordinated among all specification sections as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
 - .1 Section 01 33 00 - Submittal Procedures.
 - .2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
 - .3 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 DESIGN REQUIREMENTS

- .1 Preliminary Design Review: to contain following contractor and systems information.
 - .1 Location of local office.
 - .2 Description and location of installing and servicing technical staff.
 - .3 Location and qualifications of programming design and programming support staff.
 - .4 List of spare parts.
 - .5 Location of spare parts stock.
 - .6 Names of sub-contractors and site-specific key personnel.
 - .7 Sketch of site-specific system architecture.
 - .8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
 - .9 Descriptive brochures.
 - .10 Sample CDL and graphics (systems schematics).
 - .11 Response time for each type of command and report.
 - .12 Item-by-item statement of compliance.
 - .13 Proof of demonstrated ability of system to communicate utilizing BACnet protocol.

1.5 SUBMITTALS

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

requirements in this Section.

- .2 Submit preliminary design document within 30 working days after contract award for review by Owner's Representative.
- .3 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.
- .4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .5 Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format, or PDF structured using menu format for easy loading and retrieval on OWS.
- .6 Submittals shall consist of:
 - .1 Data sheets of all products.
 - .2 Wiring and piping interconnection diagrams including panel and device power, and sources.
 - .3 List of materials of all proposed devices and equipment.
 - .4 Software documentation:
 - .5 Sequence of operation, in text form.
 - .6 Application programs.
 - .7 Point Schedules
 - .8 Controls schematics and system diagrams.
 - .9 Project installation schedule.
 - .10 Names of subtrades working for EMCS contractor.
 - .11 Mounting support details for components installed in airflow, waterflow and steam systems.
- .7 Submit shop drawings in a package which contains the various schedules and drawings which completely describe the control system installed. At a minimum the shop drawing package to contain the following items described in Section 1.4.8 to 1.4.28 as follows:
- .8 Network drawing showing the network connection of all network control units, programmable control units, terminal control units and operator workstations to indicate the location of each of these elements.
- .9 Schematic control diagram for each system being controlled. Where there are typical systems a drawing to be provided for each system. This drawing to be on a AB size sheet (11 x 17) and shall include a title block which includes as a minimum the drawing title, drawing number, project title, contractor's name, contractor's address, contractor's phone and fax numbers, contractor's project number and a section to provide a record for revision information.
- .10 The schematic control diagram to include a bill of materials which provides a list of all part numbers and descriptions for the control components on the drawing list to include field equipment as well as panel mounted components.

- .11 The schematic control diagram to include a complete wiring diagram for all electrical connections, including motor starters, heating coils, cooling coils etc.
- .12 The schematic control diagram to include a layout of the control panels for each system. This layout to show the mounting of all panel equipment, including transformers, power supplies, controllers, transducers, sensors, relays, contactors and any other panel mounted equipment.
- .13 The contractor to include with the shop drawing submittal drawings, showing all wiring details for the connections of sensors, transducers, relays and contactors these details to show terminal numbers and be referenced to the appropriate schedules and drawings.
- .14 The contractor to supply with the shop drawing package a complete point schedule to show every point connected to the system. This schedule to be in tabular format and provide the point identification, point type, wire tag, termination details reference, referenced drawings, device mounting location and device code numbers.
- .15 The point schedule to provide at a minimum the following information on the software attributes of the point:
 - .1 Tag name – ex. EPT-1
 - .2 Point type – ex. AO-3
 - .3 System name – ex. A/C-1
 - .4 Object name – H-VLV.
 - .5 Expanded ID- Heating control valve
 - .6 Units of measurement - %.
- .16 The point schedule to provide at a minimum the following information on the digital controller to which the point is connected:
 - .1 Controller type – ex. Unitary controller
 - .2 Controller address ex. 256.
 - .3 Cable destination – the termination at the controller, ex. AO-1.
 - .4 Terminal numbers – the termination at the controller.
- .17 The point schedule to provide at minimum the following information on the control panel:
 - .1 Panel identification
 - .2 Panel location
 - .3 Reference drawing
- .18 The point schedule to provide at a minimum the following information on any intermediate device which may be associated with the point:
 - .1 Type of wiring or tubing used
 - .2 Device part number
 - .3 Location of the device.
 - .4 Reference details.
- .19 The point schedule to provide at a minimum the following information on any field device which may

be associated with the point;

- .1 Type of wiring or tubing used
 - .2 Device part number
 - .3 Location of the devices
 - .4 Reference details
- .20 The contractor to supply with the shop drawing package a complete room schedule, to show the equipment associated with the room controls. Schedule to be in tabular format and provide the room number and location, terminal unit number, part numbers for the terminal unit controller, sensors and actuators. Included on this schedule terminal unit type, size, minimum flow and maximum flow.
- .21 Sequence of operation for each system controlled. Sequence to be in complete conformance with the sequence of operations included with this specification. Any changes require the approval of the Owner's Representative in writing. Sequence to include all modes of operation including fail safe, emergency and fire modes.
- .22 Valve schedule including design flow, CV, size, type, actuator, pressure drop and maximum shut off pressure differential for each control valve.
- .23 Damper schedule including design air flow, size, type actuator and torque requirements for each control damper.
- .24 Provide one permanent, not fading, as built copy of each control drawing, enclosed by an aluminium frame with glass cover, or sealed by plastic laminate in rigid metal bound frame. To be installed at each respective control panel location.
- .25 Catalogue cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, dampers, control air system components, etc.
- .26 Range and scale information for all transmitters and sensors. This sheet to clearly indicate one device and any applicable options. Where more than one device to be used is on a single sheet, submit two sheets, individually marked.
- .27 Hardware data sheets for all operator workstations, local access panels, and portable operator terminals.
- .28 Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices, and so forth for

1.6 PRELIMINARY SHOP DRAWING REVIEW

- .1 Submit preliminary shop drawings within 30 working days of award of contract and include following:
 - .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data

- to establish compliance.
- .2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.
- .3 Spare point capacity of each controller by number and type.
- .4 Controller locations.
- .5 Auxiliary control cabinet locations.
- .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
- .7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
- .8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
- .9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.
- .10 Compressor schematic and sizing data.

1.7 DETAIL SHOP DRAWING REVIEW

- .1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
 - .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
 - .2 Wiring diagrams.
 - .3 Piping diagrams and hook-ups.
 - .4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
 - .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.
 - .3 Associated field wiring schematics, schedules and terminations.
 - .4 Pneumatic schematics and schedules.
 - .5 Complete Point Name Lists.
 - .6 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
 - .7 Software and programming details associated with each point.
 - .8 Manufacturer's recommended installation instructions and procedures.
 - .9 Input and output signal levels or pressures where new systems ties into existing control equipment.
 - .6 Control schematics, narrative description, CDL's fully showing and describing automatic

and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

- .7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
- .8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
- .9 Listing of and example of specified reports.
- .10 Listing of time of day schedules.
- .11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
- .12 Type and size of memory with statement of spare memory capacity.
- .13 Full description of software programs provided.
- .14 Sample of "Operating Instructions Manual" to be used for training purposes.
- .15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

1.8 QUALITY ASSURANCE

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes.
 - .1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 **RELATED SECTIONS**

- .1 Section 01 78 00 - Closeout Submittals.
- .2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
- .3 Section 25 05 01 - EMCS: General Requirements.
- .4 Section 25 05 02 - EMCS: Submittals and Review Process.

1.3 **DEFINITIONS**

- .1 BECC - Building Environmental Control Centre.
- .2 OWS - Operator Work Station.
- .3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 **SUBMITTALS**

- .1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.
- .2 Submit Record Documents, As-built drawings, Operation and Maintenance Manual to Owner's Representative in English.
- .3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.
 - .1 Binders to be 2/3 maximum full.
 - .2 Provide index to full volume in each binder.
 - .3 Identify contents of each manual on cover and spine.
 - .4 Provide Table of Contents in each manual.
 - .5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.5 **AS-BUILTS**

- .1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:
 - .1 Changes to contract documents as well as addenda and contract extras.
 - .2 Changes to interface wiring.

- .3 Routing of conduit, wiring and control air lines associated with EMCS installation.
- .4 Locations of obscure devices to be indicated on drawings.
- .5 Listing of alarm messages.
- .6 Panel/circuit breaker number for sources of normal/emergency power.
- .7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
- .8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
- .9 Basic system design and full documentation on system configuration.
- .2 Submit for final review by Owner's Representative.
- .3 Provide before acceptance 4 hard and 1 soft copy incorporating changes made during final review.

1.6 O&M MANUALS

- .1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
- .2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests.
- .3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
- .4 Functional description to include:
 - .1 Functional description of theory of operation.
 - .2 Design philosophy.
 - .3 Specific functions of design philosophy and system.
 - .4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
 - .5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
 - .6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.
- .5 System operation to include:
 - .1 Complete step-by-step procedures for operation of system including required actions at each OWS.
 - .2 Operation of computer peripherals, input and output formats.
 - .3 Emergency, alarm and failure recovery.
 - .4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator

need only refer to these pages for keystroke entries required to call up display or to input command.

- .6 Software to include:
 - .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
 - .2 Detailed descriptions of program requirements and capabilities.
 - .3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
 - .4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
 - .5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
 - .6 Software for each Controller and single section referencing Controller common parameters and functions.
- .7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware, plus diagnostics and repair/replacement of system hardware.
- .8 System configuration document:
 - .1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.
 - .2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.
- .9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

PART 2 **PRODUCTS (NOT USED)**

PART 3 **EXECUTION (NOT USED)**

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes.
 - .1 Requirements and procedures for identification of devices, sensors, wiring, tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates, materials, colours and lettering sizes.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 25 05 01 - EMCS: General Requirements.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.4 **DEFINITIONS**

- .1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 **SYSTEM DESCRIPTION**

- .1 Language Operating Requirements: provide identification for control items in English.

1.6 **SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process supplemented and modified by requirements of this Section.
- .2 Submit to Owner’s Representative for approval samples of nameplates, identification tags and list of proposed wording.

PART 2 **PRODUCTS**

2.1 **NAMEPLATES FOR PANELS**

- .1 Identify by plastic laminate, 3 mm thick melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws.
- .2 Sizes: 25 x 67 mm minimum.
- .3 Lettering: minimum 7 mm high, black.
- .4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by plastic tie.
- .2 Sizes: 50 x 100 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.
- .4 Data to include: point name and point address, make, model number.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by Owner's Representative.
- .3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

- .1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.
- .2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Owner's Representative.

2.5 WIRING

- .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
- .2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.
- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 PNEUMATIC TUBING

- .1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

2.7 CONDUIT

- .1 Colour code EMCS conduit.
- .2 Pre-paint box covers and conduit fittings.
- .3 Coding: use fluorescent orange paint and confirm colour with Owner's Representative during "Preliminary Design Review".

PART 3 **EXECUTION**

3.1 **NAMEPLATES AND LABELS**

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 **EXISTING PANELS**

- .1 Correct existing nameplates and legends to reflect changes made during work.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 73 00 – Execution Requirements.
- .3 Section 07 84 00 – Firestopping.
- .4 Section 21 05 01 – Common Work Results-Mechanical.
- .5 Section 21 07 19 – Thermal Insulation of Piping.
- .6 Section 22 13 17 – Drainage Waste and Vent Piping – Cast Iron and Copper.
- .7 Section 23 05 05 – Installation of Pipework.
- .8 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .9 Section 23 07 13 – Duct Insulation.
- .10 Section 23 21 13.02 – Hydronic Systems:Steel.
- .11 Section 23 23 00 – Copper Tubing and Fittings Refrigerant.
- .12 Section 25 05 01 – EMCS: General Requirements.
- .13 Section 26 05 00 – Common Work Results-Electrical.

1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .2 ANSI C2, National Electrical Safety Code.
 - .3 ANSI/NFPA 70, National Electrical Code.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

- .2 CAN/CSA C22.3 No.1, Overhead Systems.
- .3 CSA C22.3 No. 7, Underground Systems.

1.3 SYSTEM DESCRIPTION

- .1 Electrical:
 - .1 Provide power wiring from emergency power panels where emergency power is provided to EMCS field panels. If no emergency power provided, install UPS Device. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.
 - .2 Hard wiring between field control devices and EMCS field panels.
 - .3 Communication wiring between EMCS field panels and OWS's including main control centre BECC.
 - .4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
 - .5 Refer to wiring diagrams included as part of flow diagrams. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval by Owner's Representative before commencing work.
 - .6 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.
- .2 Pneumatic:
 - .1 Pneumatic tubing, valves and fittings for field control devices.
- .3 Mechanical:
 - .1 Pipe taps required for EMCS equipment will be supplied and installed by Mechanical Division.
 - .2 Wells and control valves shall be supplied by EMCS Contractor and installed by Mechanical.
 - .3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Mechanical. Costs to be carried by designated trade.
- .4 VAV Terminal Units.
 - .1 Air flow probe for VAV boxes to be supplied and installed under Mechanical Division. Air flow dp sensor, actuator and associated VAV controls to be supplied and installed by EMCS contractor. Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators to be the responsibility of EMCS contractor. Coordinate air flow adjustments with balancing trade.

- .5 Structural:
 - .1 Special steelwork as required for installation of work.

1.4 PERSONNEL QUALIFICATIONS

- .1 Qualified factory trained supervisory personnel to:
 - .1 Continuously direct and monitor all work.
 - .2 Attend site meetings.

1.5 EXISTING CONDITIONS

- .1 Cutting and Patching: refer to Section 01 73 00 – Execution Requirements supplemented as specified herein.
- .2 Repair all surfaces damaged during execution of work.
- .3 Turn over to Owner's Representative existing materials removed from work not identified for re-use.

PART 2 PRODUCTS

2.1 PIPING

- .1 Domestic H&CWS: refer to Section 22 11 18-Domestic Water Piping Copper and Section 22 11 18.01 – Domestic Water Piping Plastic.
- .2 Sanitary, storm water: refer to Section 22 13 17- Drainage Waste, Vent Piping – Cast Iron and Copper and Section 22 13 18 – Drainage, Waste and Vent Piping – Plastic.
- .3 Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems: Steel and Section 23 20 12 Pressure Piping – Plastic.
- .4 Condenser water: refer to Section 23 21 13 02– Hydronic Systems: Steel.
- .5 Refrigeration: refer to Section 23 23 00 - Refrigerant Piping.
- .6 Sleeves, escutcheons: refer to Section 23 05 05 – Installation of Pipework.
- .7 Hangers and supports: refer to Section 23 05 29– Hangers and Supports for HVAC Piping and Equipment.
- .8 Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

2.2 SPECIAL SUPPORTS

- .1 Structural grade steel, primed and painted after construction and before installation.

2.3 PIPING FOR PNEUMATIC CONTROL SYSTEMS

- .1 Copper:
 - .1 Tubing: Type L Hard Drawn
 - .1 Fittings: wrought copper solder type to ANSI/ASME B16.22, and 95.5 antimonial tin solder. At instruments use compression fittings.
 - .2 At panels and junction boxes where there is a transition from plastic to copper use bulkhead fittings.
 - .2 Plastic:
 - .1 Flame retardant, black PVC with minimum burst strength 1.3 MPa at 23°C installed in conduit.
 - .2 Fittings: compression or barbed type as required.

2.4 WIRING

- .1 As per requirements of Electrical Divisions.
- .2 For 50V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
- .3 For wiring under 50 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.
- .4 Sizes:
 - .1 120V Power supply: to match or exceed breaker, size #12 minimum.
 - .2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
 - .3 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.
 - .4 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair. Wiring must be continuous without joints.
 - .5 More than 4 conductors: #22 minimum solid copper.
- .5 Terminations:
 - .1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.5 CONDUIT

- .1 As per requirements of Electrical Division.
- .2 Electrical metallic tubing to CSA C22.2 No. 03. Flexible and liquid tight flexible metal conduit to CSA C22.2 No.56. Rigid steel threaded conduit to CSA C22.2 No. 45.
- .3 Junction and pull boxes: welded steel.
 - .1 Surface mounting cast FS: screw-on flat covers.
 - .2 Flush mounting: covers with 25 mm minimum extension all round.
- .4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.
- .5 Outlet boxes: 100 mm minimum, square.
- .6 Conduit boxes, fittings:
 - .1 Bushings and connectors: with nylon insulated throats.
 - .2 With push pennies to prevent entry of foreign materials.
- .7 Fittings for rigid conduit:
 - .1 Couplings and fittings: threaded type steel.
 - .2 Double locknuts and insulated bushings: use on sheet metal boxes.
 - .3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.
- .8 Fittings for thin wall conduit:
 - .1 Connectors and couplings: steel, set screw type.

2.6 WIRING DEVICES, COVER PLATES

- .1 Conform to CSA.
- .2 Receptacles:
 - .1 Duplex: CSA type 5-15R.
 - .2 Single: CSA type 5-15R.
 - .3 Cover plates and blank plates: finish to match other plates in area.

2.7 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

- .1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.
 - .1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.
- .2 Exposed conduits or cables:
 - .1 50 mm diameter and smaller: one-hole steel straps.
 - .2 Larger than 50 mm diameter: two-hole steel straps.
- .3 Suspended support systems:
 - .1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.
 - .2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 PIPING

- .1 Domestic H&CWS: refer to Section 22 11 18 –Domestic Water Piping Copper.
- .2 Sanitary, storm water: refer to Section 22 13 17- Drainage Waste and Vent Piping – Cast Iron and Copper.
- .3 Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems:Steel.
- .4 Condenser water: refer to Section 23 21 13.02 – Hydronic Systems:Steel.
- .5 Refrigeration: refer to Section 23 23 00 - Copper Tubing and Fittings Refrigerant..
- .6 Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

3.3 MECHANICAL PIPING

- .1 Install piping in accordance with Section 23 05 05 – Installation of Pipework.

3.4 SUPPORTS

- .1 Install special supports as required and as indicated.

3.5 PNEUMATIC CONTROL SYSTEMS

- .1 General:
 - .1 Install tubing in accessible concealed locations, straight, parallel and close to building structure with required grades for drainage and venting.
 - .2 Install drip legs and drains at low points.
 - .3 Tubing to be free from surface damage.
 - .4 Tubing NOT to pass through or touch unheated ducts or enclosures.
 - .5 Do not cover pneumatic tubing with insulation.
 - .6 Test tubing, check joints after connection to system.
- .2 Copper tubing:
 - .1 Not to come into contact with dissimilar metal. Use non-metallic stand-offs on air handling systems.
 - .2 Install dielectric couplings where dissimilar metals are connected.
 - .3 Plastic tubing:
 - .1 Inaccessible locations: install plastic tubing in conduit.
 - .2 Inside panels: install in tube trays or racks, or clip individually to back of panel.
 - .3 Multiple tube bundles: install in tube trays, conduit or armoured flexible cable.

3.6 ELECTRICAL GENERAL

- .1 Do complete installation in accordance with requirements of:
 - .1 Electrical Divisions, this specification.
 - .2 CSA 22.1 Canadian Electrical Code, latest edition.
 - .3 ANSI/NFPA 70.
 - .4 ANSI C2.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage (above 50 V) contacts and mark to prevent accidental injury.
- .3 Do underground installation to CAN/CSA C22.3 No.7, except where otherwise specified.
- .4 Conform to manufacturer's recommendations for storage, handling and installation.

- .5 Check factory connections and joints. Tighten where necessary to ensure continuity.
- .6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- .7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.
- .8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .9 Install conduits, and sleeves prior to pouring of concrete.
- .10 Holes through exterior wall and roofs: flash and make weatherproof.
- .11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.7 CONDUIT SYSTEM

- .1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fills not to exceed 40%. Design drawings do not show conduit layout.
- .2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.
- .3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Owner's Representative before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.
- .4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.
- .5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.
- .6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
- .7 Limit conduit length between pull boxes to less than 30 m.
- .8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
- .9 Fastenings and supports for conduits, cables, and equipment:

- .1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.
- .2 Provide adequate support for raceways and cables, sloped vertically to equipment.
- .3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Owner's Representative.

- .10 Install polypropylene fish cord in empty conduits for future use.

- .11 Where conduits become blocked, remove and replace blocked sections.

- .12 Pass conduits through structural members only after receipt of Owner's Representative's written approval.

- .13 Conduits may be run in flanged portion of structural steel.

- .14 Group conduits wherever possible on suspended or surface channels.

- .15 Pull boxes:
 - .1 Install in inconspicuous but accessible locations.
 - .2 Support boxes independently of connecting conduits.
 - .3 Fill boxes with paper or foam to prevent entry of construction material.
 - .4 Provide correct size of openings. Reducing washers not permitted.
 - .5 Mark location of pull boxes on record drawings.
 - .6 Identify AC power junction boxes, by panel and circuit breaker.

- .16 Install terminal blocks or strips indicated in cabinets to Electrical Division.

- .17 Install bonding conductor for 120 volt and above in conduit.

3.8 WIRING

- .1 Install multiple wiring in ducts simultaneously.

- .2 Do not pull spliced wiring inside conduits or ducts.

- .3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.

- .4 Tests: use only qualified personnel. Demonstrate that:
 - .1 Circuits are continuous, free from shorts, unspecified grounds.
 - .2 Resistance to ground of all circuits is greater than 50 Megohms.

- .5 Provide Owner's Representative with test results showing locations, circuits, results of tests.
- .6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.
- .7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.
- .8 Do not allow wiring to come into direct physical contact with compression screw.
- .9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.9 WIRING DEVICES, COVER PLATES

- .1 Receptacles:
 - .1 Install vertically in gang type outlet box when more than one receptacle is required in one location.
- .2 Cover plates:
 - .1 Install suitable common cover plate where wiring devices are grouped.
 - .2 Use flush type cover plates only on flush type outlet boxes.

3.10 STARTERS, CONTROL DEVICES

- .1 Install and make control connections as indicated. Power connections above 50V by Electrical Division.
- .2 Install correct over-current devices.
- .3 Identify each control wire, terminal for external connections with permanent number marking identical to diagram.
- .4 Performance Verification:
 - .1 Operate switches and controls to verify functioning.
 - .2 Perform start and stop sequences of contactors and relays.
 - .3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.11 GROUNDING

- .1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.
- .2 Install separate grounding conductors in conduit within building.
- .3 Install ground wire in all PVC ducts and in tunnel conduit systems.
- .4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.12 TESTS

- .1 General:
 - .1 Perform following tests in addition to tests specified Section 25 08 20 - EMCS: Warranty and Maintenance.
 - .2 Give 14 days written notice of intention to test.
 - .3 Conduct in presence of Owner's Representative and authority having jurisdiction.
 - .4 Conceal work only after tests satisfactorily completed.
 - .5 Report results of tests to Owner's Representative in writing.
 - .6 Preliminary tests:
 - .1 Conduct as directed to verify compliance with specified requirements.
 - .2 Make needed changes, adjustments, replacements.
 - .3 Insulation resistance tests:
 - .1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.
 - .2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Owner's Representative and authority having jurisdiction.

3.13 IDENTIFICATION

- .1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

PART 1

GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

- .1 Canada Labour Code (R.S., c. L-2)/Part I - Industrial Relations.
- .2 Canadian Standards Association (CSA)
 - .1 CSA Z204 – Guidelines for Managing Indoor Quality in Buildings

1.4 DEFINITIONS

- .1 OWS - Operator Work Station.
- .2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit detailed preventative maintenance schedule for system components to Owner's Representative.
- .3 Submit detailed inspection reports Owner's Representative.
- .4 Submit dated, maintenance task lists to Owner's Representative and include the following sensor and output point detail, as proof of system verification:
 - .1 Point name and location.
 - .2 Device type and range.
 - .3 Measured value.
 - .4 System displayed value.
 - .5 Calibration detail
 - .6 Indication if adjustment required,
 - .7 Other action taken or recommended.
- .5 Submit network analysis report showing results with detailed recommendations to correct problems found.

- .6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Maintain records and logs of each maintenance task on site.
 - .2 Organize cumulative records for each major component and for entire EMCS chronologically.
 - .3 Submit records to Owner's Representative, after inspection indicating that planned and systematic maintenance have been accomplished.
- .7 Revise and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.6 MAINTENANCE SERVICE DURING WARRANTY PERIOD

- .1 Provide services, materials, and equipment to maintain EMCS for warranty period of one year after date of substantial completion. Provide detailed preventative maintenance schedule for system components as described in Submittal article.
- .2 Emergency Service Calls:
 - .1 Initiate service calls when EMCS is not functioning correctly.
 - .2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
 - .3 Furnish Owner's Representative with telephone number where service personnel may be reached at any time.
 - .4 Service personnel to be on site ready to service EMCS after receiving request for service.
 - .5 Perform work continuously until EMCS restored to reliable operating condition.
- .3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.
- .4 Work requests: record each service call request, when received separately on approved form and include:
 - .1 Serial number identifying component involved.
 - .2 Location, date and time call received.
 - .3 Nature of trouble.
 - .4 Names of personnel assigned.
 - .5 Instructions of work to be done.
 - .6 Amount and nature of materials used.
 - .7 Time and date work started.
 - .8 Time and date of completion.
- .5 Provide system modifications in writing.
 - .1 No system modification, including operating parameters and control settings, to be made without prior written approval of Owner's Representative.

PART 2 **PRODUCTS (NOT USED)**

PART 3 **EXECUTION**

3.1 **FIELD QUALITY CONTROL**

- .1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Owner's Representative as described in Submittal article.
- .2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.
- .3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:
 - .1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
 - .2 Check and calibrate random sample of 10% field input/output devices in accordance with Canada Labour Code - Part I and CSA Z204.
 - .3 Provide dated, maintenance task lists, as proof of execution of complete system verification.
- .4 Minor inspections to include, but not limited to:
 - .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
 - .2 Check equipment cooling fans as required.
 - .3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.
 - .4 Review system performance with Operations Supervisor and/or Owner's Representative to discuss suggested or required changes.
- .5 Major inspections to include, but not limited to:
 - .1 Minor inspection.
 - .2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
 - .3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
 - .4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required (as per 3.1. 3.2).
 - .5 Provide mechanical adjustments, and necessary maintenance on printers.
 - .6 Run system software diagnostics as required.
 - .7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

- .1 Perform network analysis and provide report as described in Submittal article.
- .6 Rectify deficiencies revealed by maintenance inspections and environmental checks.
- .7 Continue system debugging and optimization.
- .8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.
 - .1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

PART 1

GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).
- .2 Related Sections:
 - .1 Section 25 05 01 – EMCS: General Requirements.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications).
 - .2 CSA T530, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA – 569-A with modifications).
- .2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information Technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements.
 - .1 IEEE Std 802.3TM, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.
- .3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA).
 - .1 TIA/EIA-568, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements, Part 2 Balanced Twisted- Pair Cabling Components, Part 3 Optical Fiber Cabling Components Standard.
 - .2 TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces.
- .4 Treasury Board Information Technology Standard (TBITS).
 - .1 TBITS 6.9, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings-Technical Specifications.

1.3 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 – EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

- .1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530 and TIA/EIA-569-A.
 - .1 Provide reliable and secure connectivity of adequate performance between different sections segments of network.

- .2 Allow for future expansion of network, with selection of networking technology and communication protocols.
- .2 Data communication network to included, but not limited to:
 - .1 EMCS-LAN.
 - .2 Modems.
 - .3 Network interface cards.
 - .4 Network management hardware and software.
 - .5 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

- .1 EMCS Local Area Network (EMCS-LAN).
 - .1 High Speed, high performance, local area network over MS/TP with MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
 - .2 EMCS-LAN to be: BACnet Protocol
 - .3 Each EMCS-LAN to be capable of supporting at least 50 devices.
 - .4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.
 - .5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.
 - .6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
 - .7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.
- .2 Dynamic Data Access.
 - .1 LAN to provide capabilities for OWSs, either network resident or connected remotely to access point status and application report data or execute control functions for other devices via LAN.
 - .2 Access to data to be based upon logical identification of building equipment.
- .3 Network Medium.
 - .1 Network medium: twisted cable, shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

PART 2 **PRODUCTS (NOT USED)**

PART 3 **EXECUTION (NOT USED)**

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 25 05 01 – EMCS: General Requirements.
- .2 Section 25 05 02 – EMCS: Submittals and Review Process.
- .3 Section 25 05 03 – EMCS: Project Record Documents.
- .4 Section 25 30 01 – EMCS: Building Controllers.
- .5 Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.2 **DEFINITIONS**

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 **SUBMITTALS**

- .1 In accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

1.4 **MAINTENANCE**

- .1 In accordance with Section 25 08 20 – EMCS: Warranty and Maintenance and Section 25 05 03 - EMCS: Project Records Documents.

PART 2 **PRODUCTS**

2.1 **OWS HARDWARE**

- .1 No EMCS operator workstation is required for this project.

2.2 **OPERATOR'S CONTROL SOFTWARE**

- .1 No graphics is required by the EMCS contractor for this project.

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Materials and installation for building automation controllers including:
 - .1 Master Control Unit (MCU).
 - .2 Local Control Unit (LCU)
 - .3 Equipment Control Unit (ECU).
 - .4 Terminal Control Unit (TCU).

1.2 **RELATED SECTIONS**

- .1 Section 25 05 01 - EMCS: General Requirements.
- .2 Section 25 05 02 - EMCS: Submittals and Review Process.
- .3 Section 25 05 03 - EMCS: Project Records Documents.
- .4 Section 25 30 02 - EMCS: Field Control Devices.
- .5 Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 **REFERENCES**

- .1 American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE, Applications Handbook, SI Edition.
 - .2 ASHRAE Standard 135 – BAC net – A Data Communications Protocol for Building Automation and Control Networks.
 - .3 ASHRAE Standard 135.1 Method of Test Conformance to BAC net.
- .2 Canadian Standards Association (CSA)
 - .1 C22.2 No.205, Signal Equipment.
- .3 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE C37.90.1, Surge Withstand Capabilities Test for Protective Relays and Relays Systems.

1.4 **DEFINITIONS**

- .1 Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

- .1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.
 - .1 Provide sufficient controllers to meet intents and requirements of this section.
 - .2 Controllers quantity, and point contents to be approved by Owner's Representative at time of preliminary design review.
- .2 Controllers: stand-alone intelligent Control Units:
 - .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
 - .2 Incorporate communication interface ports for communication LANs to exchange information with other Controllers.
 - .3 Capable of interfacing with operator interface device.
 - .4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.6 DESIGN REQUIREMENTS

- .1 To include:
 - .1 Scanning of AI and DI connected inputs for detection of change of value and processing the detection of alarm conditions.
 - .2 Perform On-Off digital control of connected points, including the resulting required states generated through programmable logic output.
 - .3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.
 - .4 Control of systems as described in sequence of operations.
 - .5 Execution of optimization routines as listed in this section.
- .2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.
- .3 Field Termination and Interface Devices.
 - .1 To conform to CSA C22.2 No. 205.
 - .2 Electronically interface sensors and control devices to processor unit.
 - .3 Include, but not be limited to, following:
 - .1 Programmed firmware or logic circuits to meet functional and technical requirements.
 - .2 Power supplies for operation of logic devices and associated field equipment.
 - .3 Lockable wall cabinet.
 - .4 Required communications equipment and wiring .
 - .5 Leave controlled system in "fail-safe" mode in event of loss of communication

- with, or failure of, processor unit.
- .6 Input/Output interface to accept as minimum AI, AO, DI, DO functions as specified.
- .7 Wiring terminations: use conveniently located screw type or spade lug terminals.
- .4 AI interface equipment to:
 - .1 Convert analog signals to digital format with 12 bit analog-to-digital resolution.
 - .2 Provide for following input signal types and ranges:
 - .1 4 - 20 mA;
 - .2 0-10V DC
 - .3 10 K ohm.
 - .3 Meet IEEE C37.90.1 surge withstand capability.
 - .4 Have common mode signal rejection greater than 60 dB to 60 Hz.
 - .5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.
- .5 AO interface equipment:
 - .1 Convert digital data from controller processor to acceptable analog output signals using 12 bit digital-to-analog resolution.
 - .2 Provide for following output signal types and ranges:
 - .1 4 - 20 mA.
 - .2 0 - 10 V DC.
 - .3 Meet IEEE C37.90.1 surge withstand capability.
- .6 DI interface equipment:
 - .1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
 - .2 Meet IEEE C37.90.1 surge withstand capability.
 - .3 Accept pulsed inputs up to 2 kHz.
- .7 DO interface equipment:
 - .1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.
 - .2 Switch up to 5 amps at 220 V AC using optional interface relay.
- .4 Controller's and associated hardware and software: operate in conditions of 0°C to 44°C and 20 % to 90 % non-condensing RH.
- .5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.
 - .1 Provide for conduit entrance from top, bottom or sides of panel.
 - .2 ECUs to be mounted in equipment enclosures or separate enclosures.
 - .3 Mounting details as approved by Owner's Representative for ceiling mounting.
- .6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.
- .7 Provide surge and low voltage protection for interconnecting wiring connections.

1.7 SUBMITTALS

- .1 Make Submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process.
 - .1 Submit product data sheets for each product item proposed for this project.

1.8 MAINTENANCE PROCEDURES

- .1 Provided manufacturers recommended maintenance procedures for insertion in Section 25 05 03 – EMCS: Project Record Documents.

PART 2 PRODUCTS

2.1 MASTER CONTROL UNIT (MCU)

- .1 Primary function of MCU is to provide co-ordination and supervision of subordinate devices. Supervisory role shall include coordination of subordinate devices in the execution of optimization routines such as demand limiting or enthalpy control.
- .2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices. Include support for Open System Protocols, BACnet.
- .3 MCU shall have local I/O capacity as follows:
 - .1 To have at least 16 I/O points of which minimum to be 2AO, 6AI, 4DI, 4DO.
 - .2 LCU's to be added to support system functions as indicated in I/O Summary List.
- .4 Central Processor Unit (CPU)
 - .1 Processor to consist of at minimum a 16 bit microprocessor capable of supporting software to meet specified requirements.
 - .2 CPU idle time to be more than 30 % when system configured to maximum input and output with worst case program use.
 - .3 Minimum addressable memory to be at manufacturer's discretion but to support at least all performance and technical specifications. Memory to include:
 - .1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.
 - .2 Battery backed (72 hr minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) RAM to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS, CAB-Gateway, or locally installed floppy disk.
 - .4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving month/day/hour/minute/second, with rechargeable batteries for minimum 72 hr operation in event of power failure.
- .5 Local Operator Terminal (OT)

- .1 OT to:
 - .1 Have integral access/display panel where immediate access to OWS is not available.
 - .2 Support operator's terminal for local command entry, instantaneous and historical data display, programs additions and modifications.
 - .3 Simultaneously display minimum of 16 points with full English identification to allow operator to view single screen dynamic displays depicting entire mechanical systems.
- .2 Functions to include, but not be limited to, following:
 - .1 Start and stop points.
 - .2 Modify setpoints.
 - .3 Modify PID loop setpoints.
 - .4 Override PID control.
 - .5 Change time/date.
 - .6 Add/modify/start/stop weekly scheduling.
 - .7 Add/modify setpoint weekly scheduling.
 - .8 Enter temporary override schedules.
 - .9 Define holiday schedules.
 - .10 View analog limits.
 - .11 Enter/modify analog warning limits.
 - .12 Enter/modify analog alarm limits.
 - .13 Enter/modify analog differentials.
- .3 OT to provide access to real and calculated points in controller to which it is connected or to any other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and any other controller in network.
- .4 Operator access to OTs to the same as OWS user password. Password changes to automatically be downloaded to controllers on network.
- .5 OT to provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.
- .6 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

2.2 LOCAL CONTROL UNIT (LCU)

- .1 Provide multiple control functions for typical built-up and package HVAC, hydronic and electrical systems.
- .2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.
- .3 Points of one Building System to be connected to one controller as listed in I/O Summary designations.

- 4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements. As per MCU requirements (section 2.3.4) above with the following additions:
 - .1 Include as minimum 2 interface ports for connection to local computer terminal.
 - .2 Design so that shorts, opens or grounds on any input or output will not interfere with other input or output signals.
 - .3 Physically separate line voltage (50V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
 - .4 Include power supplies for operation of LCU and associated field equipment.
 - .5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
 - .6 Provide conveniently located screw type or spade lug terminals for field wiring.
 - .7 LCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

- .1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.
 - .1 The TCU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook.
- .2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.
- .3 VAV Terminal Controller
 - .1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.
 - .2 Controller to support point definition; in accordance with section 25 05 01 – EMCS: General Requirements.
 - .3 Controller to operate independent of network in case of communication failure.
 - .4 Controller to include damper actuator and terminations for input and output sensors and devices.

2.4 SOFTWARE

- .1 General:
 - .1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.
 - .2 To include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.
 - .3 Include initial programming of all Controllers, for entire system.

- .2 Program and data storage:
 - .1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.
 - .2 Maintain CDL and operating data such as setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.
- .3 Programming languages:
 - .1 Control Description Logic software to be programmed using English like or graphical, high level, general control language.
 - .2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed.
- .4 Operator terminal interface:
 - .1 MCU to perform operating and control functions specified Section 25 10 02 - EMCS: Operator Work Stations (OWS), including:
 - .1 Multi-level password access protection to allow user/manager to limit workstation control.
 - .2 Alarm management: processing and messages.
 - .3 Operator commands.
 - .4 Reports.
 - .5 Displays.
 - .6 Point identification.
- .5 Pseudo or calculated points:
 - .1 Software to have access to any value or status in controller or other networked controller so as to define and calculate pseudo point from other values/status of controller. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.
 - .2 Inputs and outputs for any process to be able to include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to any number of other processes (eg. cascading).
- .6 Control Description Logic (CDL):
 - .1 Capable of generating on-line project-specific control loop algorithms (CDLs). CDLs to be software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.
 - .2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (eg. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS or BC(s) and to tune control loops.
 - .3 Perform changes to CDL on-line.
 - .4 Control logic to have access to values or status of all points available to controller including global or common values, allowing cascading or inter-locking control.

- .5 Energy optimization routines such as enthalpy control, supply temperature reset, etc. to be LCU or MCU resident functions and form part of CDL.
- .6 MCU to be able to perform following pre-tested control algorithms:
 - .1 Two position control.
 - .2 Proportional Integral and Derivative (PID) control.
 - .3 Automatic control loop tuning.
- .7 Control software to provide the ability to define the time between successive starts for each piece of equipment to reduce cycling of motors.
- .8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
- .9 Power Fail Restart: Upon detection of power failure system to verify availability of emergency power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.
- .7 Event and Alarm management: The system to use a management by exception concept for Alarm Reporting. This is a system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as a direct result of the primary event to be suppressed by the system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. The exception is, when an air handler which is supposed to stop or start fails to do so under the event condition.
- .8 Energy management programs: The following programs shall include specific summarizing reports, to include the date stamp indicating sensor details which activated and or terminated the feature.
 - .1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:
 - .1 Time of day scheduling.
 - .2 Calendar based scheduling.
 - .3 Holiday scheduling.
 - .4 Temporary schedule overrides.
 - .5 Optimal start stop.
 - .6 Night setback control.
 - .7 Enthalpy (economizer) switchover.
 - .8 Peak demand limiting.
 - .9 Temperature compensated load rolling.
 - .10 Fan speed/flow rate control.
 - .11 Cold deck reset.
 - .12 Hot deck reset.
 - .13 Hot water reset.

- .14 Chilled water reset.
- .15 Condenser water reset.
- .16 Chiller sequencing.
- .17 Night purge.
- .2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.
- .3 Apply programs to equipment and systems as specified or requested by the Owner's Representative.
- .9 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.
 - .1 MCUs to accumulate and store automatically run-time for binary input and output points.
 - .2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.
 - .3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.
 - .4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.
 - .5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWh, litres, tonnes, etc.).
 - .6 Store event totalization records with minimum of 9,999,999 events before reset.
 - .7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 LEVELS OF ADDRESS

- .1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.
 - .1 Display analog values digitally to 1 place of decimals with negative sign as required.
 - .2 Update displayed analog values and status when new values received.
 - .3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.
 - .4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 POINT NAME SUPPORT

- .1 Controllers (MCU, LCU) to support point naming convention as defined in Section 25 05 01 – EMCS: General Requirements.

PART 3 **EXECUTION**

3.1 LOCATION

- .1 Location of Controllers to be approved by Owner's Representative.

3.2 INSTALLATION

- .1 Install Controllers in secure enclosures as indicated.
- .2 Provide necessary power from local 120 V branch circuit panel for equipment.
- .3 Install tamper locks on breakers of circuit breaker panel.
- .4 Use Uninterruptible Power Supply (UPS) and emergency power when equipment must operate in an emergency and co-ordinating mode.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 33 56 13 - Aboveground Fuel Storage Tanks.
- .2 Section 25 05 02 - EMCS: Submittals and Review Process.
- .3 Section 25 05 03 - EMCS: Project Records Documents.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C12.7, Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13, Requirements for Instrument Transformers.
- .2 Canadian Standards Association (CSA)
 - .1 CSA Type 1 Enclosure
 - .2 CSA Type 4X Enclosures
 - .3 CSA Type 12 Enclosures

1.3 SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.
- .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 Owner's 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 25 05 03 - EMCS: Project Records Documents.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.
- .3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in CSA 4X 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 TEMPERATURE SENSORS

- .1 General: except for VAV box control to be resistance or thermocouple type to following requirements:
 - .1 Thermistors 10 K ohm, $\pm 0.2^\circ$ C accuracy, less than 0.1° C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac..
 - .2 RTD's: 1000 ohm at 0 °C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm°C.
 - .3 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.
- .2 Sensors:
 - .1 Room type: wall mounting, in slotted type covers, LCD display °C or °F, with guard as indicated. Dual set point momentary push button, override switch.
 - .2 Room type for VAV boxes: as for room type, above. Include setpoint adjustment, local indication, push button override for night set back function.
 - .3 General purpose duct type: suitable for insertion into ducts at any angle, insertion length 460 mm.
 - .4 Averaging duct type: continuous filament with minimum immersion length 6000 mm. Bend probe at field installation time to 100 mm radius at any point along probe without degradation of performance.

- .5 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in CSA 4X enclosure.
- .6 Immersion type: spring loaded probe, NPT ½ fitting insertion to suit pipe size.

2.3 TEMPERATURE TRANSMITTERS

- .1 Requirements:
 - .1 Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detector type sensors.
 - .2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg C per volt change.
 - .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .4 Input and output short circuit and open circuit protection.
 - .5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.
 - .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
 - .7 Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.
 - .8 Integral zero and span adjustments.
 - .9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 °C.
 - .10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.
 - .11 Transmitter ranges: Select narrowest range to suit application from following:
 - .1 Minus 50 °C to plus 50 °C, plus or minus 0.5 °C.
 - .2 0 to 100 °C, plus or minus 0.5 °C.
 - .3 0 to 50 °C, plus or minus 0.25 °C.
 - .4 0 to 25 °C, plus or minus 0.1 °C.
 - .5 10 to 35 °C, plus or minus 0.25°C.

2.4 HUMIDITY SENSORS

- .1 Requirements:
 - .1 Range: 5 - 95 % RH minimum.
 - .2 Operating temperature range: -40°C to 85°C.
 - .3 Absolute accuracy:
 - .1 Duct sensors: plus or minus 5 %.
 - .2 Room sensors: plus or minus 2 % .
 - .4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
 - .5 Maintenance: by simple field method such as washing with solvent or mild detergent solution so as to remove anticipated airborne contaminants.
 - .6 Maximum sensor non-linearity: plus or minus 0.5% RH with defined curves.
 - .7 Room sensors: wall mounted as indicated.

- .8 Duct mounted sensors: locate so that sensing element is between 1/3 and 2/3 distance across any duct dimension.
- .9 Sensors to be unaffected by external transmitters such as walkie-talkies. Demonstrate to Owner's Representative.
- .10 Power supply: 18-35 Vdc, 18-32 Vac with temperature sensor.

2.5 HUMIDITY TRANSMITTERS

- .1 Requirements:
 - .1 Input signal: from 1000 ohm RTD.
 - .2 Output signal: 4 - 20 mA into 1000 ohm maximum load, 0-5 Vdc, 0-10 Vdc.
 - .3 Input and output short circuit and open circuit protection.
 - .4 Output accuracy: not to exceed 0.1 % of full span.
 - .5 Output linearity error: plus or minus 1.0 % maximum of full scale output.
 - .6 Integral zero and span adjustment.
 - .7 Temperature range: 0-70°C, -40°C to 85°C for outside air.
 - .8 Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.

2.6 PRESSURE/CURRENT (P/I) TRANSMITTERS

- .1 Requirements:
 - .1 Range: as indicated in I/O summaries.
 - .1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.
 - .2 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
 - .2 Output signal: 4 - 20 mA, 0-5V, 0-10V.
 - .3 Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10 %.
 - .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1% of full scale output over entire range.
 - .5 Integral zero and span adjustment.
 - .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.
 - .7 Over-pressure input protection to at least twice rated input pressure.
 - .8 Output short circuit and open circuit protection.
 - .9 Pressure ranges: see I/O Summaries.
 - .10 Accuracy: plus or minus 1 % of full scale.
 - .11 LCD Display.

2.7 DIFFERENTIAL PRESSURE (KPA) TRANSMITTERS

- .1 Requirements:
 - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
 - .2 Output signal: 4 - 20 mA, 0-5V, 0-10V.
 - .3 Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10 %.

- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1 % of full scale output over entire range.
- .5 Integral zero and span adjustment.
- .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.
- .7 Over-pressure input protection to at least twice rated input pressure.
- .8 Output short circuit and open circuit protection.
- .9 The unit to have a NPT connections. The enclosure shall be an integral part of the unit.
- .10 LCD Display.

2.8 DIFFERENTIAL PRESSURE (PA) TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.
 - .2 Output variations: \pm 1% full scale for supply voltage variations of plus or minus 10%.
 - .3 Integral zero and span adjustment.
 - .4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.
 - .5 Output short circuit and open circuit protection.
 - .6 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.
 - .7 Pressure ranges: see I/O Summaries.
 - .8 LCD Display.

2.9 FAN SYSTEM STATIC PRESSURE SENSORS

- .1 As per 2.10

2.10 FAN SYSTEM STATIC PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.
 - .2 Output variations: \pm 1% full scale for supply voltage variations of plus or minus 10%.
 - .3 Integral zero and span adjustment.
 - .4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.
 - .5 Output short circuit and open circuit protection.
 - .6 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.
 - .7 Pressure ranges: see I/O Summaries.
 - .8 LCD Display.

2.11 DUCT SYSTEM VELOCITY PRESSURE SENSORS

- .1 Requirements:
 - .1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.

- .2 Maximum pressure loss: 37 Pa at 1000 m/s.
- .3 Accuracy: plus or minus 1 % of actual duct velocity.

2.12 FAN SYSTEM VELOCITY PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
 - .2 Calibrated span: not to exceed 25 % of duct velocity pressure at maximum flow.
 - .3 Accuracy: 0.4 % of span.
 - .4 Repeatability: within 0.1 % of output.
 - .5 Linearity: within 0.5 % of span.
 - .6 Deadband or hysteresis: 0.1 % of span.
 - .7 External exposed zero and span adjustment.
 - .8 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

2.13 TURBINE FLOW METERS

- .1 Requirements:
 - .1 Flow range: as specified in I/O summaries.
 - .2 Pressure rating: 1035 kPa (gauge) at 38 °C.
 - .3 Temperature rating: 5 to 260 °C.
 - .4 Repeatability: plus or minus 0.1 %.
 - .5 Accuracy and linearity: plus or minus 0.5 %.
 - .6 Flow rangability: at least 10:1.
 - .7 Output voltage: 30 to 300 mV peak-to-peak into 10 Kohm load.
 - .8 Body material: brass, bronze or cast iron.
 - .9 Ends:
 - .1 NPS 2 and under: screwed or flanged
 - .2 NPS 2 1/2 and over: flanged.

2.14 FREQUENCY-TO-DC TRANSMITTERS FOR TURBINE METERS

- .1 Requirements:
 - .1 Input: greater than 5000 ohm.
 - .1 Range: greater than 100 mV less than 20 V peak-to-peak, 200 through 400 Hz.
 - .2 Span adjustment: fully adjustable.
 - .3 Zero adjustment: 0 to 10% of output.
 - .4 Output: 4 to 20 mA into 500 ohm load.
 - .5 Load effect: plus or minus 0.1 % of span zero to maximum load resistance.
 - .6 Linearity and repeatability: plus or minus 0.05 % of span.
 - .7 Power input: 24 V DC plus or minus 10 %.
 - .8 Input, output and power input transformer isolated.
 - .9 Enclosure: general purpose CSA 1.

2.15 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS AND SWITCHES

- .1 Requirements:
 - .1 Range: as indicated in I/O summaries.
 - .1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.
 - .2 Adjustable setpoint and differential.
 - .3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.
 - .4 Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.
 - .5 Accuracy: within 2% repetitive switching.
 - .6 Provide sensor pressure and accuracy ratings:
 - .1 Chilled and condenser water: 860 kPa.
 - .2 Hot water: 860 kPa.
 - .3 Low pressure steam, compressed air: 1050 kPa. Range: 0 to 200 kPa. Accuracy: plus or minus 3 kPa.
 - .4 Medium pressure steam, compressed air: 1050 kPa. Range: 0 to 700 kPa. Accuracy: plus or minus 7 kPa.
 - .5 High pressure steam: 2100 kPa. Range: 0 to 2100 kPa. Accuracy: plus or minus 14 kPa.
 - .6 High temperature water: 2700 kPa. Range: 0-2700 kPa. Accuracy: plus or minus 25 kPa.
 - .7 For fan operation: Range: 0 to 3000 Pa. Adjustable differential: 10 to 300 Pa.
 - .7 Provide sensors with isolation valve and snubber between sensor and pressure source on liquid service.
 - .8 Sensors on steam and high temperature hot water service: provide pigtail syphon.

2.16 TEMPERATURE SWITCHES

- .1 Requirements:
 - .1 Range: see I/O summaries.
 - .2 Temperature sensor: liquid, vapour or bimetallic type. Operate automatically. Reset automatically, except as follows:
 - .1 Freeze protection: manual reset. Optional if software does not auto restart.
 - .2 Fire detection: manual reset. Optional if software does not auto restart.
 - .3 Duct Heater: high limit manual reset in addition to automatic reset.
 - .3 Adjustable setpoint and differential.
 - .4 Accuracy: plus or minus 1 °C.
 - .5 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.
 - .6 Type as follows:
 - .1 Room: for wall mounting on standard electrical box with or without protective guard as indicated.
 - .2 Duct, general purpose: insertion length = 460 mm.

- .3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.
- .4 Freeze detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 300 mm length.
- .5 Strap-on: with helical screw stainless steel clamp.

2.17 TANK LEVEL SWITCHES

- .1 Requirements:
 - .1 Indicate high/low water level and to alarm.
 - .2 For mounting on top of tank.
 - .3 Maximum operating temperature: 120 °C.
 - .4 Mechanical switch or snap action contacts rated 15 amp at 120 V.
 - .5 Adjustable setpoint and differential.

2.18 LIQUID LEVEL SWITCHES

- .1 Requirements:
 - .1 Liquid level activated switch sealed in waterproof and shockproof enclosure.
 - .2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.
 - .3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.19 WIND VELOCITY TRANSMITTERS

- .1 Requirements:
 - .1 3-cup anemometer and airfoil vane mounted on common vertical axis, designed for mast mounting.
 - .2 Anemometer:
 - .1 Range: 0-160 km/h.
 - .2 Threshold: 3.0 km/h.
 - .3 Accuracy: +/- 2%.
 - .3 Airfoil vane
 - .1 Anemometer range: 0-360° with infinite resolution potentiometer with no loss of reading at transition point.
 - .2 Starting threshold: 1.1 m/s.
 - .3 Accuracy: +/- 0.5%.
 - .4 Output signal: 4 to 20 mA into 500 ohm load.
 - .5 Provide two output signals: velocity, direction.
 - .6 Mast: aluminum, size and height as indicated. Provide at least 3 stainless steel guys, turnbuckles, anchor bolts. Follow manufacturers installation guidelines. Lightning protection as indicated on electrical drawings.

2.20 SOLAR SENSORS

- .1 Monitor solar irradiation as indicated.
- .2 Pyranometer, black and white, producing proportional 0-50 mV signal. Include converter for 4-20 mA signal.

2.21 CURRENT/PNEUMATIC (I/P) TRANSDUCERS

- .1 Requirements:
 - .1 Input range: 4 to 20 mA.
 - .2 Output range: proportional 20-104 kPa.
 - .3 Housing: dustproof or panel mounted.
 - .4 Internal materials: suitable for continuous contact with industrial standard instrument air.
 - .5 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 2 % of full scale over entire range.
 - .6 Integral zero and span adjustment.
 - .7 Temperature effect: plus or minus 2.0 % full scale/ 50 °C or less.
 - .8 Regulated supply pressure: 206 kPa maximum.
 - .9 Air consumption: 16.5 ml/s maximum.
 - .10 Integral gauge manifold c/w gauge (0-206 kPa).

2.22 SOLENOID CONTROL AIR VALVES

- .1 Coil: 120V AC or 24V DC, as indicated.
- .2 Complete with manual over-ride.
- .3 Shall have the capacity to pass .07 l/s air at 104 kPa differential.

2.23 AIR PRESSURE GAUGES

- .1 Diameter: 38 mm minimum.
- .2 Range: zero to two times operating pressure of measured pressure media to nearest standard range.

2.24 ELECTRICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.
 - .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
 - .3 Contacts: rated at 5 amps at 120 V AC.
 - .4 Relay to have visual status indication

2.25 SOLID STATE RELAYS

- .1 Requirements:

- .1 CSA approved.
- .2 Suitable to the application as recommended by manufacturer.
- .3 Voltage range: 75-265 VAC
- .4 Panel mounting.
- .5 Suitable for AC or DC loads.
- .6 Output surge absorbing element for inductive on/off loads.
- .7 Input capacitor/resistor circuit for pulse noise absorption.
- .8 For input inductive noise use twisted-pair wires for electromagnetic noise and shielded cable for static noise.

2.26 CURRENT TRANSDUCERS

- .1 Requirements:
 - .1 Range: in accordance with Equipment Schedules.
 - .2 Purpose: measure line current and produce proportional signal in one of following ranges:
 - .1 4-20 mA DC.
 - .2 0-5 volt DC.
 - .3 0-10 volts DC.
 - .4 2-10 volts DC.
 - .3 Frequency insensitive from 10 - 80 hz.
 - .4 Accuracy to 0.5% full scale.
 - .5 Zero and span adjustments. Field adjustable range to suit motor applications.
 - .6 Adjustable mounting bracket to allow for secure/safe mounting inside the MCC or starter enclosure.

2.27 CURRENT SENSING RELAYS

- .1 Requirements:
 - .1 Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.
 - .2 Suitable for single or 3 phase metering into single relay.
 - .3 To have adjustable latch level, adjustable delay on latch and minimum differential of 10 % of latch setting between latch level and release level.
 - .4 3-Phase application: provide for discrimination between phases.
 - .5 To have adjustable latch level to allow detection of worst case selection. To be powered from control circuit of motor starter being metered. Relay and base to be mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. Adjustments to be acceptable from auxiliary cabinet.
 - .6 Relay contacts: capable of handling 10 amps at 240 V AC.

2.28 CONTROL DAMPERS

- .1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.
- .2 Materials

- .1 Frame: 2.3 mm minimum thickness galvanized steel.
 - .2 Blades: galvanized steel with two sheets 0.5 mm thick or otherwise reinforced to ensure specified low leakage when fully closed.
 - .3 Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.
 - .4 Linkage and shafts: zinc plated steel.
 - .5 Seals: replaceable neoprene or stainless steel spring on sides, top, bottom of frame, along all blade edges and blade ends.
- .3 Performance:
- .1 Capacity: refer to I/O Summaries.
 - .2 0.02 L/s.m² maximum allowable leakage against 1000 Pa static pressure.
 - .3 Temperature range: minus 50°C to plus 100°C.
 - .4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

2.29 PNEUMATIC CONTROL DAMPER OPERATORS

- .1 Requirements:
- .1 Piston type with spring return for "fail-safe" in Normally Open or Normally Closed position, as indicated.
 - .2 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).
 - .3 Adjustable spring and stroke external stops to limit strokes in either direction.
 - .4 Full relay type positioner with interconnecting linkage for mechanical feedback of actual damper position.
 - .5 Multiple section dampers over 1200 mm long: to be driven from both ends.

2.30 ELECTRONIC CONTROL DAMPER OPERATORS

- .1 Requirements
- .1 Push-pull proportional type as indicated.
 - .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
 - .3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).
 - .4 Power requirements: 5 VA maximum at 24 V AC.
 - .5 Operating range: 4-20 mA. 0-10 V DC, 2-10 V DC.

2.31 CONTROL VALVES

- .1 Requirements:
- .1 NPS 2 and under: bronze with screwed ends.
 - .2 NPS 2 1/2 and over: cast iron with flanged ends.
 - .3 Trim: type 316 stainless steel.
 - .4 Leakage: 0.5 % of rated flow maximum.
 - .5 Two or three port as indicated. Normally Open or Normally Closed, as indicated.

- .6 Flow characteristics: linear or equal percentage as indicated.
- .7 Rangeability: 50:1 minimum.
- .8 Performance: Capacity refer to I/O Summaries and Valve Schedule.

2.32 PNEUMATIC VALVE ACTUATORS

- .1 Requirements:
 - .1 Construction: steel, cast iron, aluminum.
 - .2 Diaphragm: moulded Buna-N rubber, nylon reinforced.
 - .3 Spring return to normal position.
 - .4 Spring range adjustment and position indicator.

2.33 ELECTRONIC/ELECTRIC VALVE ACTUATORS

- .1 Requirements:
 - .1 Construction: steel, cast iron, aluminum.
 - .2 Control voltage: 0-5, 0-10, 2-10V DC, or 4-20 mA.
 - .3 Positioning time: to suit application, 90 sec maximum.
 - .4 Spring return to normal position as indicated.

2.34 WATTHOUR METERS AND CURRENT TRANSFORMERS

- .1 Requirements:
 - .1 Include three phases, test and terminal blocks for watthour meter connections and connections to FID for monitoring of current. Provide three potentiometer transformers for 600 V 4 wire systems for watthour meter use. Accuracy: plus or minus 0.25 % of full scale. For chiller applications: To have instantaneous indicator with analog or digital display.
 - .2 Watthour meter sockets: to ANSI C12.7.
 - .3 Potentiometer and current transformers: to ANSI/IEEE C57.13.
 - .4 Potential transformers: provide two primary fuses.
 - .5 Demand meters: configure to measure demand at 15 minute intervals.

2.35 SURFACE WATER DETECTORS

- .1 Requirements:
 - .1 Provide alarm on presence of water on floor.
 - .2 Expendable cartridge sensor.
 - .3 Internal waterproof switch.
 - .4 One set of dry contacts 2 amps at 24 V.
 - .5 Unaffected by moisture in air.
 - .6 Self-powered.

2.36 PANELS

- .1 Either free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door.

- .2 To be modular multiple panels as required to handle requirements with additional space to accommodate future capacity as required by Owner's Representative without adding additional cabinets.
- .3 Panels to be lockable with same key.

2.37 CONTROL AIR COMPRESSOR STATIONS

- .1 Requirements: Provide 2 high pressure, compressors, receiver mounted, base mounted, each complete with belts, guards, intake muffler, replaceable cartridge intake cleaner, starter, pressure switches, alternator.
- .2 Capacity: size to maintain air pressure, meet all control air requirements on 25 % maximum running time.
- .3 Receiver: size to suit running time. Complete with automatic drain, pressure relief valve, pressure gauge ASME code rated for 1400 kPa.
- .4 Vibration isolation: 5 % transmissibility.
- .5 Refrigerated air drier:
 - .1 2 continuous operating type, complete with refrigerant evaporator, mechanical condensate separator, installed with 2 isolating valves. Designed for 1400 kPa maximum operating pressure.
 - .2 Capacity: sized for full capacity of air compressors, to reduce dewpoint to minus 10°C when dehydrating at 700 kPa. Maximum pressure drop 19 kPa at rated capacity.
 - .3 Provide 2 filter and PRV assemblies, with isolating valves and filter element, having 99% efficiency in removal of 0.5 micron diameter solid particles and oil aerosols and with indication of degree of saturation. Piping to be such that one dryer is always in circuit and active.

2.38 ELECTRONIC VAV TERMINAL CONTROL BOX

- .1 Terminal box sized to deliver air quantities as per mechanical VAV Box Schedule.
- .2 Box complete with factory installed averaging air velocity sensor.
 - .1 Provide removable air flow sensor with minimum 4 point sensing with +/- 5% accuracy at 10 deg C to 35 deg C and 40 to 1000 l/s.
- .3 Box to include direct damper shaft mounted actuator, of the non stall, full linear with position feedback type. Actuator to de-energize when at desired position.
- .4 Box to be complete with power transformer and control wiring to damper actuator and termination terminals for room sensors and other specified sensors and auxiliary devices.

- .5 Box to include VAV Controller as described in Section 25 30 01-EMCS: Building Controllers with appropriate mounting plate and protective cover.

2.39 ELECTRONIC AIR FLOW MEASUREMENT STATIONS AND TRANSMITTERS

- .1 Each station to contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements to be of the thermal, temperature compensated thermistor type, with linearizing means. The sensing elements to be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE and SMACNA for the traversing of ducted air flows. The resistance to air flow through the airflow measurement station not to exceed 20 Pa gauge at an airflow of 10 m/s. Station construction suitable for operation at airflows of up to 25 m/s over a temperature range of 5 to 50 degrees C, and accuracy plus or minus 3 percent over a range of 0.625 to 12.5 m/s scaled to air volume.
- .2 Transmitters to produce a linear, temperature compensated 4-20 mAdc output corresponding to the required velocity pressure measurement. The transmitter to be a 2-wire, loop powered device with local indication where indicated. The output error of the transmitter not to exceed 0.5 percent of the calibrated measurement.

2.40 FUEL TANK LEVEL SENSOR

- .1 Provide suitable electronic, ULC approved oil tank level sensor to measure product and water level in oil tank specified in Section 33 56 13 – Aboveground Fuel Storage Tanks. Components in oil tank to be of stainless steel construction, electrical enclosures CSA rated. Float type probes to be provided with riser to suit oil tank c/w suitable tapping adaptor and S.S. guide tube with foot.
- .2 Sensor to communicate with EMCS system for oil and water level in tank.

PART 3 EXECUTION.

3.1 INSTALLATION

- .1 Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.
- .2 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.
- .3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.
- .4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 TEMPERATURE AND HUMIDITY SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.

- .2 To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.
- .3 Outdoor installation:
 - .1 Protect from solar radiation and wind effects by stainless steel shields.
 - .2 Install in CSA 4X enclosures.
- .4 Duct installations
 - .1 Do not mount in dead air space.
 - .2 Location to be within sensor vibration and velocity limits.
 - .3 Securely mount extended surface sensor used to sense average temperature.
 - .4 Thermally isolate elements from brackets and supports so as to respond to air temperature only.
 - .5 Support sensor element separately from coils, filter racks.
- .5 Averaging duct type temperature sensors:
 - .1 Sensor length to be not less than 1000 mm per square metre of duct cross-sectional area.
 - .2 Use multiple sensors where single sensor does not meet minimum length ratio. Wire multiple sensors in series for freeze protection applications.
 - .3 Wire multiple sensors separately for temperature measurement.
 - .4 Use either software averaging algorithm to derive overall average for control purposes or separate inputs, based on site requirements.
- .6 Thermowells: install for piping installations. Where pipe diameter is less than well insertion length, locate well in elbow. Thermowell to restrict flow by less than 30%.

3.3 PANELS

- .1 Arrange for conduit and tubing entry from top, bottom or either side.
- .2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).
- .3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.
- .4 Identify wiring and conduit clearly.

3.4 MAGNEHELIC PRESSURE INDICATORS

- .1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensors (as approved by the Owner's Representative).
- .2 Locations to be as indicated or specified.

3.5 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

- .1 Install isolation valve and snubber on sensors between sensor and pressure source. In addition, protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.6 I/P TRANSDUCERS

- .1 Install air pressure gauge on outlet.

3.7 PRESSURE GAUGES

- .1 Install on pneumatic systems only.
- .2 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.
- .3 Install pressure gauge on output of controller and auxiliary cabinet pneumatic devices.

3.8 AIR PRESSURE GAUGES

- .1 Install on pneumatic systems only.
- .2 Install on pneumatic devices including I/P's, pilot positioners, motor operators.

3.9 PNEUMATIC VALVE ACTUATORS

- .1 Install full relay type positioner having interlocking linkage for mechanical feedback of actual valve position on all modulating valves except radiation and unit heaters.

3.10 TANK LEVEL SWITCHES

- .1 Mount in top of tank in threaded coupling.

3.11 LIQUID LEVEL SWITCHES

- .1 Suspend float in sump from flexible cord and with weight mounted not more than 50 mm above switch.

3.12 IDENTIFICATION

- .1 Identify field devices properly.
- .2 Refer to Section 25 05 54 - EMCS: Identification.

3.13 AIR FLOW MEASURING STATIONS

- .1 Cap manifold until cleaning of ducts is completed.

3.14 TESTING

- .1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to Owner's Representative for approval. Owner's Representative will verify results at random. Provide testing equipment and manpower necessary for this verification.

3.15 COMMISSIONING

- .1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

PART 1 GENERAL

1.1 DESIGN DOCUMENTATION

- .1 Design documentation for each system to include, as a minimum:

Narrative type of Sequence of Operation.
Control Description Logic (CDL).
Input/Output Summary Schedules.
Schematics.

1.2 EMCS LANGUAGE DESIGN CRITERIA

- .1 Language: refer to Section 25 05 01 EMCS: General Requirements.

- .2 Levels of EMCS Language

Level 1: alarm and operational messages to convey alarm conditions or operational messages.

Level 2: full names of equipment and control points. The various systems, their equipment and components and all control points are named in accordance with this section.

Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.

Level 4: commands: represent various computer functions and routines.

.1 Operational commands - relate to building operations and building system controls.

.2 Computer system commands - relate to computer maintenance, upgrading or development software used to improve and maintain the application software for the building site.

Level 5: machine language. Languages specific to each manufacturer's product, used internally to perform its functions and routines.

- .3 Additional Equipment, Components and/or Control Points. Where additional equipment, components and/or control points are required on specific projects, the following procedures shall be adopted:

Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.

SYSTEM descriptors shall be not more than 10 alphanumeric characters. INPUT and OUTPUT descriptors shall be not more than 10 alphanumeric characters. The letters shall be based upon the English/French language full name, and should, where possible, be the first letter of each word of the full name.

- .4 The descriptor shall be unique.

- .5 Descriptors and expansions: table lists standardized system identifiers and point identifiers.

Table:

Identifiers and Expansions

English Identifier (10 characters max)	English Expansion (40 characters max)
OAD	Outside air damper
OAT	Outside air temperature
OAH	Outside air humidity
OAV	Outside air volume
RAD	Return air damper
RAT	Return air temperature
RAH	Return air humidity
RASP	Return air static pressure
MAD	** Mixed air dampers **
MAT	Mixed air temperature
MAPSP	Mixed air plenum static pressure

** MAD shall be used for applications where outside air and return air dampers are controlled from one (1) only output signal.

EAD	Exhaust air damper
PFPD	Pre-filter pressure drop
PFALM	Pre-filter pressure drop alarm
FFPD	Final filter pressure drop
FFALM	Final filter pressure drop alarm
HCVLV	Heating coil valve
HCVLVC	Heating coil valve control
HCVLVS	Heating coil valve status
BPD	Heating coil face and bypass damper
HCFA	Heating coil freeze alarm
CCVLV	Cooling coil valve
CCVLVC	Cooling coil valve control
CCVLVS	Cooling coil valve status
SVLV	Steam valve
SVLVC	Steam valve control
SVLVS	Steam valve status
SF#-C	Supply fan # control
SF#-S	Supply fan # status
SF#-VSD	Supply fan # VSD control

SF#-VSDF	Supply fan # VSD fault
SAV	Supply air volume
SAVC	Supply air volume control
SAT	Supply air temperature
SAH	Supply air humidity
SAVP	Supply air velocity pressure
SASP	Supply air static pressure
RF#-C	Return fan #control
RF#-S	Return fan # status
RF#-VSD	Return fan # VSD control
RF#-VSDF	Return fan # VSD fault
RAV	Return air volume
RAVC	Return air volume control
RAT	Return air temperature
RAH	Return air humidity
RAVP	Return air velocity pressure
RASP	Return air static pressure
EF#-C	Exhaust fan # control
EF#-S	Exhaust fan # status
EXAT	exhaust air temperature
EXAV	exhaust air volume
Chiller #1:	
CH1F	flow rate
CH1LWT	leaving chilled water temperature
CH1LWP	Leaving chilled water pressure
CH1EWT	Entering chilled water temperature
CH1EWP	Entering chilled water pressure
CD1EWT	Entering condenser water temperature
CD1EWP	Entering condenser water pressure
CD1LWT	Leaving condenser water temperature
CD1LWP	Leaving condenser water pressure
CHP1F	Chilled water pump #1 flow rate
CHP1DP	Chilled water pump #1 discharge pressure
CHP1S	Chilled water pump #1 status
CP3C	Circulating pump #3 control
CP3F	Circulating pump #3 flow rate
CP3DP	Circulating pump #3 discharge pressure
CP3S	Circulating pump #3 status

HTA	High temperature alarm
LTA	Low temperature alarm
HTCO	High temperature cutout
LTCO	Low temperature cutout
HLA	High level alarm
LLA	Low level alarm
HLCO	High level cutout
LLCO	Low level cutout
HWF	Heating water flow rate
HWST	Heating water supply temperature
HWRT	Heating water return temperature
STP	Steam pressure
STF	Steam flow rate
RM-T	Room temperature
RM-H	Room humidity
RM-SP	Room static pressure (add reference point)

Examples of specific space conditions:

RM-TNPER 2	Space temperature, North Perimeter, 2 nd floor
RM-SPSPER I9	Space static pressure, South Perimeter, 19th floor
RM-HEINT 9	Space humidity, East Interior, 9th floor
AFS	Air Flow Switch
AFM	Air Flow Monitor
F	Flow
P	Pressure
ST	Supply temperature
RT	Return temperature
FA	Fire alarm
FTA	Fire trouble alarm
CW	Chilled water system
CD	Condenser Water System
HWH	Hot water heating system
RADN	Radiation system
CDR	Condensate return system
HPS	Steam - High pressure system
LPS	Steam - Low pressure system
DCW	Domestic cold water system
DHW	Domestic hot water system

DHWR	Domestic hot water system Recirculation
SANP	Sanitary sewage - pumped system
STMP	Storm water - pumped system
SPRD	Sprinkler - Dry pipe system
SPRW	Sprinkler - Wet pipe system
FSTP	Fire standpipe & hose system
VBA	Volume Box Control Assembly

1.3 I/O SUMMARY SCHEDULES

.1 General:

The EMCS contractor shall provide a complete I/O summary schedule similar to the one listed below, listing and describing all I/O's in detail. Contractor's standard schedule may be used provided all relevant information is provided.

PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.

Building/Area: unique label given to each building forming part of a multi-building facility.

Area/System Label: unique label given to each area of the building or to each system.

- .1 Column 1: Point no: I/O Summary Schedule reference number.
- .2 Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.
- .3 Column 3: Description: describes the point label in expanded terms.
- .4 Column 4: Type: (eg. AI, AO, DI, DO).
- .5 Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).
- .6 Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).
- .7 Column 7: Sensor type: describes in 2 or 3 words.
- .8 Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.
- .9 Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).
- .10 Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).
- .11 Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).
- .12 Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.
- .13 Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.

- .14 Column 14: Set Point: Defines the design set-point of the control loop.
- .15 Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.
- .16 Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").
- .17 Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA: defines the form of action. DA = direct acting. RA = REVERSE ACTING.
- .18 Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.
- .19 Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.
- .20 Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.
- .21 Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.
- .22 Column 22: Programs:
 - .1 Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).
 - .2 Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.
 - .3 Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).
 - .4 Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.
 - .5 Run time totals: for calculation of operation of digital points.
 - .6 Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

.1 Schedule:

INPUT/OUTPUT			SCHEDULE PCU NO.				(see 1.3.2)			
PROJECT NO.			BLDG/AREA				NAME (see 1.3.3)			
PROJECT NAME			AREA/SYSTEM				NAME (see 1.3.3)			
POINT IDENTIFICATION							ALARMS			
1	2	3	4	5	6	7	8	9	10	11
Point No	Point Label	Descrip	Type	Eng. Unit	Access Level	Sensor type	Assoc Point	Type (M,CR)	DI/DO NO/NC	Limits

MESSAGES

DI/DO

12	13	14	15	16	17	18	19	20	21	22
Alarm	Maint	Set-	Dead	Dev.	NO/NC	Cont's	Delay	Heavy	Auto	Prog
Limit		Point	band	alarm	DA/RA	NO/NC	succ.	Motor	reset	
		MO/MA	start	delay						

1.4 CONTROL NARRATIVE SEQUENCE OF OPERATIONS

.1 General Heat Pump Operation:

System Start-Stop Control: the system occupied and unoccupied modes will be controlled manually or by a seven day time schedule. The manual override will be done from the override button on the thermostat, the thermostat will have an occupied and unoccupied mode indication in the form of an LED displaying green in the occupied and red for unoccupied mode. The Heat Pumps will be scheduled from the Central Computer and will have operator adjustable schedules.

Fan Operation: Fan operation will be constant during the occupied period and will be intermittent during the unoccupied period. The system will be started whenever the manual after hours override button on the thermostat is activated. The system will operate in Occupied Mode until the switch times out. The override time will be an operator adjustable parameter.

Night Cycle: the system will cycle on and off at night to prevent the space from getting too hot or too cold. When the room temperature falls below the unoccupied heating setpoint, then the system will start and continue to run until the room temperature rises by 3°C. if the room temperature rises above the unoccupied cooling setpoint, then the system will start and continue to run until the room temperature falls by 3°C. All setpoints to be operator adjustable in a simple graphics or text based format.

Unoccupied Mode: Anytime the system operates prior to or after scheduled occupied periods, the system will operate with the following room temperature setpoints.

Heating	13°C
Cooling	32°C

During the Unoccupied Mode the water source control valve is closed, the compressor and supply fan are off.

System "ON" (Occupied) Mode (Room Temperature Control) During occupied periods, the system will operate with the following room temperature setpoints:

Heating	20°C
Cooling	23°C

Space temperature deviation above the cooling set point or below the heating set point will generate a demand signal to control the system as follows:

Heating Stages: A PI control algorithm will cycle on and off the compressor and auxiliary heat outputs as required to maintain room temperature heating setpoint. The auxiliary heat will be controlled at 1°C below heating set point on single compressor units and 2°C below heating set point on double compressor models.

Cooling Stages: A PI control algorithm will cycle on and off the compressor as required to maintain room temperature cooling setpoint.

Operation Minimum ON/OFF Times: the control algorithm will provide for user adjustable minimum ON and OFF times for equipment stages. The program will maintain a minimum operation time of 4 minutes "ON" and 4 minutes "OFF" for compressor stages and 2 minutes "ON" and 2 minutes "OFF" for auxiliary heat.

Automatic System Change-Over: the heating-cooling mode will be determined based on room temperature and the occupied/unoccupied heating and cooling setpoints. The refrigerant reversing valve will be controlled to the appropriate heating-cooling mode position for that heat pump with dual refrigerant circuits (2 compressors, 2 reversing valves and 2 emergency shutdown circuits). Provide for 2-stage heating and cooling with duplicate operating, monitoring and alarm points.

Power Interruption: during an interruption of ac power, backup power will be provided to maintain operational parameters. The system will cycle off and provide timed restaging of heating or cooling equipment upon restoration of power. The restaging operation will occur according to minimum stage operating times incorporated in the control algorithm.

- .2 Sequence of Operation – Heat Pump
 - .1 This section to be read in conjunction with subsection 1.4.1 General Heat Pump Operation.
 - .2 Room thermostat monitors space temperature and provides setpoint adjustment, over-ride and over-ride indication. Night set back schedule to be programmed for each heat pump at central work station.
 - .3 Heat pumps will be on a time-of-day schedule for occupied and unoccupied modes from the building automation system.
 - .4 On a call for heating or cooling, the slow closing water solenoid valve is energized and opened to allow water flow through the heat pump. The reversing valve is positioned in the required position depending on whether heating or cooling is required.

- .5 The evaporator fan runs continuously during the occupied period but is cycled on-off during the unoccupied period to maintain the night-setback temperature. The cooling cycle will be locked out during the unoccupied periods.
- .6 The heat pump will start the compressor only after the system has verified that the heat pump emergency shutdown conditions are not present. These emergency shutdown conditions shall include high discharge pressure, low suction pressure, high water level and freeze protection.
- .7 Heat pump controller will position the reversing valve depending on whether heating or cooling is required. A replay across the emergency shut-down circuit will be monitored by the Building Automation System to signal when the heat pump has been shut down on an emergency condition.
- .8 Heat pump controller shall have capability of monitoring CO₂ levels.
- .9 Provide programming for individual time-of-day scheduled operation for each heat pump.

1.5 INPUT/OUTPUT POINT SUMMARY TABLE

- .1 Provide an input/output table summarizes the Input/Output (I/O) points for the various systems as outlined within the EMCS specifications and control schematic drawings. All points and field devices required to accomplish the specified sequence of operation shall be provided.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33 and Division 34. Refer to Section 01 00 00 – Bid Depository Sections where applicable for bid depository.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 CARE, OPERATION AND START-UP

- .1 Instruct Owner's Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 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. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 10 33 00 – Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, load balance report as described in sentence 3.4.6.
 - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owner's Representative.

- 1.6 PERMITS, FEES AND INSPECTION
- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
 - .2 Pay associated fees.
 - .3 Owner's Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.
 - .4 Notify Owner's Representative of changes required by Electrical Inspection Division prior to making changes.
 - .5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Owner's Representative.
- 1.7 CO-ORDINATION
- .1 Co-ordinate work with work of other divisions to avoid conflict.
 - .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
 - .3 Locate all existing underground services and make all parties aware of their existence and location.
 - .4 Where interference occurs, Owner's Representative must approve relocation of equipment and materials regardless of installation order.
 - .5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Owner's Representative shall decide the extent of relocation required.
- 1.8 CUTTING AND PATCHING
- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.
- 1.9 PROTECTION
- .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
 - .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.
- .2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.
- .3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.
- .4 Submit record drawings within 30 days prior to start of commissioning.

1.11 INSPECTION OF WORK

- .1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

- .1 Work shall be scheduled in phases as per other divisions of the architectural specifications.
- .2 Become familiar with the phasing requirements for the work and comply with these conditions.
- .3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

- .1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.
- .2 Use 3M brand or equal fire barrier products at each penetration.
- .3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.
- .4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project.

PART 2 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .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, where applicable.
- .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 25 and shown on mechanical drawings. Division 25 – EMCS Controls Contractor is responsible for all conduit, wiring and connections below 50V which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division.
- .3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Owner's Representative.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters

NAMEPLATE SIZES

Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Owner's Representative prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate and label.

.5 Identification to be English (and French where applicable).

.6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system name and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

.10 All new panel boards in the work area to be painted as follows. Provide new lamicoid labels and arc flash labels for all panel boards.

<u>Equipment System</u>	<u>Color</u>	<u>Pantone</u>
12500+ V Normal	Bright Yellow	12-0752 Buttercup
4160 V Essential	Dark Orange	17-1461 Orangeade
480 to 600 V Normal	Light Blue	13-5410 Iced Aqua
480 to 600 V Essential	Dark Blue	17-4530 Barrier Reef
120 to 240 V Normal	Light Green	14-0425 Beachnut
120 to 240 V Essential	Dark Green	18-0430 Avocado
Fire Alarm	Bright Red	-

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1, Canadian Electrical Code.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code all new conduits, boxes and metallic sheathed cables using 25mm wide tape (minimum 2 full wraps)..
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours:

<u>Conduit System</u>	<u>Color</u>	<u>Pantone</u>
12500+ V Normal	Bright Yellow	12-0752 Buttercup
4160 V Essential	Dark Orange	17-1461 Orangeade
480 to 600 V Normal	Light Blue	13-5410 Iced Aqua
277 to 600 V Essential	Dark Blue	17-4530 Barrier Reef
120 to 240 V Normal	Light Green	14-0425 Beachnut
120 to 240 V Essential	Dark Green	18-0430 Avocado
Fire Alarm	Bright Red	-

PART 3 EXECUTION

3.1 NAMEPLATES AND LABELS

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

3.2 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 27 26 – Wiring Devices.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 406 mm.
 - .2 Above top of continuous baseboard heater: 200mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 400 mm.
 - .5 Wall mounted telephone and interphone outlets: 1400 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm bells: 2400 mm.
 - .8 Wall mounted speakers: 2400 mm.
 - .9 Clocks: 2400 mm.
 - .10 Door bell pushbuttons: 1200 mm.
 - .11 Exit lights: 2400 mm.
 - .12 Emergency lighting heads: 2400 mm.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.
- .3 Perform tests in Accordance with this section as noted and Section 01 91 13 – Commissioning (Cx) Requirements.

- .4 Load Balance:
 - .1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
 - .5 Conduct and pay for following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.
 - .5 Systems: fire alarm system, communications.
 - .6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
 - .7 Insulation resistance testing.
 - .1 Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger and record 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing and record value.
 - .8 Carry out tests in presence of Owner's Representative.
 - .9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.
 - .10 Submit test results for Owner's Representative's review and include in Commissioning Manuals specified in Section 01 91 13 – Commissioning (Cx) Requirements.
- 3.7 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

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for wire and box connectors.

1.2 **RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results - Electrical.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for copper bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors and bars as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:

- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .2 Install fixture type connectors and tighten. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .2 Refer to drawings for wiring type required under different applications.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
 - .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

PART 2 **PRODUCTS**

2.1 **BUILDING WIRES**

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE as indicated. Provide RWU90 XLPE rated cable for underground wiring. Related to new service entrance feeders and site lighting circuits. RWU90 XLPE not required under interior floor slabs.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires.

2.2 **TECK Cable**

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE, rating – 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight and/or type approved for TECK cable, as indicated.

2.3 MINERAL-INSULATED CABLES

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
- .3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250°C.
- .4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project for direct buried and wet locations, as indicated.
- .5 Two hour fire rating.
- .6 Connectors: watertight, field installed, approved for MI cable.
- .7 Termination kits: field installed approved for MI cable.

2.4 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: standard as required, complete with double split rings.

2.5 CONTROL CABLES

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket. Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40° C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

- .2 Perform tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 No splices permitted in panel board feeders in new construction. Splices in re-work or renovation projects only with pre-approval by Owner's Representative.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.
- .2 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .4 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34- Conduits, Fastenings and Fittings.
 - .2 In cable troughs in accordance with Section 26 05 33.01- Cable Trays for Electrical Systems.
 - .3 In underground ducts in accordance with Section 26 05 43.01- Installation of Cables in Ducts.
 - .4 In trenches in accordance with Section 26 05 43.01- Installation of Cables in Trenches.
 - .5 In underfloor distribution system in accordance with Section 26 05 39- Underfloor Raceways for Electrical Systems
 - .6 In cellular floor raceways in accordance with Section 26 05 38 – Cellular Metal Floor Raceway Fittings.
 - .7 In surface and lighting fixture raceways in accordance with Section 26 50 00- Lighting.

- .8 In wireways and auxiliary gutters in accordance with Section 26 05 37 – Wireways and Auxiliary Gutters.
- .9 Overhead service conductors in accordance with Section 26 24 01 - Service Equipment.

3.4 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

- .1 Run cable exposed, securely supported by straps.
- .2 Support 2 h fire rated cables at 1m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 At cable terminations use thermoplastic sleeving over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.
- .6 Do not splice cables.

3.6 INSTALLATION OF ARMOURED CABLES (AC-90)

- .1 Group cables wherever possible.
- .2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.

3.7 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit as indicated.
- .2 Ground control cable shield.

END OF SECTION

PART 1 GENERAL (NOT APPLICABLE)

PART 2 PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
 - .4 Strap AC-90 cable at box location plus every 900 mm.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

- .11 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Owner's Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1

GENERAL

1.1

REALTED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results – Electrical.

1.2

SUBMITTALS

- .1 Submit shop drawings and product data for cabinets.
- .2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.

PART 2

PRODUCTS

2.1

SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2

JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3

CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

PART 3 **EXECUTION**

3.1 **SPLITTER INSTALLATION**

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 **JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 **IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results – Electrical.
- .2 Section 26 05 29 – Hangers and Supports for Electrical Systems.
- .3 Section 26 05 34 – Conduits, Conduit Fastenings and Fittings.

1.2 **REFERENCES**

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

PART 2 **PRODUCTS**

2.1 **OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 **GALVANIZED STEEL OUTLET BOXES**

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-glvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

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

2.7 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Double split rings for AC-90 terminations.

2.8 SERVICE FITTINGS

- .1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
- .2 Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.

- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.2 SUBMITTALS

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .2 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .6 FRE conduit: to CSA C22.2.
- .7 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3,

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90°, 45° or 22.5° bends are required for 25 mm and larger conduits.
- .3 Ensure conduit bends other than factory "ells" are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends are not permitted.
- .4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.

- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .4 Surface mount conduits except in finished areas or as indicated.
- .5 Use rigid hot dipped galvanized steel threaded conduit for exposed work below 2.4 m above finished floor.
- .6 Use epoxy coated conduit underground in corrosive areas and where exposed to exterior elements. (ie: pole mounted service entrance conduits)
- .7 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.
- .8 Use rigid PVC conduit underground and buried in or under concrete slab on grade.
- .9 Use FRE conduit for encasement in concrete duct bank for service entrance feeders.
- .10 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without a prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.
- .11 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .12 Use AC-90 for vertical power supply drops to light fixtures.
- .13 Use explosion proof flexible connection for connection to explosion proof motors.
- .14 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .15 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.
- .16 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.
- .17 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel. Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.
- .18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .19 Mechanically bend steel conduit over 19 mm dia.
- .20 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .21 Install fish cord in empty conduits.

- .22 Run 2 - 25 mm spare conduits up to ceiling space and 2 - 25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.
- .23 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .24 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

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

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab. Use rigid PVC conduit.
- .2 Protect conduits from damage where they stub out of concrete. Use rigid steel conduit for stub-up and adapt to in floor rigid PVC conduit.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

PART 1

GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results - Electrical.
- .4 Section 26 50 00 - Lighting.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.184.1, Solid-State Dimming Controls (Bi-national standard with UL 1472).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for lighting control devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect lighting devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 **PRODUCTS**

2.1 **DIMMING WALL SWITCH**

- .1 Single button, single scene.
- .2 Decora type wall plate. White Colour.
- .3 Customizable buttons with LED indicators.
- .4 Connections via RJ45 connectors and Category 5e cables.
- .5 Standard of Acceptance: Wattstopper LMSW-101-W Digital 1 Button Wall Switch.

2.2 **WIRELESS CONFIGURATION TOOL**

- .1 Handheld tool for configuration of system parameters.
- .2 Communication via Infrared Transceiver.
- .3 IR Range = 10 Metres.
- .4 Remotely configures and reports dimming parameters.
- .5 Manually adjusts light level of dimmed loads to facilitate scene setting.
- .6 Standard of Acceptance: Wattstopper time LMCT-100 Digital Wireless Configuration Tool.
(Provide one).

2.3 **CONTROLLER**

- .1 Series Digital ON/OFF/0-10V Dimming Room Controller.
- .2 Voltage: 120VAC, 60 Hz.
- .3 Maximum 120A load per Room Controller.
 - .1 Each relay rated for 20A ballast.
- .4 Class 2 dimming control signal: 0-10 VDC, sinks up to 100 mA per channel for control of compatible ballasts.
- .5 Class 2 output to DLM local network: 24VDC, 250 mA maximum across 4 RJ45 Ports.
- .6 DLM Local Network:
 - .1 Maximum current: 800 mA.
 - .2 Category 5e cable, up to 1000 ft.

- .3 Up to 64 loads.
- .4 Up to 48 communicating devices.
- .5 Max 4 LMRC-100 Series Room Controllers.
- .7 Operating Conditions: 32-158°F (0-70°C); 5-96% RH, non-condensing.
- .8 UL (88T9) and cUL listed.
- .9 Five year warranty.
- .10 ON/OFF/Dim local override button for each load.
- .11 LED to indicate status of each load.
- .12 Integral current monitoring of total connected load.
- .13 4 RJ45 parts with integral strain relief.
- .14 Zero-crossing.
- .15 UL 2043 plenum rated.
- .16 RoHS complaint.
- .17 Store load preset level and 16 scene preset levels for each load.
- .18 Standard of Acceptance: Wattstopper LMRC 212.

2.4 .1 ACCEPTABLE MANUFACTURERS

- Standard of Acceptance: Wattstopper.
- .2 Acceptable Alternates:
 - .3 Lutron.
 - .4 Sensor Switch.
 - .5 Lithonia.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.
- .2 Install wiring, shielding, grounding in accordance with manufacturer's instructions.

- .3 Ensure shielded leads between intensity selector potentiometer and intensity controls have outer insulating jackets and are connected to ground at one point only.
- .4 Keep radio, VCR, TV and intercom wiring a minimum of 1.8 m away from dimming circuitry. Where crossing of wiring is essential, ensure that grounded shields surround such intercom wiring, and that crossings take place at 90°.
- .5 Locate intensity controls and "on-off" switches as indicated.
- .6 Ensure positive, low resistance lamp to pin contact within lampholder.
- .7 Age lamps by operating at full intensity for 100 h prior to final inspection. Operate ballasts in ambient temperature above 18°C.
- .8 Ensure connections are correctly made and to same phase before energizing.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Demonstrate that dimming systems are installed as indicated.
- .3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at any setting of dimming intensity control.
- .4 Demonstrate that no radio, VCR or TV interference is carried by system and that there is no interference between dimming system and locally used infrared-based remote/integral controls.

3.3 ADJUSTING

- .1 Adjust lighting control devices for correct function and operation in accordance with manufacturer's written instructions.
- .2 Include in the tender price for the manufacturer's representative to set up and program the system on site as per the Owner's instructions. At the end of the project, provide a letter signed by the manufacturer's representative instructing that the system has been programmed as per the Owner's requirements and that training as per Clause 3.6 has been completed.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

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

3.6 TRAINING

- .1 Provide on site training to the Owner's staff. Training shall include system description, features and operating instructions.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

PART 2 **PRODUCTS**

2.1 **SWITCHES**

- .1 Single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
 - .6 Specification grade.
 - .7 Hospital grade as indicated.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Single pole, double pole, three way, four way switches as indicated on drawings.

- .5 Switches to be of one manufacturer throughout project.
- .6 Standard of Acceptance:
 - .1 Hubbell HBL 1201W (120 V) and Hubbell 18201-W (347 V)
- .7 Acceptable alternates:
 - .1 Leviton.
 - .2 Pass and Seymour.
 - .3 Cooper.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 White thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 Specification grade.
 - .7 Hospital grade as indicated.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 White thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles to be of one manufacturer throughout project.
- .5 Standard of Acceptance:
 - .1 Hubbel 5262-W.
- .6 Acceptable alternates:
 - .1 Leviton.
 - .2 Pass and Seymour.
 - .3 Copper.

2.3 GROUND FAULT INTERRUPTER (GFI) RECEPTACLES

- .1 CSA Type 5-20R, 125 V, 20A, U-ground.
- .2 Tamper resistant, weather resistant.

- .3 White urea molded housing.
- .4 10 kA short circuit current rating.
- .5 Suitable for #10 AWG wiring.
- .6 Double wide contacts and riveted grounding contacts.
- .7 Specification grade.
- .8 Trip level: 4 to 6 mA. Trip time: 0.25 seconds.
- .9 Meets UL 498 and UL 943 for Class A GFCI's. CSA certified.
- .10 Standard of Acceptance: Hubbell GFR5362WTR.
- .11 Acceptable Alternates:
 - .1 Pass and Seymour.
 - .2 Cooper.
 - .3 Leviton.

2.3 SPECIAL WIRING DEVICES

- .1 Special wiring devices:
 - .1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.
 - .2 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel lense, flush type.

2.4 WIRING DEVICES FOR COMPUTER ROOMS

- .1 As indicated.

2.5 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Stainless steel cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.
- .8 All wiring device cover plates to be labeled using clear adhesive strips with black type identifying panel and circuit number for each device.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1

GENERAL

1.1

SECTION INCLUDES

- .1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2

RELATED SECTIONS

- .1 Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .5 Section 26 05 00 – Common Work Results - Electrical.

1.3

PAYMENT PROCEDURES

- .1 Pay for field testing of ground fault equipment performed by equipment manufacturer in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

1.4

REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.5

SUBMITTALS

- .1 Submit product data and shop drawings.
- .2 Submit test report for field testing of ground fault equipment to Owner’s Representative and a certificate that system as installed meets criteria specified herein.

PART 2

PRODUCTS

2.1

MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single or two pole ground fault circuit interrupter for 15-20 A, 120 V, 1 phase circuit c/w test and reset facilities.

2.3 GROUND FAULT LIFE PROTECTOR

- .1 A, 2 pole circuit breaker to supply power to mains of 100A, 208 V, 3 phase panel and complete with:
 - .1 Automatic shunt trip breaker.
 - .2 Zero sequence current sensor.
 - .3 Facilities for testing and reset.
 - .4 CSA Enclosure 1, surface mounted.
 - .5 Ground fault trip indicator light.

2.4 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with CSA 20 A, 120 V circuit interrupter and duplex receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 LED fault indicator.
 - .3 Facility for testing and reset.
 - .4 CSA Enclosure 1, flush mounted with stainless steel face plate.
 - .5 White face.
- .2 Acceptable products:
 - .1 Hubbel GF20WL.
 - .2 Leviton.
 - .3 Pass and Seymour.
 - .4 Cooper

2.5 SYSTEM GROUND FAULT PROTECTION PANEL

- .1 Self-contained panel suitable for 120/208 V, 3 phase, 4 wire, grounded supply. Panel to have following features:
 - .1 Automatic 100 or 225 A breaker with shunt trip.
 - .2 Ground fault relay factory set at 10 mA with inverse time delay characteristics from pick-up 1 s to 0.025 s.
 - .3 Zero sequence current sensor.
 - .4 Provision for testing and reset.
 - .5 CSA Enclosure 1, surface mounted.
 - .6 Ground fault trip indicating light.
 - .7 Resistor type fused artificial neutral.

2.6 PUMP PROTECTION PANEL

- .1 Ground fault personnel protection panel for pump circuits rated for 20 hp at 208 V and 50 hp at 600 V, 3 phase grounded supply with following features:
 - .1 Test button, ground indicator light, reset button.
 - .2 Line and load terminal blocks and control terminal block for wiring to starter control.
 - .3 Unit sensitivity: 10 mA.
 - .4 CSA Enclosure 1, surface mounted.
 - .5 Contact rating: 5 A, 120 V, 60 Hz.
 - .6 Fused resistive type artificial neutral.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Do not ground neutral on load side of ground fault relay.
- .2 Pass phase conductors including neutral through zero sequence transformers.
- .3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Arrange and pay for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.
- .3 Demonstrate simulated ground fault tests.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning.
- .3 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 - Common Work Results – Electrical.

1.2 **REFERENCES**

- .1 Atomic Energy Control Board Regulations
- .2 Canadian Code for Preferred Packaging
- .3 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
 - .2 CSA C860, Performance of Internally-Lighted Exit Signs.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 101, Life Safety Code.

1.3 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and disposal.

PART 2 **PRODUCTS**

2.1 **STANDARD UNITS**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Electrical Code for Preferred Packaging guidelines.
- .2 Housing: extruded aluminum, satin finish
- .3 Lamps: LED.
- .4 Operation: designed for 25 years of continuous operation without relamping.

- .5 Edge lit design with acrylic panels for single or double face application. Green ISO pictogram c/w chevrons to indicate direction of travel as required.
- .6 Input voltage: 120/347 Vac.
- .7 Mounting: wall or ceiling mount as indicated.

2.2 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2 Housing: extruded aluminum, satin finish
- .3 Lamps: LED.
- .4 Operation: designed for 25 years of continuous operation without relamping.
- .5 Edge lit design with acrylic panels for single or double face application. Green ISO pictogram c/w chevrons to indicate direction of travel as required.
- .6 Self-powered units with integral batteries and charger. Unit to remain operational for 90 minutes upon power failure.
- .7 Input voltage: 120/347 Vac.
- .8 Mounting: wall or ceiling mount as indicated.
- .9 Recharge time: 12 hours
- .10 Battery: sealed, maintenance free, warranty to Section 26 52 00 – Emergency Lighting, 1.5 – Emergency Lights.
- .11 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .12 Signal lights: solid state, for 'AC Power ON'.
- .13 Auxiliary equipment:
 - .1 Lamp disconnect switch.
 - .2 Test switch.
 - .3 AC/DC output terminal blocks inside cabinet.
 - .4 RFI suppressor.
 - .5 Cord and single twist-lock plug connection for AC power supply.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits using RW90 wire in EMT conduit.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.
- .5 Provide tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

3.2 **CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE OF WORK

- .1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.2 SECTION INCLUDES

- .1 Commissioning of all building electrical systems and component including:
 - .1 Testing and adjustment.
 - .2 Demonstrations and Training.
 - .3 Instructions of all procedures for Owner's personnel.
 - .4 Updating as-built data.
 - .5 Co-ordination of Operation and Maintenance material.

1.3 RELATED SECTION

- .1 Section 01 77 00 – Closeout Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.4 REFERENCES

- .1 CSA (Canadian Standards Association).
- .2 Underwriters Laboratories of Canada.

1.5 QUALITY ASSURANCE

- .1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.
- .2 Submit the names of all personnel to be used during the Commissioning activities for Owner Approval.

1.6 COMMISSIONING

- .1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.
- .2 The Commissioning activities shall be co-ordinated by the General Contractor.

- .3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.
- .4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.
- .5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

- .1 A commissioning document shall be prepared by the Owner's Representative prior to conducting these activities for use by the Commissioning Team.
- .2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and co-ordinated through the General Contractor.
- .3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

- .1 Provide test instruments required for all activities as defined in the commissioning documents.
- .2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the precommissioning check out operation.
- .3 Confirm all scheduled activities have identified personnel available.
- .4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

- .1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.
- .2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.
- .3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.
- .4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .5 Conduct presentation on Owner's premises. Owner will provide space.

1.10 FINAL REPORT

- .1 This trade shall assemble all testing data and commissioning reports and submit them to the Owner.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

- .1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.
- .3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.
- .4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

- .1 This section describes the extent of services to be provided for wiring of equipment supplied by others.
- .2 Within the context of this section, Others means:
 - .1 Other divisions of this specification (i.e.: Division 25 – Integrated Automation).
 - .2 The Owner, as defined in the Contract.
 - .3 Other contractors supplying and installing equipment to the contract.

1.2 EXTENT OF SERVICES PROVIDED

- .1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.
- .2 All power and control wiring above 50 V for equipment supplied by Division 25 will be the responsibility of this contractor. Coordinate with Integrated Automation contractor for exact requirements.
- .3 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.
- .4 All power and control wiring associated with equipment supplied by Division 01 will be the responsibility of this contractor. Coordinate with general contractor for exact requirements. See Section 26 27 97 – Door Hardware Wiring for exceptions for wiring of door lock systems.
- .5 Final connection of all wiring to equipment provided by others (except control wiring below 50 V associated with Division 25 equipment) will be by division 26. Coordinate with the provider for connection instructions.

1.3 RESPONSIBILITY OF DIVISION 26

- .1 It is the responsibility of the Division 26 subcontractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:
 - .1 Confirmation of electrical characteristics.
 - .2 Location of connection point.
 - .3 Method of connection (i.e. direct or plug-in etc.)
- .2 Obtain and become familiar with shop drawings for all relevant equipment.
- .3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Procedures.
- .3 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 - Common Work Results - Electrical.
- .5 Section 26 05 21 - Wires and Cables (0 - 1000 V).
- .6 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- .1 Government of Canada
 - .1 NBC, National Building Code of Canada, latest edition.
 - .2 TB OSH Chapter 3-3, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-3, Fire Protection Standard for Electronic Data Processing Equipment.
 - .3 TB OSH Chapter 3-4, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-4, Standard for Fire Alarm Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524, Installation of Fire Alarm Systems.
 - .2 ULC-S525, Audible Signal Appliances for Fire Alarm.
 - .3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
 - .4 CAN/ULC-S527, Control Units, Fire Alarm.
 - .5 CAN/ULC-S528, Manual Pull Stations.
 - .6 CAN/ULC-S529, Smoke Detectors, Fire Alarm.
 - .7 CAN/ULC-S530, Heat Actuated Fire Detectors, Fire Alarm.
 - .8 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.
 - .9 CAN/ULC-S537, Verification of Fire Alarm Systems.

1.3 SYSTEM DESCRIPTION

- .1 Existing system consists of a Chubb fire alarm panel. All new materials and programming completed as part of the contract shall be by Chubb.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- .1 System:
 - .1 Subject to Provincial Fire Commissioner's approval.

- .2 Subject to FC inspection for final acceptance.
- .3 To electrical inspection approval.
- .2 System components: listed by ULC and comply with applicable provisions of National Building Code and meet requirements of local authority having jurisdiction.
- 1.5 SUBMITTALS
 - .1 Include:
 - .1 Details for devices.
- 1.6 CLOSEOUT SUBMITTALS
 - .1 Provide operation and maintenance data for fire alarm system for incorporation into manual specified in Section 01 78 00- Closeout Submittals.
 - .2 Include:
 - .1 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
 - .2 Technical data – illustrated parts list with parts catalogue numbers.
 - .3 Instruction for complete fire alarm system to permit effective operation and maintenance.
- 1.7 WARRANTY
 - .1 Provide manufacturer produce warranty against defects in operation, material and workmanship for 1 year from date of substantial completion.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - .1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.
 - .2 Audible signal devices: to ULC-S524.
 - .3 Visual signal devices: to CAN/ULC-S526.
 - .4 Manual pull stations: to CAN/ULC-S528.
 - .5 Thermal detectors: to CAN/ULC-S530.
 - .6 Smoke detectors: to CAN/ULC-S529.
- 2.2 SYSTEM OPERATION: SINGLE STAGE
 - .1 Existing to remain, make modifications and add modules/relays as required. Provide system programming as required.

- .2 Network Download by Owner (MUN forces). Notify Owner's representative of network download requirement at commencement of work onsite.
- 2.3 CONTROL PANEL
 - .1 Existing to remain, make modifications and add modules/relays as required. Provide system programming as required.
- 2.4 INITIATING/INPUT CIRCUITS
 - .1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, and heat detectors wired in DCLA configuration to central control unit.
 - .2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.
 - .3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".
 - .4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to central control unit.
 - .5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".
 - .6 Confirm exact wiring configuration requirements with system supplier prior to installation.
- 2.5 ALARM OUTPUT CIRCUITS
 - .1 Alarm output circuit: connected to signals, wired in configuration to match existing to central control unit.
 - .1 Signal circuits operation to follow system programming; capable of sounding horns continuously. Each signal circuit: rated at 2 A, 24 V DC; fuse-protected from overloading/overcurrent.
- 2.6 AUXILIARY CIRCUITS
 - .1 Auxiliary contacts for control functions.
 - .2 Actual status indication (positive feedback) from controlled device.
 - .3 Alarm or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
 - .4 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.
 - .5 Auxiliary circuits: rated at 2 A, 24 V DC or 120 V AC, fuse-protected.
 - .6 Auxiliary contacts for release of hold-open devices.

- 2.7 WIRING
- .1 Multi-conductor cable assemblies with dedicated bonding wire CSA FAS105 and FT-4 rated. Standard of Acceptance: Securex I, twisted copper conductors, rated 300 V.
 - .2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
 - .3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
 - .4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
 - .5 Fire alarm cables to be run in EMT conduit.
- 2.8 MANUAL ALARM STATIONS
- .1 Addressable manual pull station.
 - .1 Pull lever, break glass rod, semi-flush wall mounted type, single action, single stage, two stage with key to initiate 2nd stage and reset functions, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.
 - .2 Standard of acceptance: To match existing.
- 2.9 AUTOMATIC ALARM INITIATING DEVICES
- .1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57EC, rate of rise 8.3 EC per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector in field.
 - .3 Standard of acceptance: To match existing.
 - .2 Addressable variable-sensitivity smoke detectors.
 - .1 Photo-electric type.
 - .2 Electronics to communicate detector's status to addressable module/transponder.
 - .3 Detector address to be set on detector in field.
 - .4 Standard of acceptance: To match existing.
 - .3 Sensitivity settings: 3 settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.
 - .4 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.
- 2.10 AUDIBLE SIGNAL DEVICES
- .1 Speaker: flush mounted, 90 dBA minimum.
 - .1 Standard of acceptance: To match existing.

- 2.11 VISUAL ALARM SIGNAL DEVICES
- .1 Strobe: flashing white, 24 V dc semi-flush mounted in finished areas, red housing.
 - .2 Designed for surface mounting on ceiling and walls as indicated on drawings.
 - .3 Standard of acceptance: To match existing.
- 2.12 AUDIBLE / VISUAL ALARM SIGNAL DEVICES
- .1 Combination speaker strobes: 90 dBA minimum, 115 cd output, adjustable light output.
 - .2 Standard of acceptance: To match existing.
- 2.13 END-OF-LINE DEVICES
- .1 End-of-line devices to control supervisory current in signaling circuits sized to ensure correct for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.
- 2.14 ADDRESSABLE CONTROL/MONITOR MODULES
- .1 Addressable modules with address set in field for control/monitoring of external circuits.
 - .2 Applications: ventilation unit shut down, sprinkler device monitoring, control of magnetic door hold open devices, door electric strikes, interface to electronic door hardware controllers to facilitate door control functions when required.
 - .3 Ensure that control circuits connected to addressable relay dry contacts are protected by fuse to limit current within manufacturer's requirements.
 - .4 Single zone, dual zone and programmable relays, as required.
 - .5 Standard of acceptance: To match existing.
- 2.15 ISOLATION MODULES
- .1 Isolation modules for segmenting of fire alarm detection loop as indicated.
- 2.16 ACCEPTABLE MANUFACTURERS
- .1 Acceptable manufacturers shall be: Chubb.

PART 3 EXECUTION

- 3.1 INSTALLATION
- .1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-4.

- .2 Run all fire alarm wiring in conduit.
- .3 Install central control unit and connect to ac power supply.
- .4 Install manual alarm stations and connect to alarm circuit wiring.
- .5 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .6 Connect alarm circuits to main control panel.
- .7 Install speakers and visual signal devices and connect to signaling circuits.
- .8 Connect signaling circuits to main control panel.
- .9 Install end-of-line devices at end of signaling circuits where required.
- .10 Splices are not permitted.
- .11 Provide necessary raceways, cables and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .12 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm and ancillary devices.
 - .2 Check annunciator panels to ensure alarms are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of system.
 - .4 Addressable circuits system style DCLA:
 - .1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
 - .2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

- .3 Provide final PROM program re-burn for system incorporating program changes made during construction.
- .4 Provide programming for system to provide identification of alarm and trouble conditions to satisfaction of the owner. Coordinate with the owner prior to programming display items.

END OF SECTION

Memorial University of Newfoundland ENGINEERING BUILDING, RENOVATIONS TO EN-4029

ST. JOHN'S
MARCH, 2024

ISSUED FOR TENDER

LIST OF DRAWINGS

A-0 - GENERAL NOTES & SYMBOL LEGEND
A-0.1 SITE ACCESS AND PANEL LOCATION PLANS
A-0.2 SITE ACCESS AND CORE LOCATION PLANS
A-1.0 DEMOLITION FLOOR PLAN
A-2.0 DEMOLITION & NEW REFLECTED CEILING PLANS
A-3.0 NEW FLOOR PLAN
A-3.1 DEMOLITION FURNITURE PLANS
A-3.2 NEW FURNITURE PLAN
A-3.3 NEW FINISH PLAN
A-4.0 NEW MILLWORK ELEVATION & SECTIONS
A-4.0 DOOR SCHEDULE & ELEVATIONS
A-5.0 INTERIOR ELEVATIONS
A-5.1 INTERIOR ELEVATIONS

F-0 - NEW FURNITURE PLAN

E-0 - ELECTRICAL SYMBOL LEGEND
E-1.0 - DEMOLITION & NEW ELECTRICAL PLAN POWER & COMMUNICATIONS
E-2.0 - DEMOLITION & NEW ELECTRICAL CEILING PLAN
E-3.0 - DEMOLITION & NEW FIRE ALARM SYSTEMS
E-4.0 - ELECTRICAL DETAILS
E-4.1 - ELECTRICAL DETAILS
E-5.0 - PANEL SCHEDULES
EM-1.0 - DEMOLITION & NEW EMCS PLAN

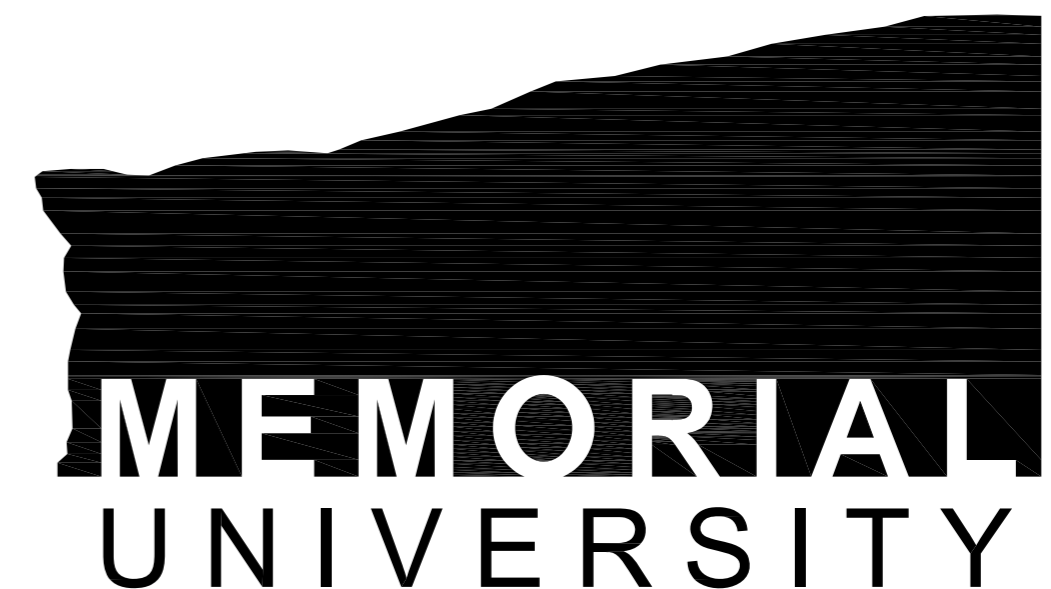
M-0 - MECHANICAL SYMBOL LEGEND
ME-1.0 - DEMOLITION & NEW EMCS PLAN
MV-1.0 - DEMOLITION VENTILATION PLAN
MV-1.1 - NEW VENTILATION PLAN
MP-1.0 - DEMOLITION & NEW WASTE & VENT PLUMBING PLANS
MP-1.1 - DEMOLITION & NEW D.W. PLUMBING PLANS

EN-123-21 ISSUED FOR TENDER

DEPARTMENT OF FACILITIES MANAGEMENT

This University was raised by the people of Newfoundland as a memorial to the fallen in the great wars, 1914-1918, 1939-1945, that in freedom of learning, their cause and sacrifice might not be forgotten.

- Dedication plaque, Arts & Administration Building, St. John's Campus



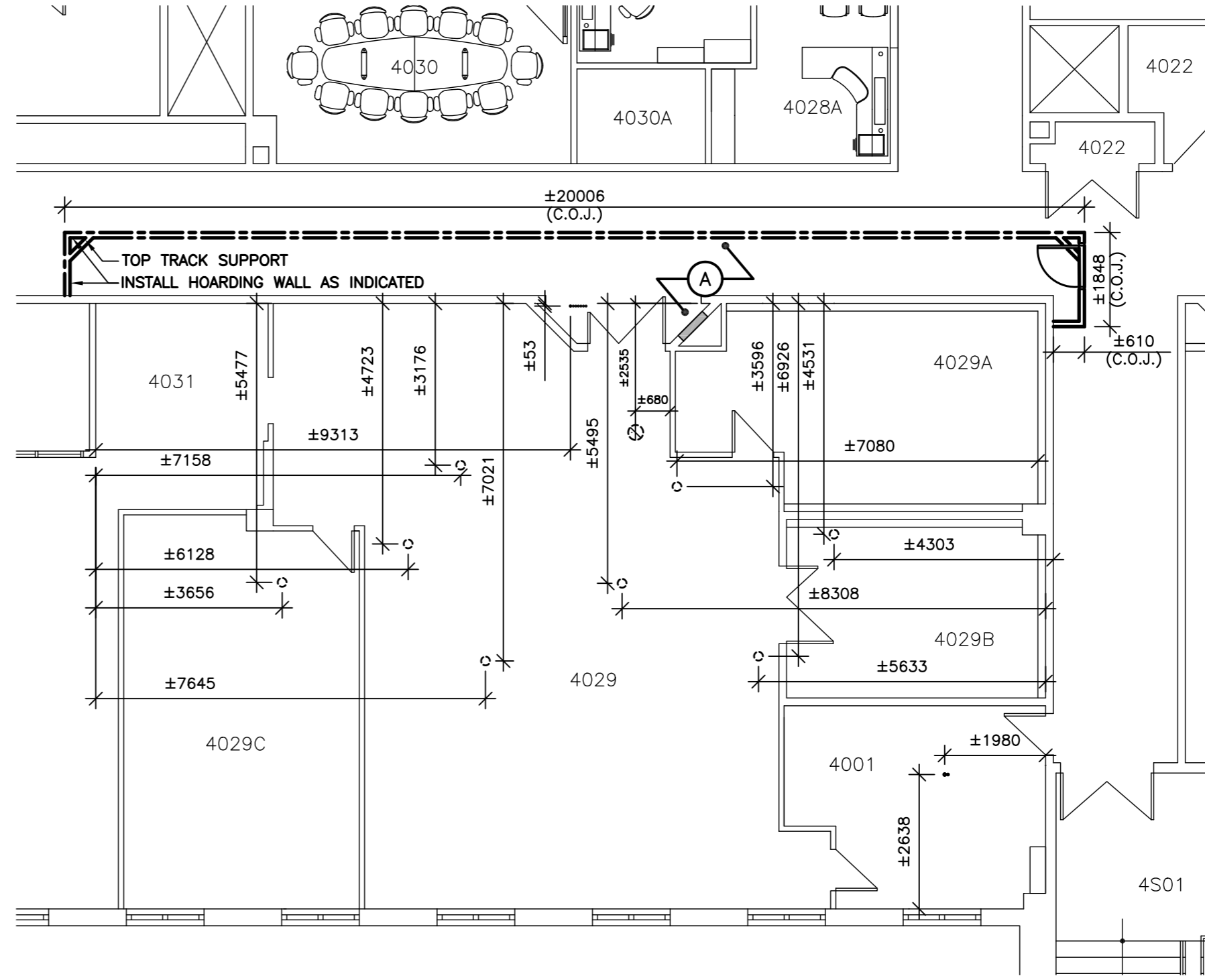
SYMBOL LEGEND: (A)

HOARDING WALL CONSTRUCTED USING FIRE RETARDENT RIP PROOF TARP (WHITE), 92mm STEEL STUDS @ 600 O.C. ALL TARP JOINTS TO BE TAPED TO PREVENT DUST AND DEBRIS MOVEMENT THROUGH WALL CONSTRUCTION. CARE TO BE TAKEN TO ENSURE NO DAMAGE TO EXISTING/SURROUNDING FINISHES.

NOTE A: 2440mm HIGH GYPSUM BOARD WALL. INSTALL TARP FROM TOP TRACK TO U/S CONCRETE DECK. COPE AROUND EXISTING SERVICES.

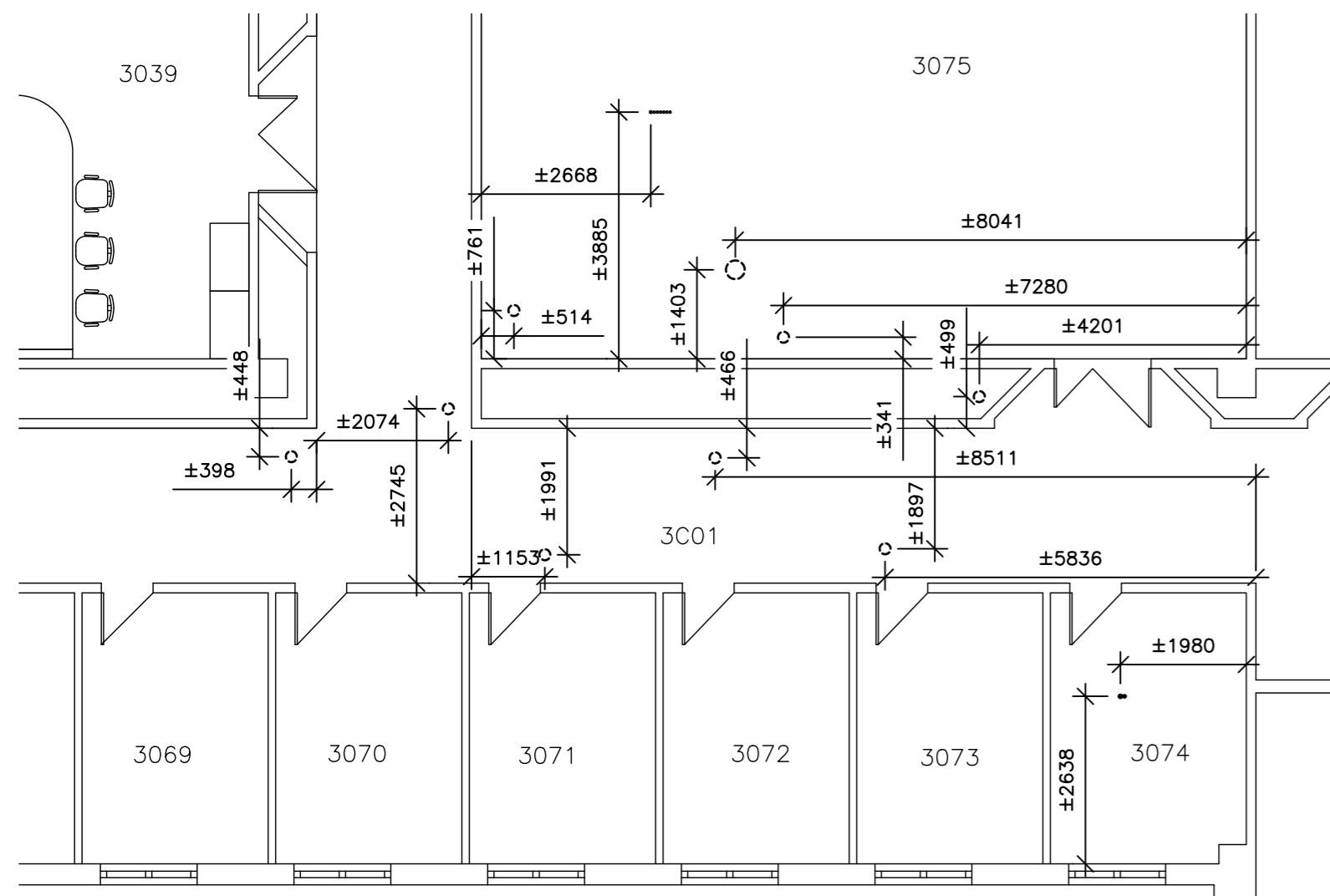
GENERAL CONSTRUCTION NOTES:

1. CONTRACTOR SHALL NOT USE ANY INTERIOR SPACES, OTHER THAN CONSTRUCTION AREAS INSIDE HOARDING WALLS, FOR STORAGE OR LAY-DOWN AREAS.
2. INSTALL PROTECTIVE COVERING OVER EXISTING FLOORING AS REQUIRED IN ACCESS ROUTES AND IN HOARDING AREA. MAINTAIN COVERINGS FOR DURATION OF THE PROJECT OR UNTIL AGREED TO WITH THE CONTRACTOR AND OWNER.
3. EXIT DOOR FROM 1009A TO EXTERIOR SHALL NOT BE PROPPED OR HELD OPEN OR LEFT UNATTENDED WHILE OPENED.
4. CONTRACTOR SHALL OBTAIN PARKING PERMITS FROM CAMPUS ENFORCEMENT PATROL (CEP) FOR THE DURATION OF THE PROJECT. PARKING IS NOT PERMITTED IN LOADING ZONES OR MATERIAL DROP-OFF AREA.
5. CONTRACTORS SHALL BE RESPONSIBLE FOR PAYING ALL PARKING TICKETS ISSUED BY CAMPUS ENFORCEMENT PATROL. CONTESTED OR DISPUTED TICKETS SHALL BE BETWEEN THE CONTRACTOR AND CAMPUS ENFORCEMENT PATROL.
6. CONSTRUCT HOARDING WALLS TO UNDERSIDE OF EXISTING CONCRETE SLAB CEILINGS TO PREVENT DUST MOVEMENT THROUGH WALL CONSTRUCTION. CONTRACTOR TO REPAIR/REPLACE DAMAGED CEILING, WALL AND FLOOR FINISHES IN THE EVENT OF DAMAGE INCURRED THROUGH THIS SCOPE OF WORK. EXISTING PAINT AT CMU BLOCK IS TO BE TREATED AS LEAD CONTAINING. EXISTING MECHANICAL INSULATION, TAR MASTIC AT PIPING, AND GOLD MASTIC AT SINKS TO BE TREATED AS ASBESTOS CONTAINING.
7. CONTRACTOR SHALL KEEP GRASS, SIDEWALKS, AND PAVED AREAS AROUND DUMPSTER CLEAR OF DEBRIS AND MATERIALS. DUMPSTER TO BE COVERED AT ALL TIMES. DUMPSTER TO BE EMPTIED WHEN FULL.
8. ALL SCOPE OF WORK LOCATED OUTSIDE CONSTRUCTION AREAS & HOARDING ON LEVEL 3 AND ABOVE CEILING SYSTEMS ON LEVEL 2 SHALL BE DONE AFTER REGULAR BUSINESS HOURS OF 8:30AM TO 5PM EACH DAY TO ENSURE THE SAFETY OF BUILDING OCCUPANTS. ALSO, THE EXACT DATE AND TIME OF WORK TO BE SCHEDULED WITH PROJECT COORDINATOR TO PROVIDE BUILDING OCCUPANTS NOTICE OF WORK TO BE DONE IN CORRIDORS AND ADJACENT OFFICES AND TO ENSURE WORK IS NOT CARRIED OUT DURING EVENING CLASSES.
9. REFER TO SECTION 01 10 00 FOR WORK RESTRICTIONS.



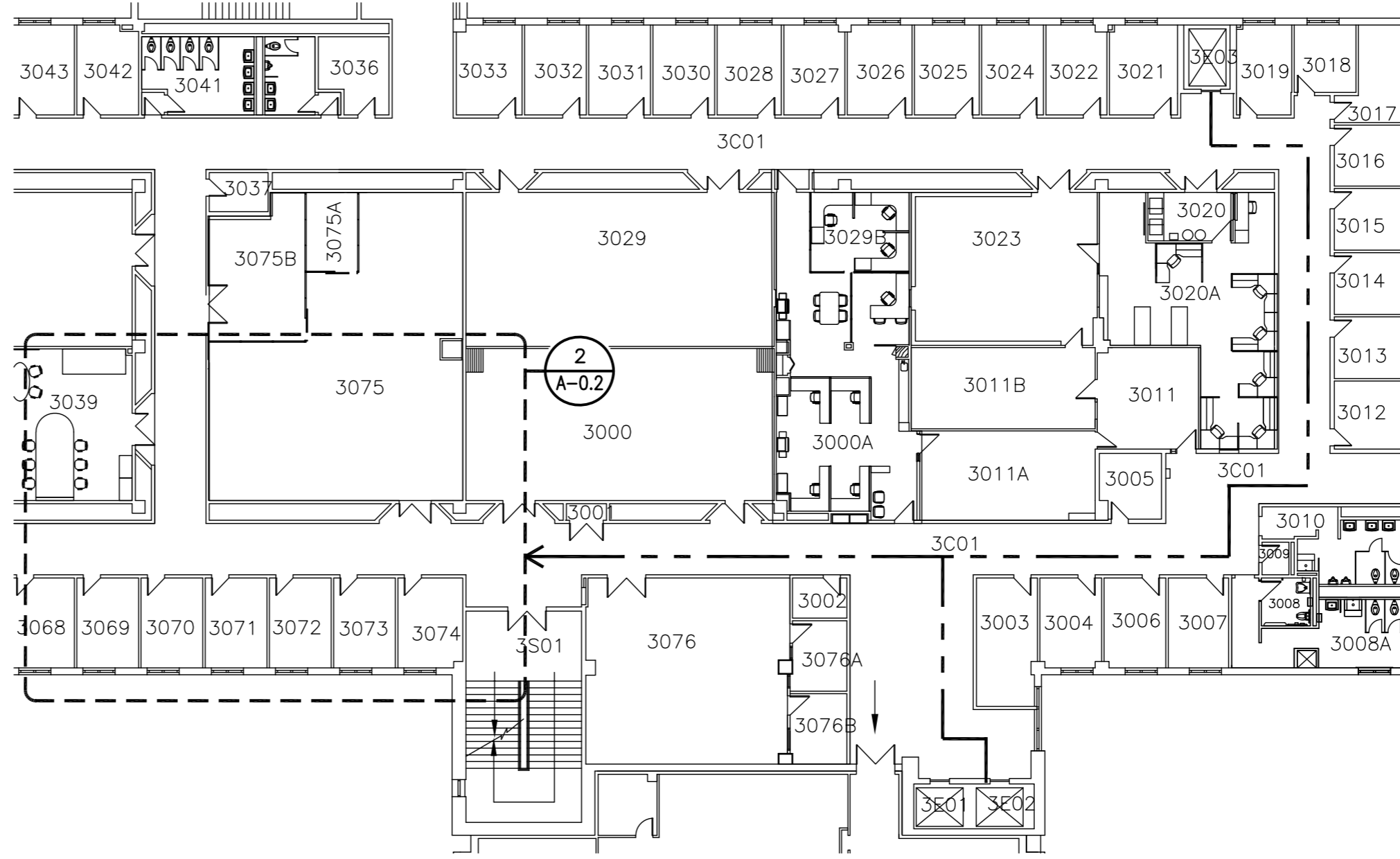
HOARDING & CORE LOCATIONS LEVEL 4
SCALE: N.T.S.

3
A-0.2



CORE LOCATIONS LEVEL 3
SCALE: N.T.S.

2
A-0.2



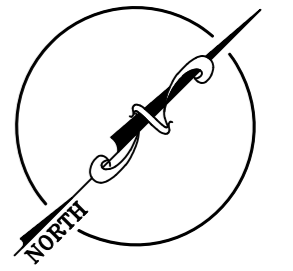
SITE ACCESS LEVEL 3 - LOCATION PLAN
SCALE: N.T.S.

1
A-0.2

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF FACILITIES MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.



Department of Facilities Management
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- Dedication plaque, Arts & Administration Building, St. John's Campus

PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
Project #: EN-123-21

DRAWING TITLE:
SITE ACCESS & CORE LOCATION PLANS


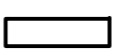
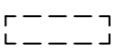
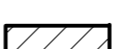
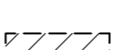








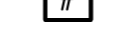
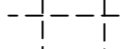
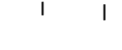
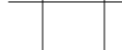

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. A-0.2

GENERAL NOTES: (APPLY TO ALL DWG SHEETS)

- ALL WORK TO BE DONE IN ACCORDANCE WITH LATEST ADDITION OF THE NATIONAL BUILDING CODE AND APPLICABLE LOCAL BUILDING CODES.
- ALL CONTRACTORS AND SUBCONTRACTORS PERFORMING WORK ON THE PROJECT ARE TO PROVIDE UTMOST QUALITY WORKMANSHIP. THEY MUST ALSO ADHERE TO ALL SCHEDULES AS SET OUT IN THE CONTRACT DOCUMENTS.
- CONTRACTOR TO ENSURE A HAZARD ASSESSMENT IS DONE ONSITE PRIOR TO THE START OF WORK TO IDENTIFY POTENTIAL HAZARDS AND RECOMMENDED CONTROLS.
- CONTRACTOR SHALL BE AWARE THAT ASBESTOS CONTAINING MATERIAL (ACM) EXISTS THROUGHOUT THE CAMPUS. COORDINATE ALL CUTTING, DRILLING, AND DEMOLITION OF VINYL TILE, DRYWALL JOINT COMPOUND, AND PARGING CEMENT AT PIPE ELBOWS IN THE ENGINEERING BUILDING BY ALL TRADES WITH MUN PROJECT COORDINATOR AND MUN ASBESTOS COORDINATOR.
- CONTRACTOR SHALL BE AWARE THAT LEAD CONTAINING MATERIAL EXISTS THROUGHOUT THE CAMPUS. COORDINATE ALL CUTTING, DRILLING, AND DEMOLITION OF PAINTED SURFACES IN THE ENGINEERING BUILDING BY ALL TRADES WITH MUN PROJECT COORDINATOR AND MUN ASBESTOS COORDINATOR.
- THE AREA OF WORK MAY BE OCCUPIED BY THE CLIENT STAFF FOR THE DURATION OF THE PROJECT. THE MUN PROJECT COORDINATOR AND GENERAL CONTRACTOR SHALL COORDINATE RENOVATING SMALL AREAS OF THE SPACE AT A TIME TO MINIMIZE DUST, DEBRIS, AND NOISE LEVELS. THE PROJECT COORDINATOR SHALL COORDINATE WITH THE CLIENT AND GENERAL CONTRACTOR TO ESTABLISH A SCHEDULE OF WORK.
- ALL TEMPORARY HOARDING AND ACCESSES REQUIRED IN EGRESS CORRIDORS, ATRIUMS, FOYERS AND STAIRWELLS TO BE OF NON-COMBUSTIBLE FIRE RATED CONSTRUCTION AS PER NBC.
- CONTRACTOR IS TO HOARD WORK AS NECESSARY AND PROTECT REMAINING PREMISES IN THE WORK AREA AND ADJACENT TENANT SPACES FROM DAMAGE AND MAKE GOOD ANY DAMAGES THAT MAY OCCUR DURING THE WORK. CONTRACTOR TO SEAL ALL AFFECTED DUCT SYSTEMS FOR DUST CONTROL WITHIN THE WORK AREA AND ADJACENT SPACES. ALL MATERIALS TO BE PROTECTED & COVERED DURING PAINTING.
- CONTRACTOR TO CAREFULLY REMOVE EXISTING SIGNAGE FROM WALL LOCATIONS PRIOR TO DEMOLITION. TURN OVER TO PROJECT COORDINATOR..
- ALL DEMOLISHED MATERIAL BECOMES THE PROPERTY OF THE CONTRACTOR. WORK SITE TO BE LEFT IN SAFE CONDITION AT THE END OF EACH WORK DAY.
- READ IN CONJUNCTION WITH MECHANICAL AND ELECTRICAL PLANS AND SPECIFICATIONS, COORDINATE ALL WORK WITH OTHER TRADES.
- ALL CIRCUIT BREAKER / PANEL SHUTDOWNS WILL REQUIRE MUN ELECTRICIAN PRESENT TO PROVIDE LOCK OUT/TAG OUT. CONTRACTOR SHALL CONTACT PROJECT COORDINATOR MIN. 48hrs IN ADVANCE TO SCHEDULE MUN ELECTRICIAN. LIVE ELECTRICAL WORK IS NOT PERMITTED.
- CONTRACTOR TO OBTAIN AND PAY FOR ANY PERMITS REQUIRED BY LOCAL CODES AND REGULATIONS.
- CONTRACTOR TO REVIEW EXISTING SITE CONDITIONS, VERIFY ALL DIMENSIONS AND SCOPE OF WORK AND REPORT ANY DISCREPANCIES TO THE MUN PROJECT COORDINATOR PRIOR TO SUBMISSIONS OF TENDER.
- WHERE DRAWINGS INDICATE TO MATCH EXISTING, NO CHARGES AFTER TENDER ACCEPTANCE FOR MINIMUM QUANTITIES OR SPECIAL SHIPPING COSTS WILL BE CONSIDERED.
- NO CHANGES OR REVISIONS TO THE WORK ARE TO BE EXECUTED WITHOUT THE PRIOR APPROVAL OF THE OWNER.
- CONTRACTORS SHALL AWAIT WRITTEN APPROVAL FOR ANY CHANGE ORDERS BY THE OWNER'S REPRESENTATIVE PRIOR TO COMMENCING ANY WORK OR ORDER OF ANY MATERIALS RELATING TO A CHANGE.
- PROVIDE CERTIFICATE OF GUARANTEE OF WORKMANSHIP AND MATERIAL FOR A PERIOD OF ONE YEAR FROM DATE OF ACCEPTANCE BY OWNER.
- ISOLATION OF WORK AREAS IN OCCUPIED FACILITIES:
 - MATERIALS:
 - POLYETHYLENE SHEET: REINFORCED, FIRE-RESISTIVE SHEET, 0.25mm MINIMUM THICKNESS, WITH FLAME-SPREAD RATING OF 15 OR LESS PER ASTM E 84.
 - DUST CONTROL ADHESIVE-SURFACE WALK-OFF MATS: PROVIDE MATS MINIMUM 914 X 1624mm.
 - INSTALLATION:
 - PREVENT DUST, FUMES, AND ODOURS FROM ENTERING OCCUPIED AREAS.
 - PRIOR TO COMMENCING WORK, ISOLATE THE HVAC SYSTEM IN AREA WHERE WORK IS TO BE PERFORMED IN ACCORDANCE WITH APPROVED COORDINATION DRAWINGS. COORDINATE WITH OWNER.
 - DISCONNECT SUPPLY AND RETURN DUCTWORK IN WORK AREA FROM HVAC SYSTEMS SERVICING OCCUPIED AREAS.
 - MAINTAIN NEGATIVE AIR PRESSURE WITHIN WORK AREA USING HEPA-EQUIPPED AIR FILTRATION UNITS, STARTING WITH COMMENCEMENT OF TEMPORARY PARTITION CONSTRUCTION, AND CONTINUING UNTIL REMOVAL OF TEMPORARY PARTITIONS IS COMPLETE. AT THE DISCRETION OF THE PROJECT COORDINATOR.
 - NON-DUCTED, SELF-CONTAINED AIR FILTRATION UNITS ARE PERMITTED TO BE USED FOR DUST CONTROL
 - WHERE DUCTED AIR FILTRATION UNITS ARE USED; CONTRACTOR TO EXHAUST DUCT TO EN-4029 WINDOWS; ALL DUCT MUST BE FASTENED AND SECURED OVERHEAD. NO DUCT PERMITTED THROUGH EXIT DOORS, OR ADJACENT SUITES.
 - MAINTAIN DUST PARTITIONS DURING THE WORK. USE VACUUM COLLECTION ATTACHMENTS ON DUST-PRODUCING EQUIPMENT. ISOLATE LIMITED WORK WITHIN OCCUPIED AREAS USING PORTABLE DUST CONTAINMENT DEVICES.
 - PERFORM DAILY CONSTRUCTION CLEANUP AND FINAL CLEANUP USING APPROVED, HEPA-FILTER-EQUIPPED VACUUM EQUIPMENT.
- GENERAL CONTRACTOR MUST REFER TO ARCHITECTURAL AND ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR EXTENT OF WORK AND COORDINATE WITH OTHER TRADES PRIOR TO THE COMMENCEMENT OF ANY WORK.
- MAINTAIN FIRE RATINGS BETWEEN FLOOR AND WALL ASSEMBLIES. FILL AND PATCH HOLES IN FLOORS AND WALLS AS A RESULT OF DEMOLITION WORK. COORDINATE OPENINGS REQUIRED IN EXISTING FIRE RATED CONCRETE BLOCK WALLS AND FLOORS WITH MECHANICAL AND ELECTRICAL SUB-TRADES. APPROPRIATELY FIRE SEAL PENETRATIONS TO MAINTAIN 1 HOUR FIRE RESISTANCE RATING. SUBMIT PRODUCT DATA SHEETS FOR REVIEW AND APPROVAL.
- REMOVE AND SALVAGE LOCKSETS, CLOSURES, AND OPERATOR SYSTEMS UNLESS OTHERWISE NOTED. TURN OVER TO OWNER.
- REFER TO SECTION 01 10 00 FOR WORK RESTRICTIONS.
- PERFORM DEMOLITION WORK SHOWN AND/OR REQUIRED TO COMPLETE THE WORK. DO NOT ASSUME DEMOLITION DRAWINGS SHOW THE FULL EXTENT OF DEMOLITION WORK REQUIRED.
- PROVIDE CUTTING, FITTING, HOLE CORING, PATCHING, FRAMING, FURRING, BLOCKING AND MISCELLANEOUS RELATED COMPONENTS REQUIRED TO EXECUTE THE WORK OF THIS CONTRACT, INCLUDING WORK REQUIRED BY ELECTRICAL AND OTHER TRADES. REINSTATE AND/OR MAKE GOOD ALL EXISTING SURFACES AFFECTED BY THE WORK. TO BE PREPARED TO RECEIVE NEW FINISHES OR FINISH TO MATCH ADJACENT CONDITIONS. COORDINATE EXTENT WITH SUB-TRADES.
- WHEREVER EXCESSIVE DEMOLITION OCCURS OR IF DAMAGE OCCURS TO ADJACENT SURFACES NOT INTENDED FOR DEMOLITION OR REMOVAL, REINSTATE ALL AFFECTED SURFACES AND PREPARE THEM TO RECEIVE NEW FINISHES IF SPECIFIED, OTHERWISE REFINISH TO MATCH EXISTING ADJACENT CONDITIONS.
- ALL DATA DROPS NOTED TO BE REMOVED SHALL BE DISCONNECTED BY MUN FORCES PRIOR TO DEMOLITION WORK BY ELECTRICAL SUB-TRADE. CONTRACTOR SHALL CONTACT PROJECT COORDINATOR 48hrs IN ADVANCE TO NOTIFY / SCHEDULE DATA DROP DISCONNECTION. DO NOT CUT OR DISCONNECT DATA CABLES.
- REMOVE ALL WIRING AND CONDUIT BACK TO NEAREST JUNCTION BOXES FOR RECEPTACLES, SWITCHES, ETC. THAT ARE INDICATED TO BE REMOVED OR RELOCATED.
- ELECTRICAL CONTRACTOR RESPONSIBLE TO VERIFY INDICATED CIRCUITS AND TRACE OUT ANY UNKNOWN POWER AND LIGHTING CIRCUITS PRIOR TO ANY WORK TAKING PLACE.
- REUSE EXISTING LIGHTING POWER CIRCUITS AS INDICATED. RE-ROUTE, EXTEND, OR MODIFY POWER FEEDS AS REQUIRED TO FACILITATE ALL NEW LOCATIONS OF LIGHT FIXTURES, ILLUMINATED EXIT SIGNS, LINE VOLTAGE DIMMER SWITCHES, AND LOW VOLTAGE SWITCHES.
- ALL ELECTRICAL ISOLATIONS SHALL BE PERFORMED IN ACCORDANCE WITH MUN ZERO ENERGY ISOLATION PROGRAM (ZEIP). ELECTRICAL CONTRACTORS ARE REQUIRED TO HAVE COMPLETED MUN ZEIP TRAINING PRIOR TO PERFORMING ELECTRICAL WORK.

**** CONTRACTOR'S ARE TO TAKE NOTE THAT ASBESTOS CONTAINING MATERIALS (ACMs) ARE PRESENT IN VARIOUS BUILDING MATERIALS IN THE ENGINEERING BUILDING. AN ASBESTOS SURVEY HAS BEEN INCLUDED IN THE SPECIFICATION SECTION 02 26 00 OUTLINING SPECIFIC INFORMATION. REMOVAL/DEMOTION OF/TO THE VINYL TILE, DRYWALL JOINT COMPOUND, AND PARGING CEMENT AT PIPE ELBOW INSULATION IN EN-4029 AND THE SURROUNDING AREAS OF THE ENGINEERING BUILDING ARE TO BE REMOVED/CARRIED OUT USING APPROPRIATE ABATEMENT PROCEDURES AS PER THE PROVINCIAL REGULATIONS AND THOSE OUTLINED IN SECTION 02 82 00.02. ****

ARCHITECTURAL SYMBOL LEGEND:

-  NEW WALL CONSTRUCTION, SEE WALL TYPE
-  EXISTING GYPSUM BOARD WALL CONSTRUCTION TO REMAIN
-  EXISTING GYPSUM BOARD WALL CONSTRUCTION TO BE REMOVED
-  EXISTING CONCRETE BLOCK WALL CONSTRUCTION TO REMAIN
-  EXISTING CONCRETE BLOCK WALL CONSTRUCTION TO BE REMOVED
-  NEW TEMP HOARDING WALL:
 - FIRE RETARDENT RIP PROOF TARP (WHITE)
 - 92mm METAL STUDS @ 400 O.C.
-  NEW TEMP HOARDING WALL:
 - 6mil POLYETHYLENE SHEETING
-  EXISTING DOOR TO REMAIN
-  EXISTING DOOR TO BE REMOVED
-  NEW DOOR
-  NEW DOOR NUMBERS
-  REFER TO CONSTRUCTION NOTE
-  REFER TO DEMOLITION NOTE
-  = LAT CEILING SYSTEM TO BE REMOVED
-  = LAT CEILING SYSTEM TO REMAIN
-  = NEW LAT CEILING SYSTEM, SEE SPEC
-  = NEW SUSPENDED x2 - 16mm GYPSUM BOARD CEILING SYSTEM
-  = NEW CEILING INSTALLATION HEIGHT ABOVE FINISH FLOOR

WALL TYPES: (EXISTING FLOOR TO U/S OF STRUCTURE IS APPROX. 4400mm)

- ① **WALL TYPE 1:**
 - 16mm GYPSUM BOARD
 - 92mm METAL STUD FRAMING @ 400 O.C.
 - 16mm GYPSUM BOARD

WALL CONSTRUCTION TO EXTEND 150mm ABOVE FINISHED CEILING. METAL STUDS TO EXTEND TO U/S OF STRUCTURE FOR STABILITY AS REQ'D
 - ② **WALL TYPE 2:**
 - 13mm GYPSUM BOARD
 - 92mm METAL STUD FRAMING @ 400 O.C.
 - 13mm GYPSUM BOARD
 - SEE DWG 5/A-4.0 FOR INFO ON WOOD TOPPER

EXTEND WALL CONSTRUCTION TO 150mm ABOVE FINISHED CEILING. METAL STUDS TO EXTEND TO U/S OF STRUCTURE FOR STABILITY AS REQ'D WHERE WALL EXTENDS TO FINISHED CEILING. FINISH TOP OF PARTITION WITH 13mm GYPSUM BOARD WHERE PARTITION DOES NOT EXTEND TO FINISHED CEILING.
 - ③ **WALL TYPE 3:**
 - 150mm CONCRETE MASONRY BLOCK UNIT
 - INSTALL USING TOOTHED TECHNIQUE

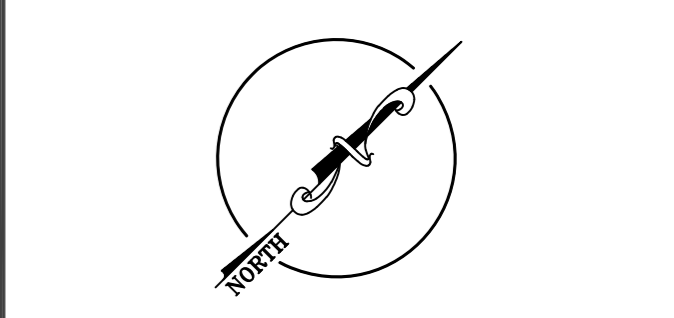
INSTALL CONCRETE BLOCK LENTIL OVER NEW DOORS C/W 2-15M REBAR, OR STRUCTURAL STEEL ANGEL AS SPECIFIED

WALL CONSTRUCTION TO EXTEND TO U/S OF CONCRETE SLAB LEVEL 4
- LIST OF SUBSCRIPTS:**
- a LOWER CASE LETTERS INDICATE SWITCHING ARRANGEMENT
 - LV INDICATES LOW VOLTAGE
 - 3 INDICATES 3-WAY
 - 4 INDICATES 4-WAY
 - D INDICATES DIMMER
 - DF INDICATES FLUORESCENT DIMMER
 - WP INDICATES WEATHER PROOF
 - EM INDICATES EMERGENCY POWER SUPPLY
 - W INDICATES WALL MOUNTED
 - P INDICATES PEDESTAL MOUNTED
 - N INDICATES NEW DEVICE
 - C INDICATES CEILING MOUNTED
 - E INDICATES EXISTING TO REMAIN
 - ER INDICATES EXISTING TO BE REMOVED
 - RL INDICATES EXISTING TO BE RELOCATED
 - NL INDICATES EXISTING IN NEW LOCATION

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

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MEMORIAL UNIVERSITY

Department of Facilities Management

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PROJECT NAME:

**ENGINEERING BUILDING
RENOVATIONS TO EN-4029
Project #: EN-123-21**

**GENERAL NOTES
&
SYMBOL LEGEND**

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. A-0

**GENERAL CONSTRUCTION NOTES -
APPLIES TO ALL SHEETS AND PHASING:**

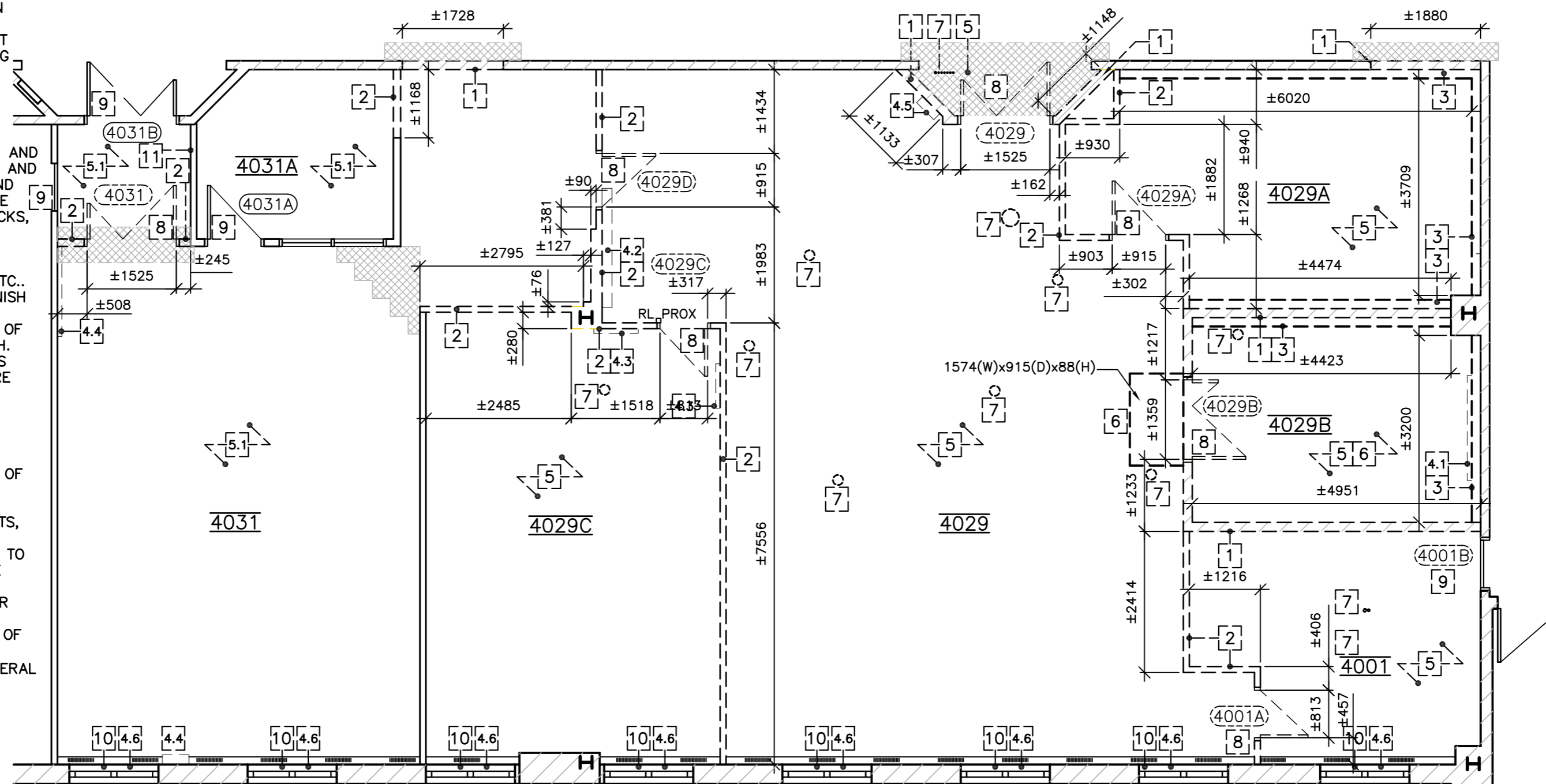
1. PERFORM DEMOLITION WORK SHOWN AND/OR REQUIRED TO COMPLETE THE WORK. DO NOT ASSUME DEMOLITION DRAWINGS SHOW THE FULL EXTENT OF DEMOLITION WORK REQUIRED.
2. REFER TO SHEET A-0 AND SECTION Q2 41 19 FOR ADDITIONAL REQUIREMENTS AND INSTRUCTIONS FOR DEMOLITION WORK.
3. GENERAL CONTRACTOR MUST REFER TO ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR EXTENT OF WORK AND COORDINATE WITH OTHER TRADES PRIOR TO THE COMMENCEMENT OF ANY WORK.
4. MAINTAIN FIRE RATINGS BETWEEN FLOOR AND WALL ASSEMBLIES. FILL AND PATCH HOLES IN FLOORS AND WALLS AS A RESULT OF DEMOLITION WORK. COORDINATE OPENINGS REQUIRED IN EXISTING FIRE RATED CONCRETE BLOCK WALLS AND FLOORS WITH MECHANICAL AND ELECTRICAL SUB-TRADES. APPROPRIATELY FIRE SEAL PENETRATIONS TO MAINTAIN 1 HOUR FIRE RESISTANCE RATING.
5. REMOVE AND SALVAGE LOCKSETS, CLOSURES, AND OPERATOR SYSTEMS UNLESS OTHERWISE NOTED AND TURN OVER TO OWNER.
6. REFER TO SECTION 01 10 00 FOR WORK RESTRICTIONS.
7. INSTALL PROTECTIVE COVERING OVER EXISTING FLOORING AS REQUIRED IN ACCESS ROUTES AND IN HOARDING AREA. MAINTAIN COVERINGS FOR DURATION OF THE PROJECT OR UNTIL AGREED TO WITH THE CONTRACTOR AND OWNER.
8. ALL WORK REQUIRED TO BE PERFORMED OUTSIDE HOARDING/ CONSTRUCTION SITE SHALL BE DONE AFTER 5PM TO 8AM. PROVIDE 24 HOURS NOTICE PRIOR TO EACH WORK SHIFT.
9. PROVIDE CUTTING, FITTING, HOLE CORING, PATCHING, FRAMING, FURRING, BLOCKING AND MISCELLANEOUS RELATED COMPONENTS REQUIRED TO EXECUTE THE WORK OF THIS CONTRACT, INCLUDING WORK REQUIRED BY MECHANICAL, ELECTRICAL AND OTHER TRADES. REINSTATE AND/OR MAKE GOOD ALL EXISTING SURFACES AFFECTED BY THE WORK. TO BE PREPARED TO RECEIVE NEW FINISHES OR FINISH TO MATCH ADJACENT CONDITIONS. COORDINATE EXTENT WITH SUB-TRADES.
10. WHEREVER EXCESSIVE DEMOLITION OCCURS OR IF DAMAGE OCCURS TO ADJACENT SURFACES NOT INTENDED FOR DEMOLITION OR REMOVAL, REINSTATE ALL AFFECTED SURFACES AND PREPARE THEM TO RECEIVE NEW FINISHES IF SPECIFIED, OTHERWISE REFINISH TO MATCH EXISTING ADJACENT CONDITIONS.
11. REVIEW DEMOLITION PLAN IN CONJUNCTION WITH ALL OTHER PLANS AND DETAILS. FURTHER DEMOLITION REQUIRED FOR NEW MECHANICAL AND ELECTRICAL TO BE DETERMINED BASED ON NEW FLOOR PLAN LAYOUT AND SITE CONDITIONS. CHECK SITE DIMENSIONS AND CONDITIONS AND REPORT UNACCEPTABLE CONDITIONS TO PROJECT COORDINATOR FOR REMEDIAL INSTRUCTIONS PRIOR TO PROCEEDING WITH THE WORK.
12. PATCH AND REPAIR WALLS AND FLOORS AS A RESULT OF MECHANICAL AND ELECTRICAL DEMOLITION AND NEW WORK.
13. PATCH AND REPAIR ALL EXISTING WALLS IN CONSTRUCTION AREA AND CORRIDORS INCLUDING AREAS OF EXISTING WALL REMOVAL, DOOR AND FRAME REMOVAL, EXISTING DAMAGES, PLUMBING, MECHANICAL, AND ELECTRICAL FIXTURE REMOVAL, ETC.. SCOPE OF WORK TO INCLUDE BUT NOT BE LIMITED TO DENTS, NICKS, HOLES, SCRATCHES, CRACKS, ETC..
14. NEW PAINT FINISH ON ALL NEW AND EXISTING WALLS, NEW AND EXISTING DOORS AND FRAMES, NEW AND EXISTING BULKHEADS, ETC.. TO PREPARE SURFACES AS REQUIRED TO RECEIVE NEW PAINT FINISH INCLUDING BUT NOT LIMITED TO PATCH AND REPAIR, SCRAPING, SANDING, ETC. PAINT FINISH ON NEW MATERIALS TO BE MINIMUM OF ONE COAT APPROPRIATE PRIMER AND MINIMUM TWO COATS FINISH. PAINT FINISH ON EXISTING MATERIALS TO BE MINIMUM TWO COATS FINISH. COLORS TO BE SELECTED BY OWNER. SEE SPEC FOR MORE PAINTING INFORMATION.
15. REMOVE EXISTING FLOORING DOWN TO CONCRETE FLOOR SLAB, PREPARE EXISTING CONCRETE FLOOR SLAB FOR NEW FLOORING INSTALLATION INCLUDING BUT NOT LIMITED TO SKIM COATING, LEVELING, FILLING, PATCHING, ETC. TO FACILITATE INSTALLATION OF NEW FLOORING.
17. GENERAL CONTRACTOR MUST COORDINATE NEW PARTITION LAYOUTS, MILLWORK LAYOUTS, PLUMBING, ELECTRICAL AND MECHANICAL LAYOUTS, ETC. WITH SUB-CONTRACTORS PRIOR TO INSTALLATION TO ENSURE THERE ARE NO CONFLICTS BETWEEN LOCATION OF THESE ITEMS. WHERE CONFLICTS OCCUR, REPORT THESE TO THE OWNER PRIOR TO INSTALLATION OF ANY ITEM IN ORDER TO ARRANGE FOR THE OWNER TO REVIEW AND ADVISE. ANY COSTS INCURRED TO CORRECT OR RESOLVE CONFLICTS THAT ARE A RESULT OF LACK OF COORDINATION BY THE GENERAL CONTRACTOR AND/OR SUB-CONTRACTORS ARE TO BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR.

FLOOR PLAN DEMOLITION NOTES: #

1. REMOVE ALL OF CONCRETE BLOCK WALL FOR NEW LAYOUT USING TOOTHED TECHNIQUE FOR NEW WALL INFILL AND PATCHING AT CORNERS AND WALL JOINS. CARE TO BE TAKEN WHERE REMOVING PORTIONS OF WALL INTERSECTING WITH REMAINING CONCRETE BLOCK WALLS. REMOVE CONCRETE BLOCK FULL HEIGHT. WALL CONSTRUCTED OF 150mm CMU. ASSUME PAINT IS LEAD CONTAINING.
2. REMOVE EXISTING GYPSUM BOARD PARTITION WALLS FOR NEW LAYOUT. ASSUME DRYWALL JOINT COMPOUND IS ASBESTOS CONTAINING. ASSUME PAINT IS LEAD CONTAINING.
3. REMOVE APRON WALLS AND COUNTERTOPS FOR NEW LAYOUT AS SHOWN.
4. ALL SURFACE MOUNTED ACCESSORIES TO BE REMOVED, STORED, AND REUSED AS INDICATED. ITEMS NOT REUSED TO BE TURNED OVER TO OWNER, OR DISPOSED OF. CONTACT PROJECT COORDINATOR FOR DIRECTION. ACCESSORIES INCLUDE:
 - 4.1. SMART BOARD
 - 4.2. MAP
 - 4.3. COAT HOOKS
 - 4.4. KEYBOX
 - 4.5. FIRST AID KIT
 - 4.6. WINDOW BLINDS
5. REMOVE EXISTING VCT, SHEET VINYL, VINYL BASE, AND ASSOCIATED COMPONENTS TO CONCRETE SLAB. SLAB TO BE PREPPED AS REQUIRED TO ACCEPT NEW FLOORING, INCLUDING BUT NOT LIMITED TO SKIM COATING, LEVELING, FILLING, PATCHING, ETC. TYPICAL THROUGHOUT.
 - 5.1. REMOVE EXISTING DAMAGED, OR DETERIORATED TILE. CONSULT PROJECT COORDINATOR PRIOR TO REMOVAL. PREP AREAS WHERE TILE IS REMOVED TO ACCEPT NEW FLOORING.
6. REMOVE 50mm RAISED CONCRETE FLOORING, WATERPROOFING MEMEBRANE, AND ASSOCIATED COMPONENTS TO CONCRETE SLAB. SLAB TO BE PREPPED AS REQUIRED TO ACCEPT NEW FLOORING, INCLUDING BUT NOT LIMITED TO SKIM COATING, LEVELING, FILLING, PATCHING, ETC. TYPICAL THROUGHOUT.
7. APPROXIMATE LOCATION OF NEW FLOOR BOXES AND ELECTRICAL/DATA CONDUIT. VERIFY LOCATION OF CORE WITH GENERAL CONTRACTOR. REFER TO DWGS

2, AND 3/A-0.2 FOR CORE LOCATIONS.

8. REMOVE AND DISPOSE OF EXISTING DOOR AND FRAME. SALVAGE DOOR HARDWARE AND TURN OVER TO OWNER.
9. EXISTING DOOR TO REMAIN.
10. REMOVE AND DISPOSE OF EXISTING WINDOW SILL. PREP LOCATION FOR NEW WINDOW SILL.
11. REMOVE PORTION OF GYPSUM BOARD AT EXISTING WALL TO FACILITATE INSTALLATION OF NEW LIGHTING SWITCH. JOINT DRYWALL COMPOUND IS ASBESTOS CONTAINING. ASSUME PAINT IS LEAD CONTAINING. CONTRACTOR TO CONFIRM LOCATION ON SITE WITH ELECTRICAL CONTRACTOR.



GENERAL FINISH PLAN CONSTRUCTION NOTES:

- INSTALL NEW VINYL COMPOSITE TILE COMPLETE WITH 100mm COVERED RUBBER BASE THROUGHOUT. PREPARE AND LEVEL FLOOR AND BASE SUBSTRATE AS REQUIRED TO ACCEPT NEW MATERIAL. COLOURS AS SHOWN. INCLUDE FOR APPROPRIATE AMOUNT OF COMPATIBLE ADHESIVE.
- INSTALL 6mm LOW PROFILE FLOORING THRESHOLD STRIP WITH BEVELED EDGE BETWEEN EXISTING AND NEW FLOORING TYPES.
- INSTALL NEW VINYL COMPOSITE TILE FLOOR PATCH COMPLETE WITH 100mm COVERED RUBBER BASE AT AREAS OF WALL AND DOOR FRAME REMOVAL. PREPARE AND LEVEL FLOOR AND BASE SUBSTRATE AS REQUIRED TO ACCEPT NEW MATERIAL. COLOURS TO BE CHOSEN FROM MANUFACTURER'S FULL COLOUR RANGE. INCLUDE FOR APPROPRIATE AMOUNT OF COMPATIBLE ADHESIVE.
 - INSTALL NEW VINYL COMPOSITE FLOOR TILE PATCH WHERE DAMAGED, OR DETERIORATED TILE HAS BEEN REMOVED. PREPARE FLOOR SUBSTRATE AS REQUIRED TO ACCEPT TILE. COLOURS TO BE CHOSEN FROM MANUFACTURER'S FULL COLOUR RANGE. INCLUDE FOR APPROPRIATE AMOUNT OF COMPATIBLE ADHESIVE.
- EXISTING FLOORING AND VINYL BASE TO REMAIN.
- NEW PAINT FINISH ON ALL NEW AND EXISTING WALLS, NEW AND EXISTING DOORS AND FRAMES, NEW AND EXISTING BULKHEADS, EXPOSED MECHANICAL, ELECTRICAL, AND PLUMBING FIXTURES. PREPARE SURFACES AS REQUIRED TO RECEIVE NEW PAINT FINISH INCLUDING BUT NOT LIMITED TO PATCH AND REPAIR, SCRAPING, SANDING, ETC. PAINT FINISH ON NEW MATERIALS TO BE MINIMUM OF ONE COAT APPROPRIATE PRIMER AND MINIMUM TWO COATS FINISH. PAINT FINISH ON EXISTING MATERIALS TO BE MINIMUM TWO COATS FINISH. COLORS TO BE SELECTED BY OWNER. SEE SPEC FOR MORE PAINTING INFORMATION.
- TOUCH-UP PAINT WHERE REQUIRED AS A RESULT OF CONSTRUCTION IN THIS AREA. MATCH NEW PAINT TO EXISTING. CONTRACTOR TO PROVIDE DRY SAMPLE TO PROJECT COORDINATOR FOR REVIEW AND APPROVAL PRIOR TO START OF WORK.
- REMOVE AND REPLACE ALL EXISTING FLOOR MOUNTED DOOR STOPS WITH NEW HIGH RISE/LOW PROFILE TYPE AT ALL NEW AND RELOCATED DOOR LOCATIONS.
- REMOVE ALL RECEPTACLE, SWITCH RELAYS, DATA DROPS, AND OTHER SIMILAR COVER PLATES TO FACILITATE WALL PAINTING.
- WALL PAINTING OUTSIDE OF HOARDING WALL TO BE COMPLETED AFTER 5PM, OR BEFORE 8AM. SCHEDULE WITH PROJECT COORDINATOR.
- SEE DWG A-5.0 FOR PAINT FINISH LOCATIONS AT PARTITION WALL.
- SEE DWG A-5.1 FOR PAINT FINISH LOCATIONS AT PARTITION WALLS.

- PT-5 - ACCENT WALLS AND ALL EXPOSED SURFACES COLOUR OF MECHANICAL AND ELECTRICAL SERVICES LOCATED ON THIS WALL. CONTACT PROJECT COORDINATOR FOR ACCENT WALL COLOURS PRIOR TO START OF WORK.
- PT-6 - ACCENT WALL AND ALL EXPOSED SURFACES COLOUR OF MECHANICAL AND ELECTRICAL SERVICES LOCATED ON THIS WALL. SPECIALTY DRY ERASE PAINT IN WHITE BY RUST-OLEUM.

OWNER RESERVES THE RIGHT TO CHOOSE UP TO EIGHT (8) DIFFERENT PAINT SELECTIONS TO BE APPLIED THROUGHOUT THE SPACE; SEE SPECIFICATION 09 01 90.63 AND 09 91 23.

FINISH PLAN CONSTRUCTION NOTES: #

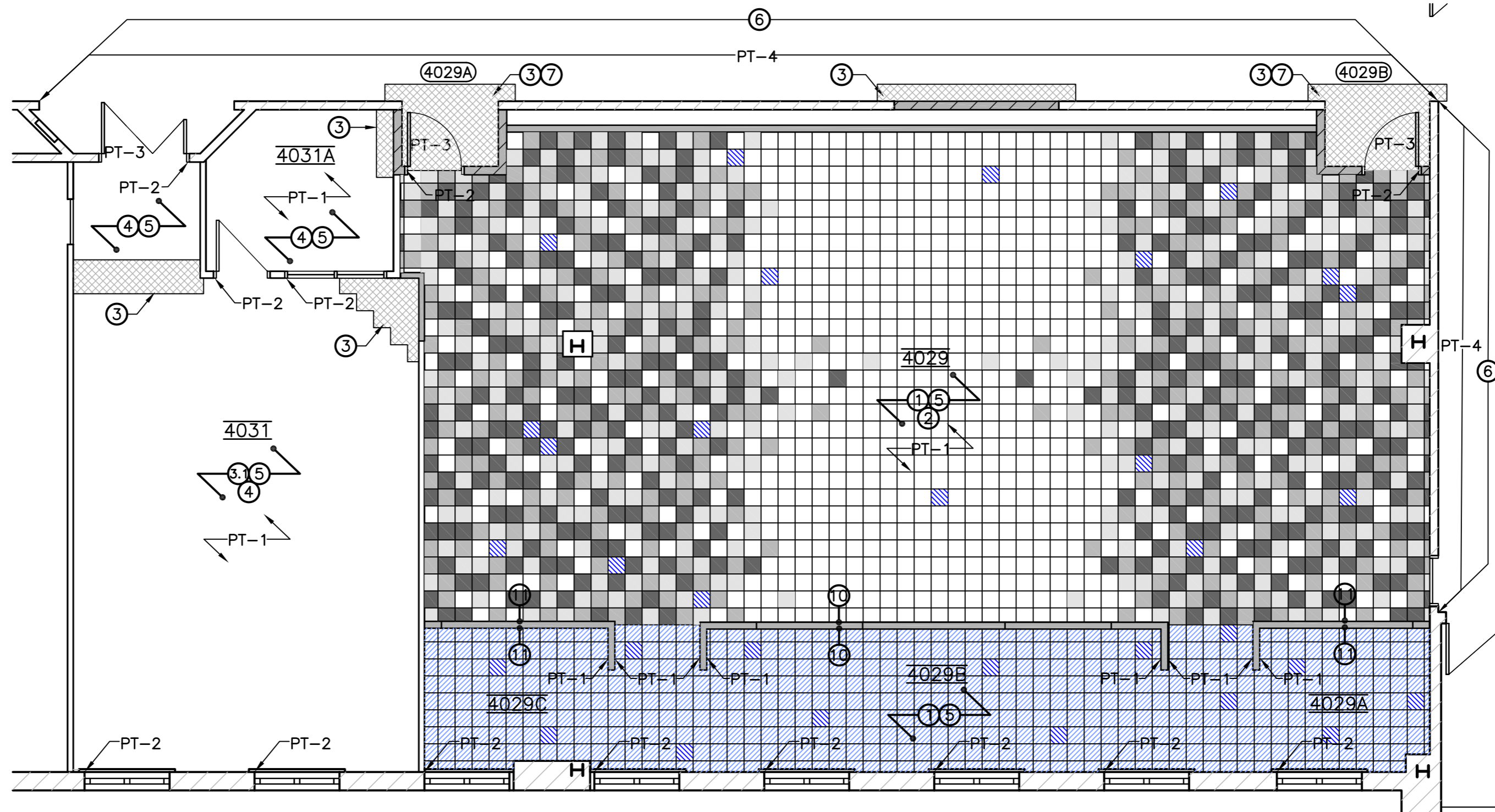
- NEW VINYL COMPOSITE TILE FLOORING AND VINYL BASE:
 - "STANDARD EXCELON IMPERIAL TEXTURE" BY ARMSTRONG FLOORING, COLOUR AS INDICATED IN FLOOR LEGEND
 - NEW PATTERN TO BE AS SHOWN; ANY VARIATIONS MUST BE COMMUNICATED TO PROJECT COORDINATOR
 - PROVIDE STRAIGHT EDGE ON EXISTING VCT FLOORING FOR NEW VCT FLOORING TIE-IN
 - NEW VINYL BASE BY "BENGUARD", OR APPROVED ALTERNATE AT ALL WALL PERIMETERS; COLOUR TO BE CHOSEN FROM MANUFACTURER'S FULL COLOUR RANGE

FLOOR LEGEND:

- VCT-1 NEW FLOORING 300x300mm
PATTERN: IMPERIAL TEXTURE
COLOUR: 51941 POLAR WHITE
- VCT-2 NEW FLOORING 300x300mm
PATTERN: IMPERIAL TEXTURE
COLOUR: 51861 SOFT WARM GRAY
- VCT-3 NEW FLOORING 300x300mm
PATTERN: IMPERIAL TEXTURE
COLOUR: 51915 CHARCOAL
- VCT-4 NEW FLOORING 300x300mm
PATTERN: IMPERIAL TEXTURE
COLOUR: 51910 CLASSIC BLACK
- VCT-5 NEW FLOORING 300x300mm
PATTERN: IMPERIAL TEXTURE
COLOUR: 51933 BLUE CLOUD
- VCT-6 NEW FLOORING 300x300mm
PATTERN: IMPERIAL TEXTURE
COLOUR: 51820 MARINA BLUE

PAINT LEGEND:

- PT-1 - MAIN WALL AND ALL EXPOSED SURFACES COLOUR OF MECHANICAL AND ELECTRICAL SERVICES LOCATED ON THIS WALL. CC-30 OXFORD WHITE BY BENJAMIN MOORE. SEMI-GLOSS FINISH.
- PT-2 - DOOR AND WINDOW FRAME COLOUR. CSP-150 WINDY CITY BY BENJAMIN MOORE. SEMI-GLOSS FINISH.
- PT-3 - DOOR COLOUR. 2057-30 NAPLES BLUE BY BENJAMIN MOORE. SEMI-GLOSS FINISH.
- PT-4 - EXISTING CORRIDOR AND ALL EXPOSED SURFACES COLOUR OF MECHANICAL AND ELECTRICAL SERVICES LOCATED ON THIS WALL. MATCH TO EXISTING. CONFIRM COLOUR WITH PROJECT COORDINATOR PRIOR TO START OF WORK.



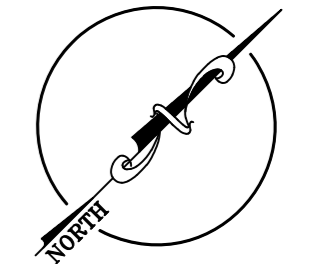
NEW FINISH PLAN

SCALE: 1:75

No.	REVISION	DATE
R0	ISSUED FOR TENDER	MARCH 1, 2024

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PROJECT NAME:

ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:

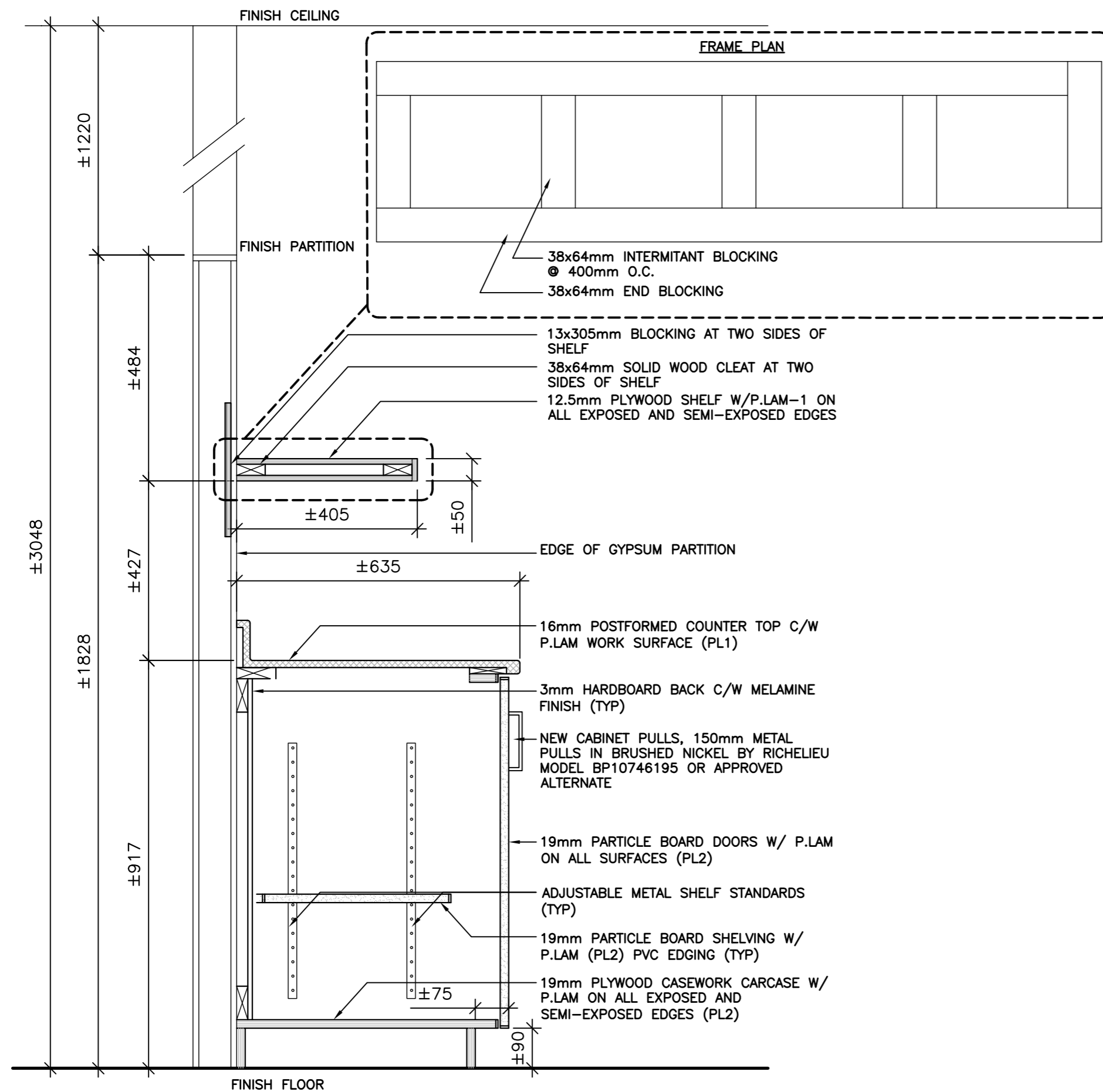
NEW FINISH PLAN

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. A-3.3

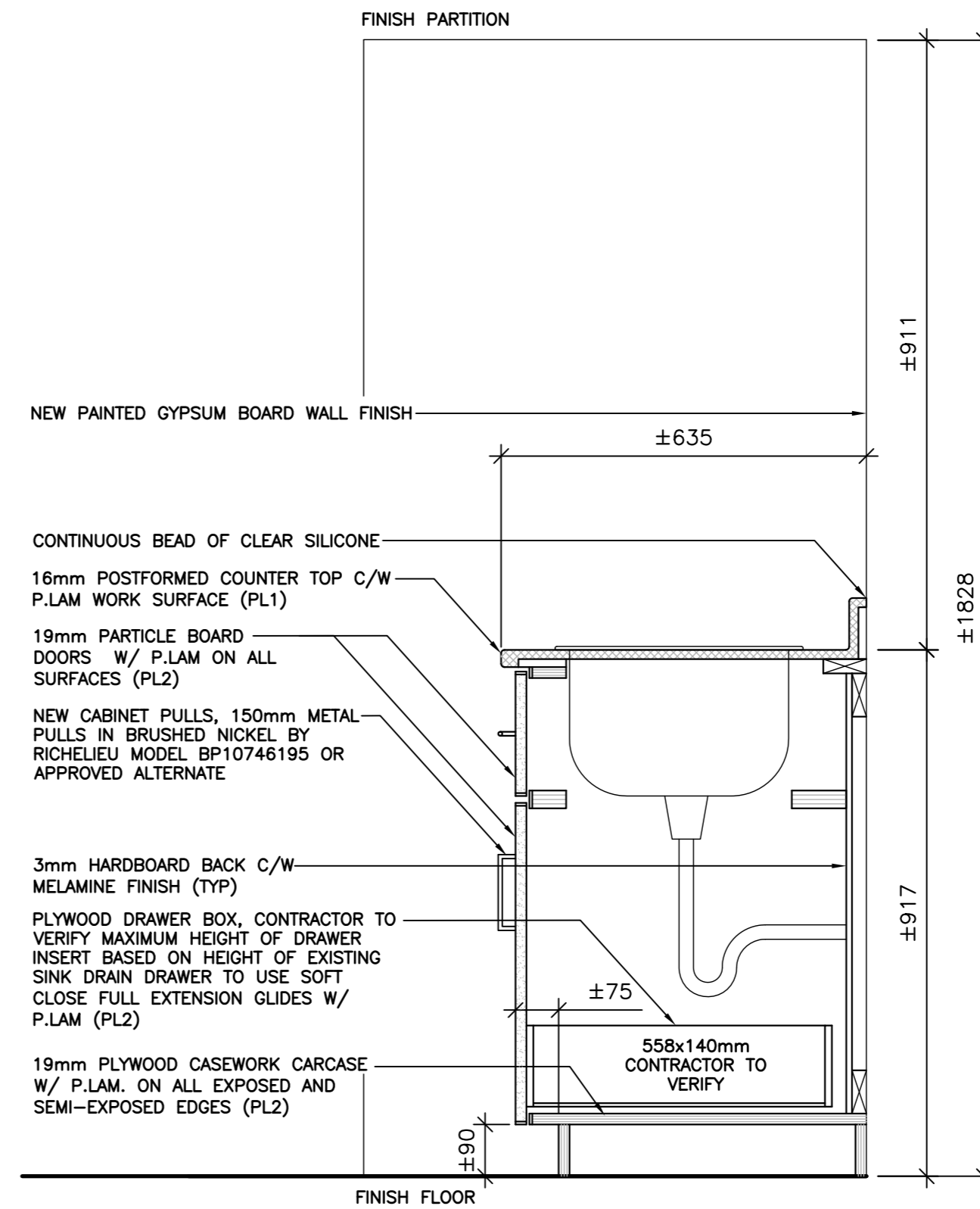
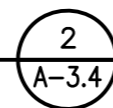
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A-3.3

GENERAL MILLWORK NOTES: #

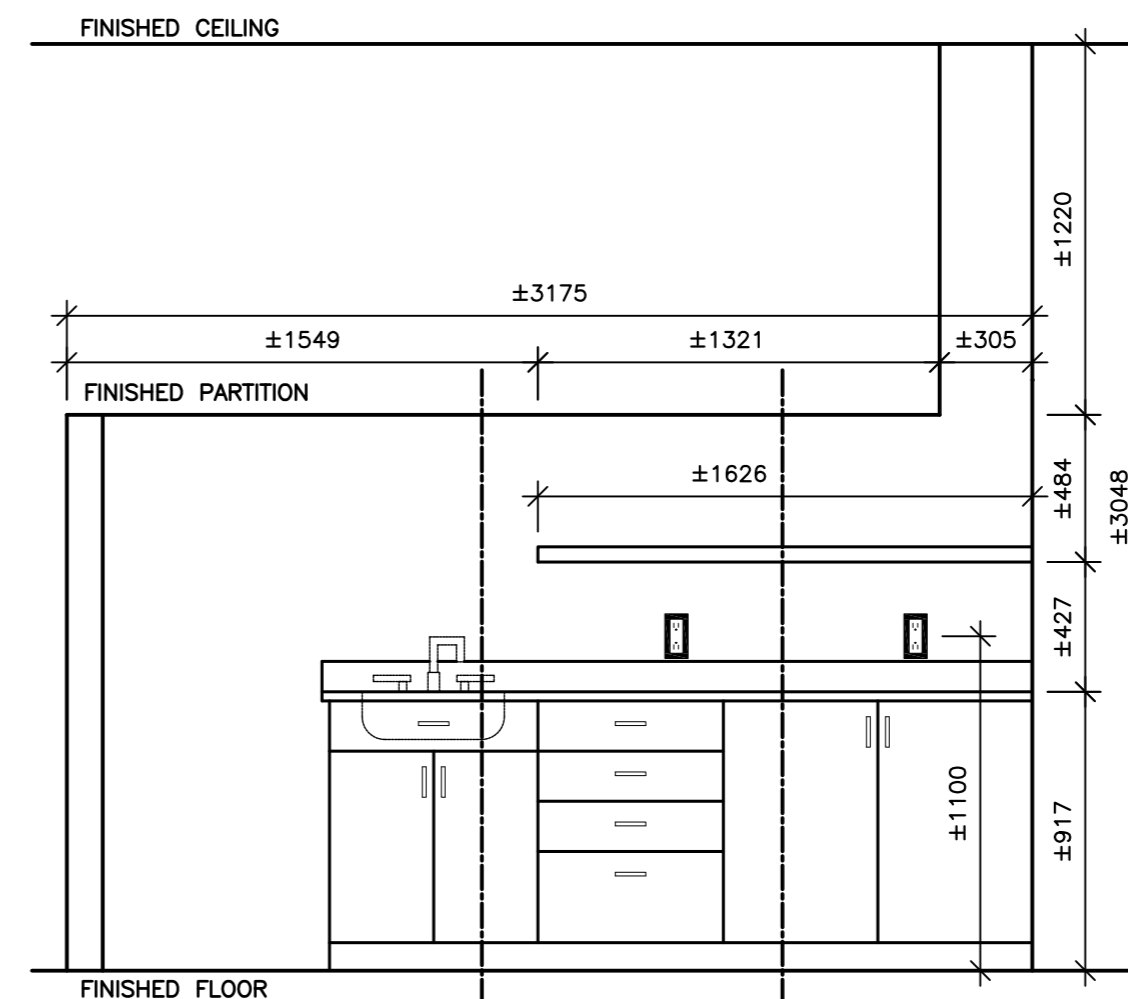
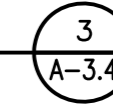
1. PROVIDE NEW MILLWORK AS PER DWG 1/A-3.4. OWNER TO SELECT MELAMINE, OR PLASTIC LAMINATE FINISH FROM MANUFACTURER'S FULL COLOUR RANGE. PLASTIC LAMINATE TO BE HIGH PRESSURE TYPE.
2. CONTRACTOR TO VERIFY DIMENSIONS ON SITE.
3. ALL NEW MATERIALS UNLESS OTHERWISE SPECIFIED.
4. MILLWORK SUBTRADE TO COORDINATE WITH PLUMBING SUBTRADE FOR FIXTURES CUTOUT REQUIREMENTS.



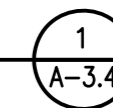
MILLWORK SECTION
SCALE: 1:10



MILLWORK SECTION
SCALE: 1:10



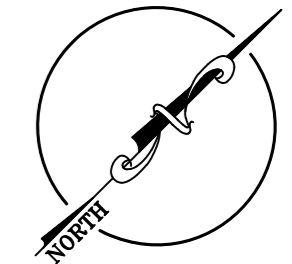
MILLWORK ELEVATION
SCALE: 1:25



No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

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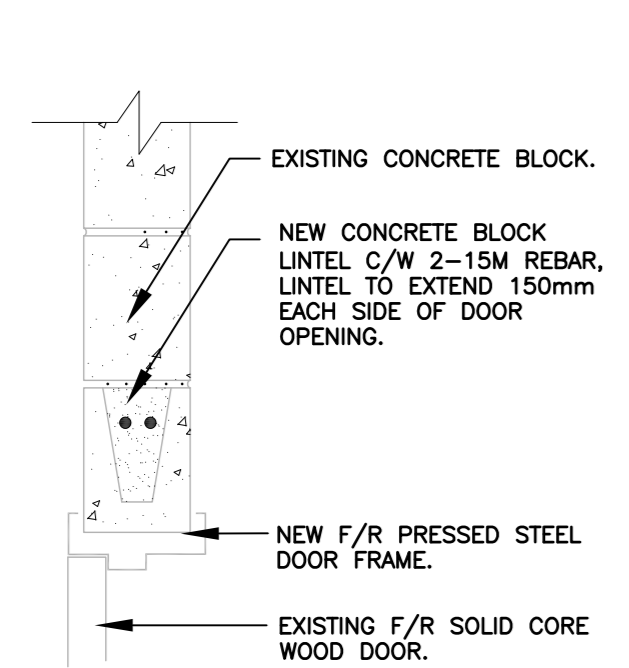
DRAWING TITLE:
NEW MILLWORK ELEVATIONS & SECTIONS

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. A-3.4

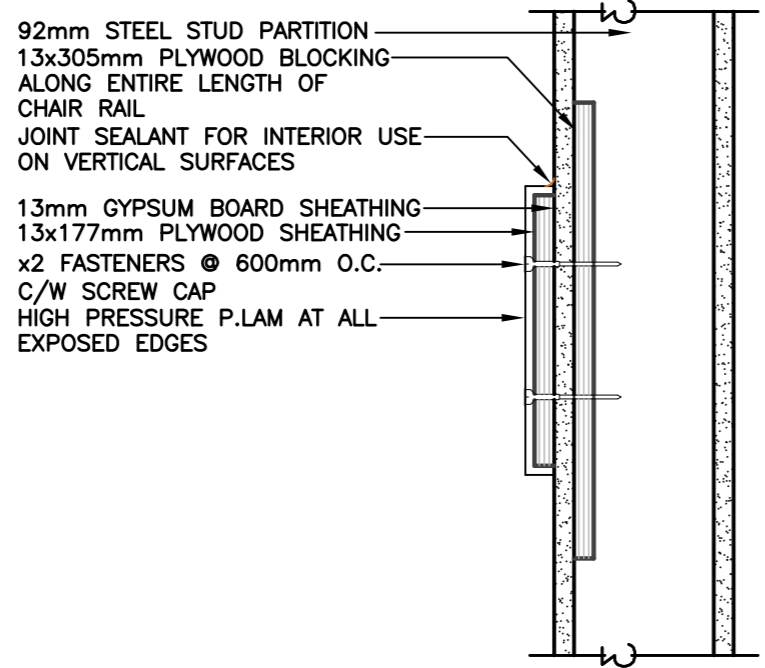
No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

GENERAL NOTES

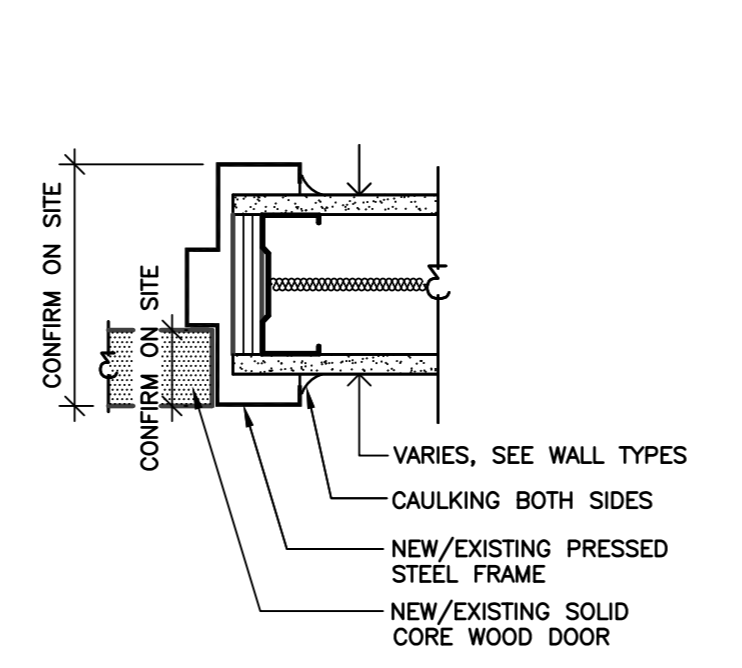
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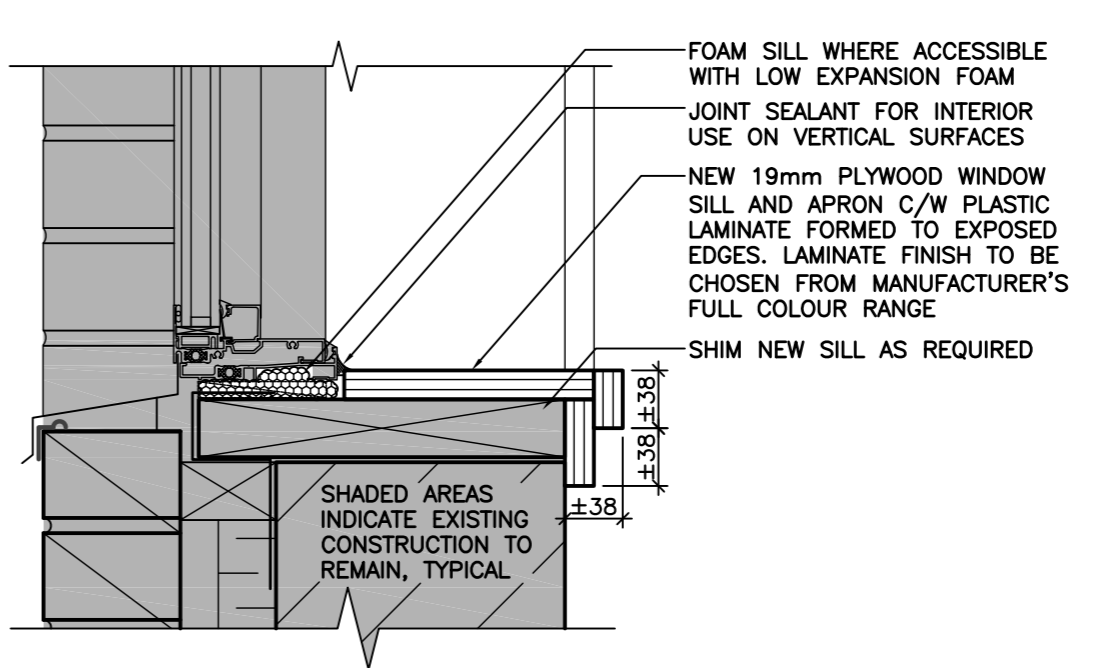
NEW LINTEL SECTIONS (6) **A-4.0**
SCALE: 1:10



PARTITION WALL DETAIL (5) **A-4.0**
SCALE: 1:5



DOOR JAMB DETAIL (4) **A-4.0**
SCALE: 1:5

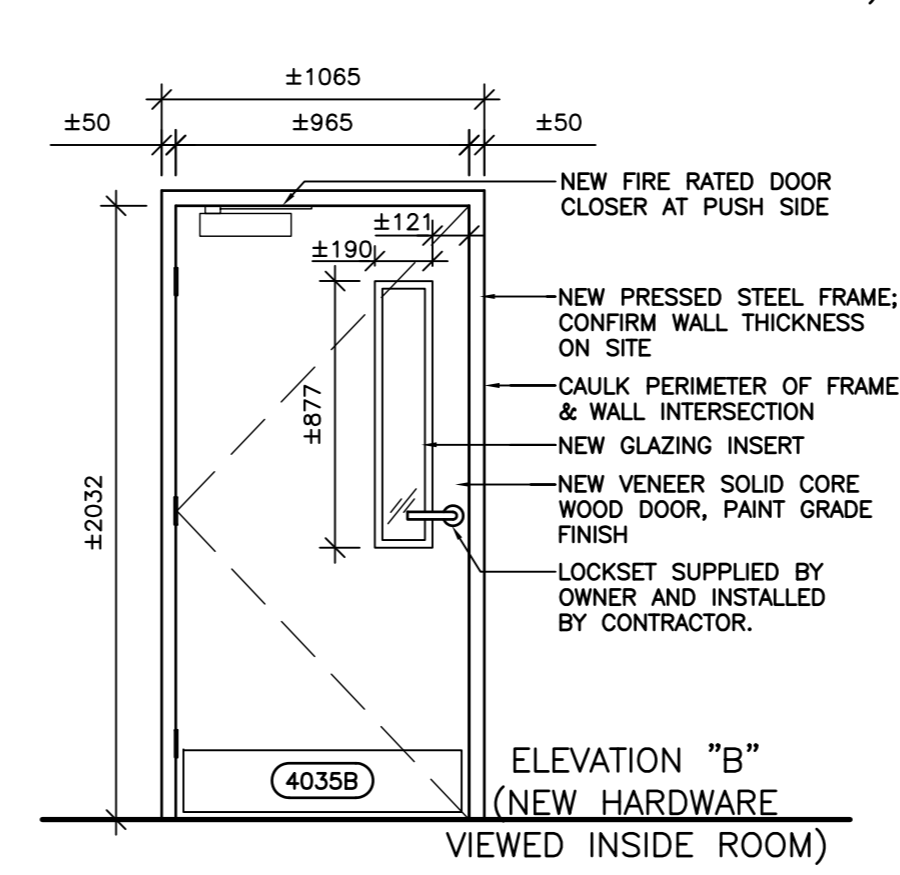
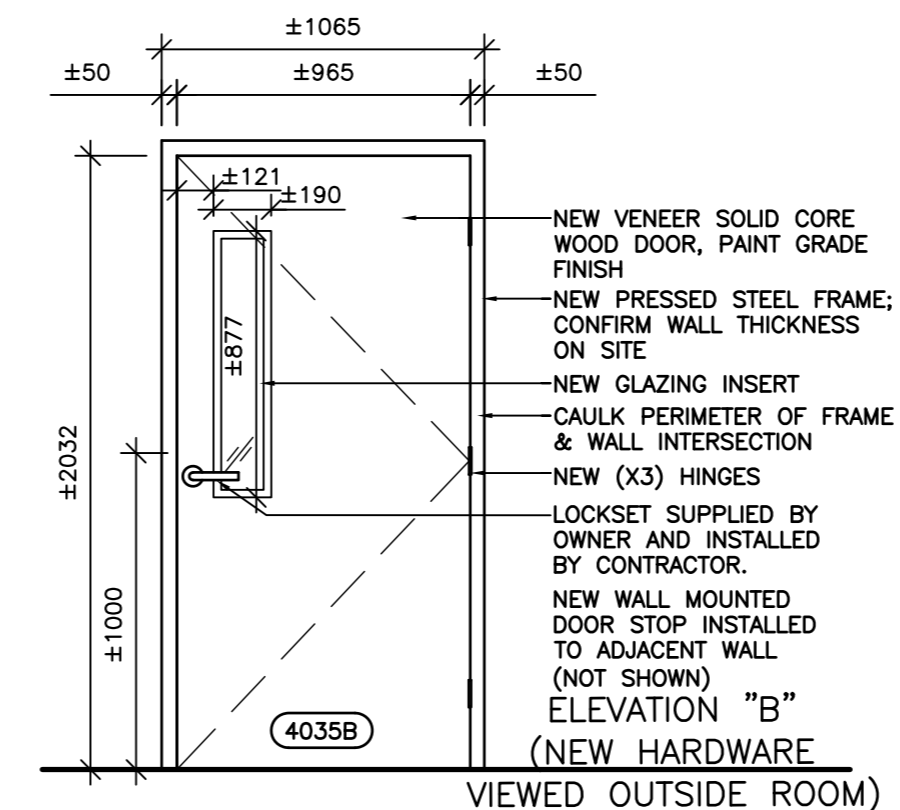


NEW SILL DETAIL (3) **A-4.0**
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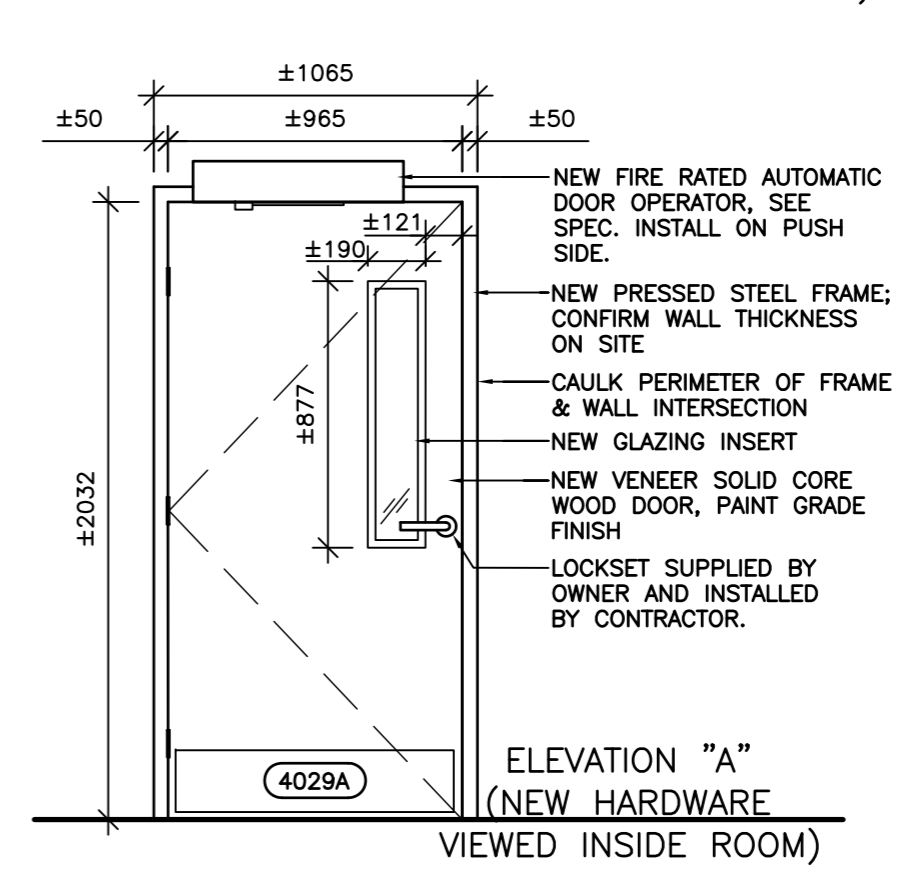
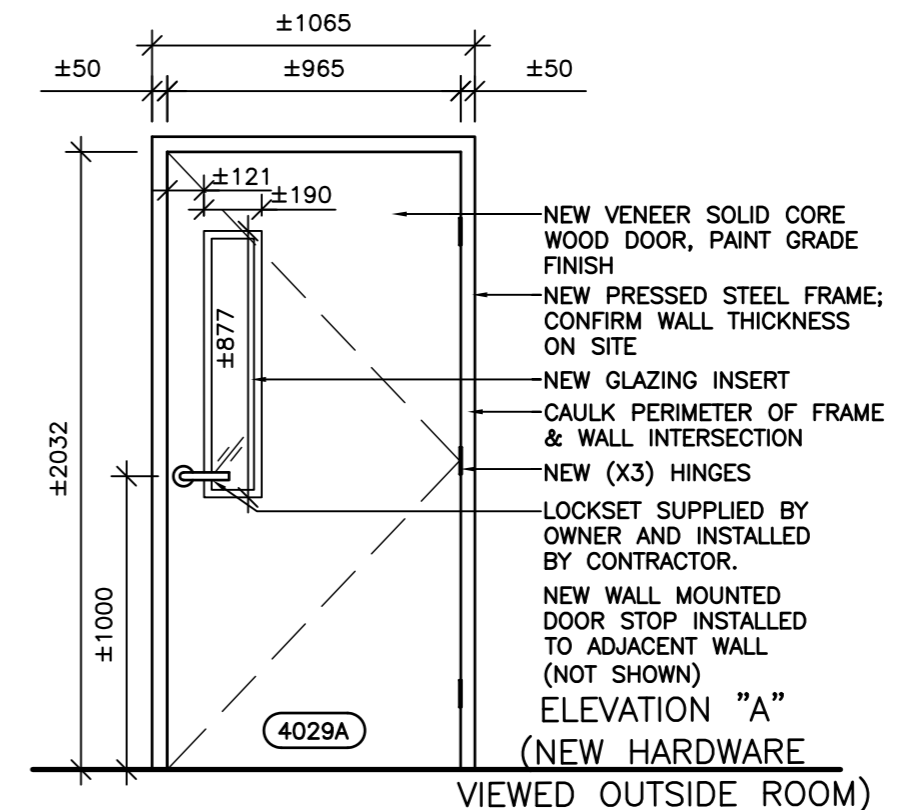
DOOR SCHEDULE																
NEW DOOR NUMBER	QUANTITY	SIZE		MATERIAL	FINISH	GLAZING	FRAME		WALL TYPE	FIRE RATING (min)	HARDWARE GROUP	REMARKS	LEGEND:			
		WIDTH	HEIGHT				FINISH	TYPE					EX = EXISTING	PSF = PRESSED STEEL FRAME	CMU = CONCRETE MASONRY UNIT	
4035A	1	NEW 965mm	NEW 2032mm	PSF	PAINT	CMU	45	HG1	SEE NOTES							
4035B	1	NEW 915mm w/ 610mm LEAF	NEW 2032mm	PSF	PAINT	CMU	45	HG2	SEE NOTES							
4031	1	NEW 915mm	EXISTING 2032mm	PSF	PAINT	CMU	45	HG1	EXISTING DOOR TO REMAIN							
4031A	1	NEW 915mm	EXISTING 2032mm	PSF	PAINT	CMU	NONE	NONE	EXISTING DOOR TO REMAIN							

- DOOR SCHEDULE NOTES:**
1. REMOVE AND SALVAGE EXISTING LOCKSETS, CLOSURES, AND OPERATOR SYSTEMS UNLESS OTHERWISE NOTED. TURN OVER HARDWARE TO OWNER.
 2. EXISTING DOOR FRAME TO BE PREPARED ON LATCH SIDE BY ELECTRICAL CONTRACTOR FOR PROXIMITY CARD READER AND ELECTRIC STRIKE, WIREMOLD TO BE STUBBED FROM CEILING SPACE AND SURFACE MOUNTED DOWN ALONG DOOR FRAME.
 3. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL WIREMOLD TO SURFACE MOUNT MOUNTING BOX AT NEW PUSH BUTTON ACTUATORS; LOCATIONS AS PER DWG 1/A-3.0 AND 2/E-4.1.
 4. COORDINATE AUTOMATIC DOOR OPERATOR INSTALLATION WITH ELECTRICAL CONTRACTOR.
 6. NOTCH NEW FRAME AS REQUIRED TO RECEIVE ELECTRIC STRIKE.

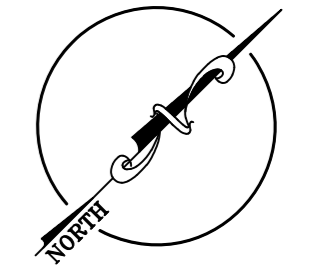
- HARDWARE GROUPS:**
1. HG1:
 - 1.1. NEW HORTON 7100 SERIES DOOR OPERATOR TO NEW AND EXISTING DOORS. OPERATOR TO BE INSTALLED ON THE PUSH SIDE OF THE DOOR.
 - 1.2. NEW AUTOMATIC DOOR CONTROL ITEMS BELOW BY CAMDEN DOOR CONTROLS, OR APPROVED ALTERNATE:
 - 1.3. (x2) NEW CM-7536/40 36" HARDWIRED LOW VOLTAGE WALL MOUNTED PUSH BUTTON ACTUATORS HAVING LONG ANODIZED ALUMINUM COLUMN PLATE W/ ENGRAVED BLUE FILLED HANDICAP GRAPHIC, 'PUSH TO OPEN' LETTERING, AND SHOE BUTTON LOCATIONS.
 - 1.4. (x2) CM-75SB SURFACE MOUNT BOXES FOR 36" COLUMN SWITCHES.
 - 1.5. (x1) NEW CX-33 ADVANCED LOGIC RELAY TO BE LOCATED INSIDE DOOR OPERATOR.
 - 1.6. (x1) NEW CX-MDA MAGNETIC CONTACT, SURFACE, SPST, WHITE
 - 1.7. NEW FLOOR MOUNTED HIGH RISE LOW PROFILE DOOR STOP
 - 1.8. NEW LOCKSET SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR
 - 1.9. (x3) NEW STANLEY HINGES FBB 179, 114x101, NRP
 - 1.10. (x1) NEW IVES 8400 COMMERCIAL PROTECTION PLATE, SATIN STAINLESS STEEL, BEVELED EDGES, B-CS
 - 1.11. **PROXIMITY CARD READER AND SURFACE MOUNTED ELECTRIC STRIKE BY MUN FORCES
 2. HG2:
 - 2.1. NEW FLOOR MOUNTED HIGH RISE LOW PROFILE DOOR STOP
 - 2.2. NEW LOCKSET SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR
 - 2.3. NEW FIRE RATED DOOR CLOSER TO PUSH SIDE, MODEL "4040XP" BY LCN, OR APPROVED ALTERNATE.
 - 2.4. (x3) NEW STANLEY HINGES FBB 179, 114x101, NRP
 - 2.5. (x1) NEW IVES 8400 COMMERCIAL PROTECTION PLATE, SATIN



DOOR ELEVATIONS (2) **A-4.0**
SCALE: 1:25



DOOR ELEVATIONS (1) **A-4.0**
SCALE: 1:25



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PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
DOOR SCHEDULE & ELEVATIONS

REVIEWED: M.F. DRAWN: E.B.

SCALE: AS SHOWN DATE: MARCH, 2024

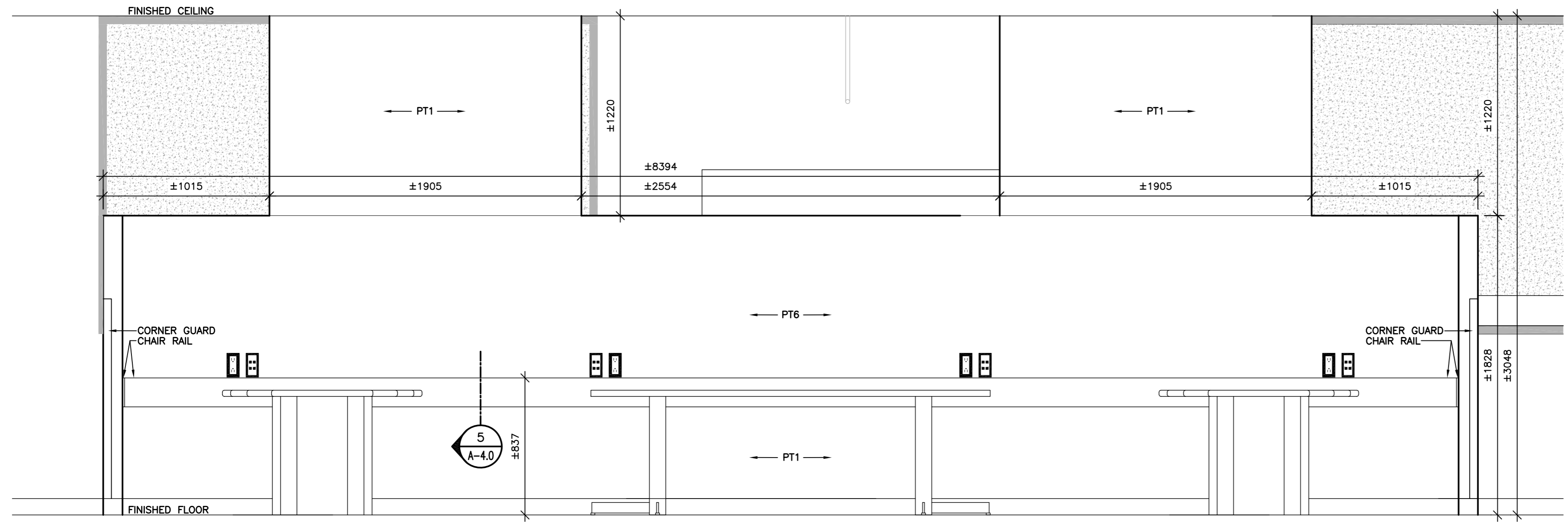
MUN PROJECT No. **EN-123-21** DRAWING No. **A-4.0**

DOOR SCHEDULE & NOTES
SCALE: NTS

No.	REVISION	DATE
R0	ISSUED FOR TENDER	MARCH 1, 2024

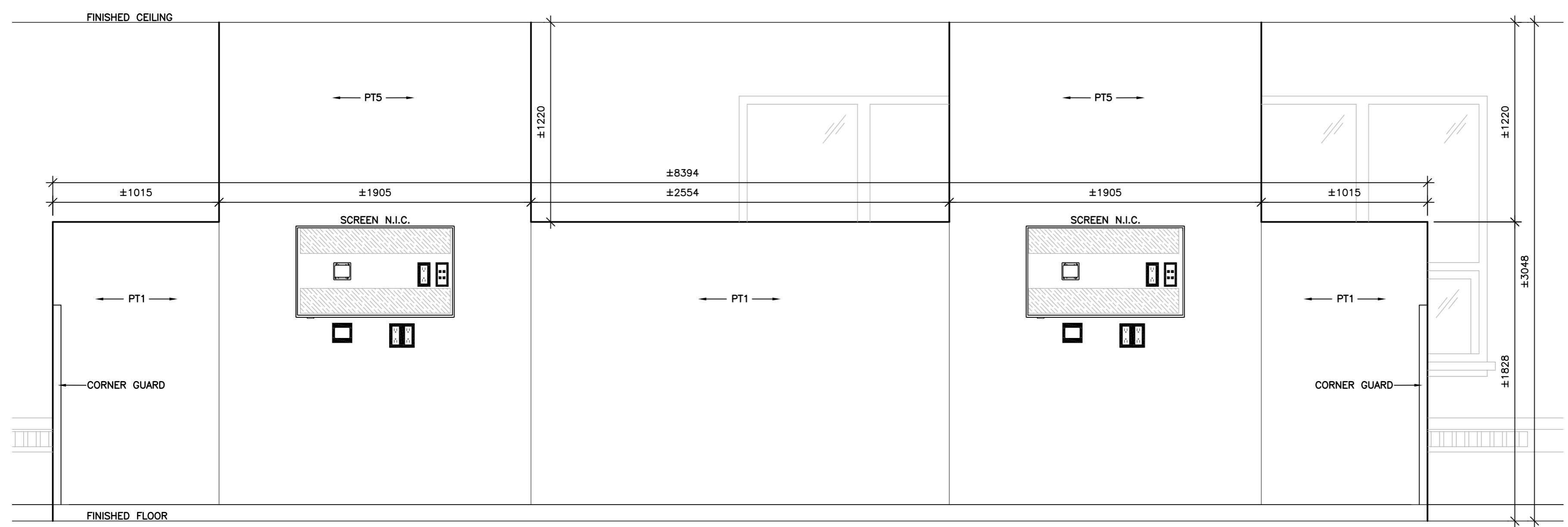
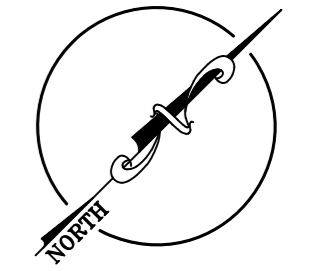
GENERAL NOTES

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2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF FACILITIES MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.



DEMOUNTABLE WALL – SOUTH ELEVATION
SCALE: 1:20

2
A-5.0



DEMOUNTABLE WALL – NORTH ELEVATION
SCALE: 1:20

1
A-5.0



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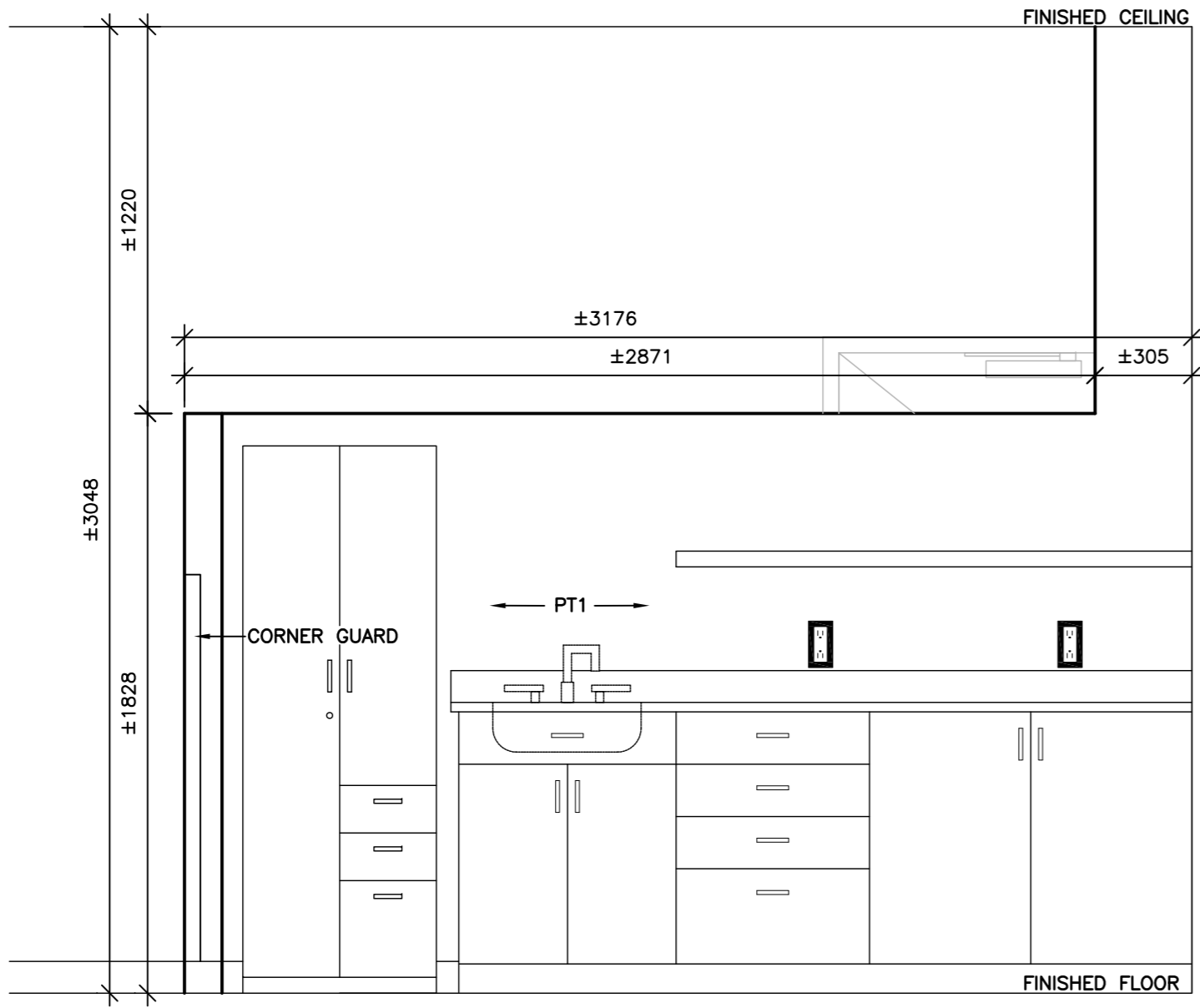
DRAWING TITLE:
INTERIOR ELEVATIONS

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. A-5.0

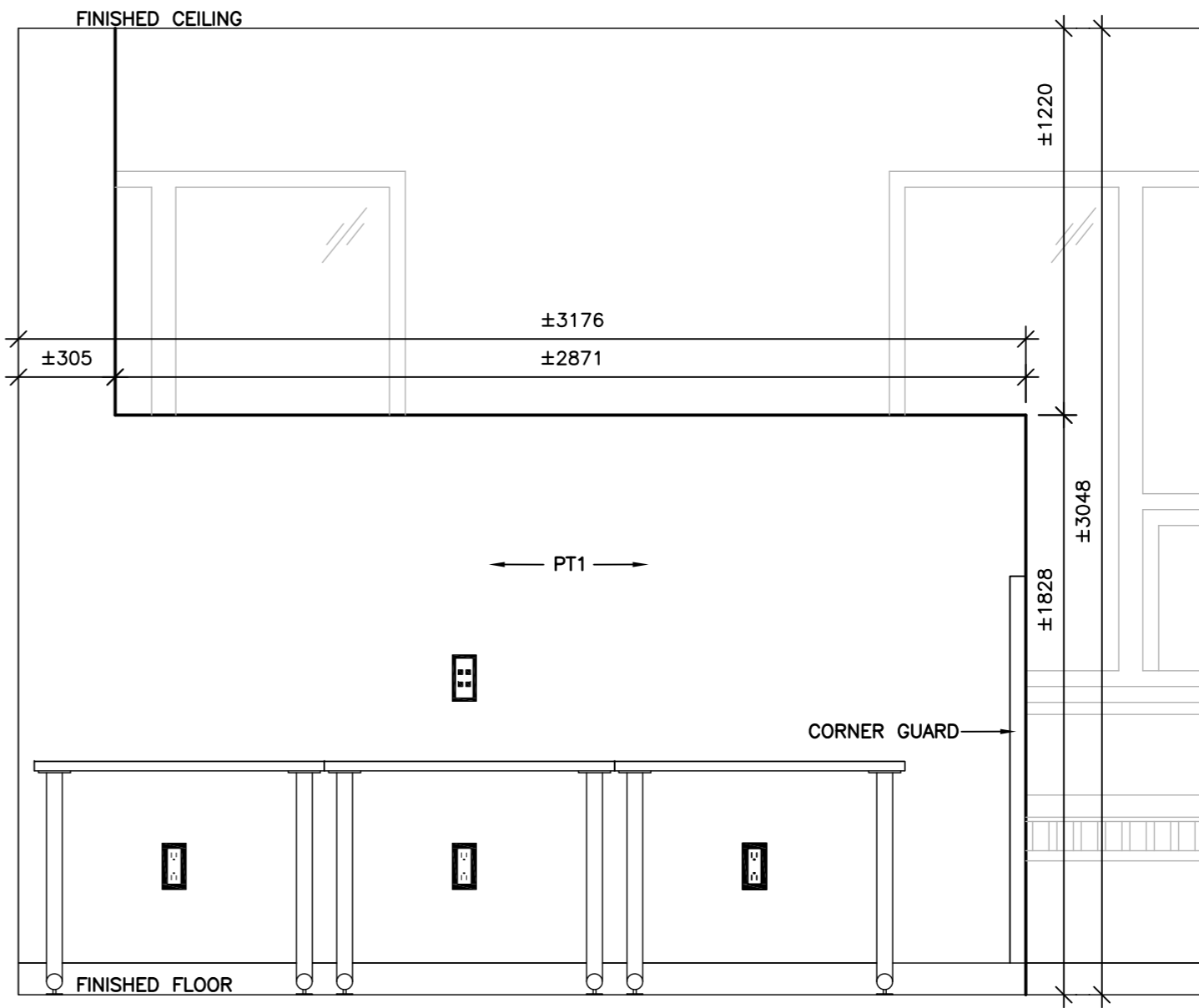
No.	REVISION	DATE
R0	ISSUED FOR TENDER	MARCH 1, 2024

GENERAL NOTES

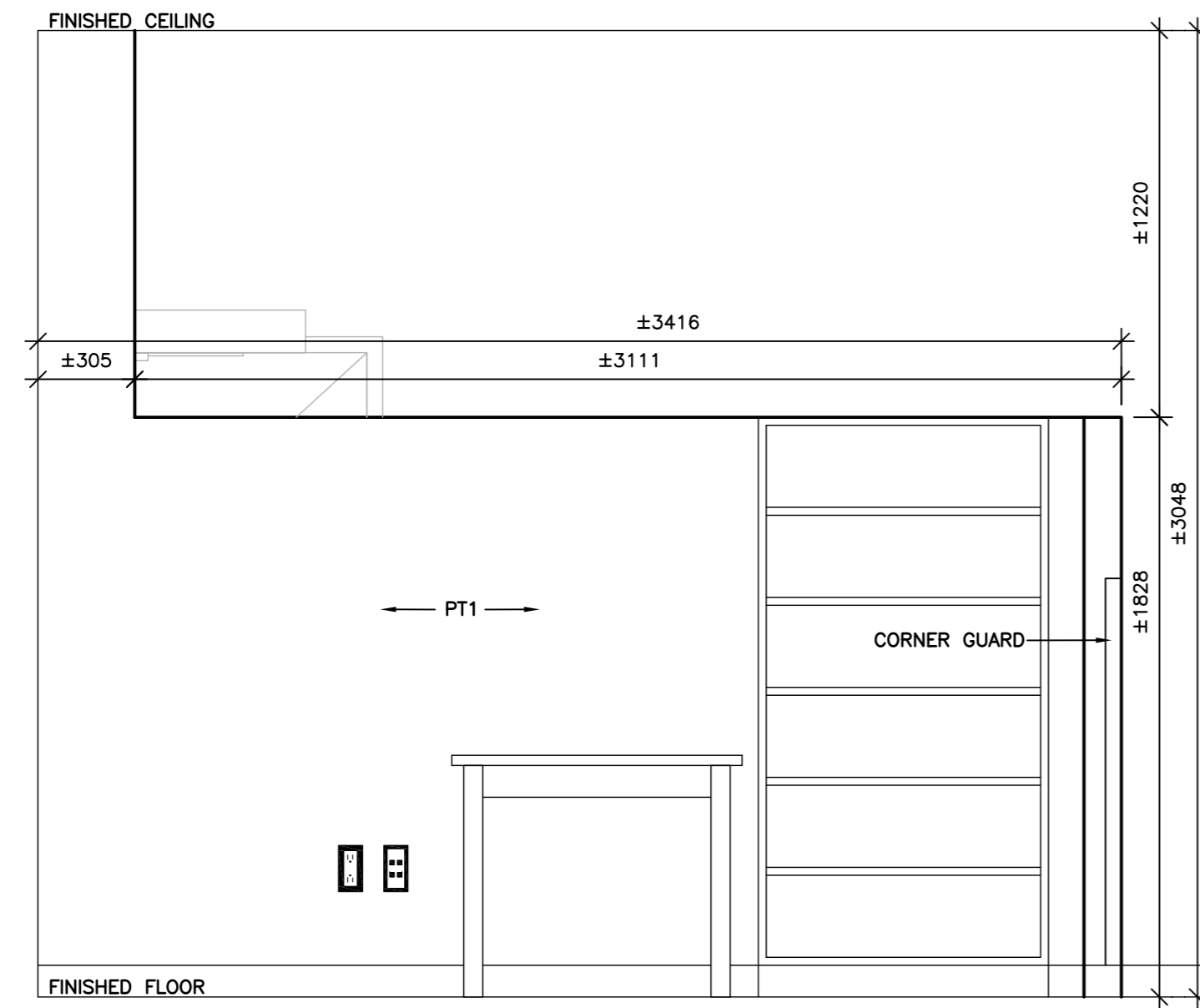
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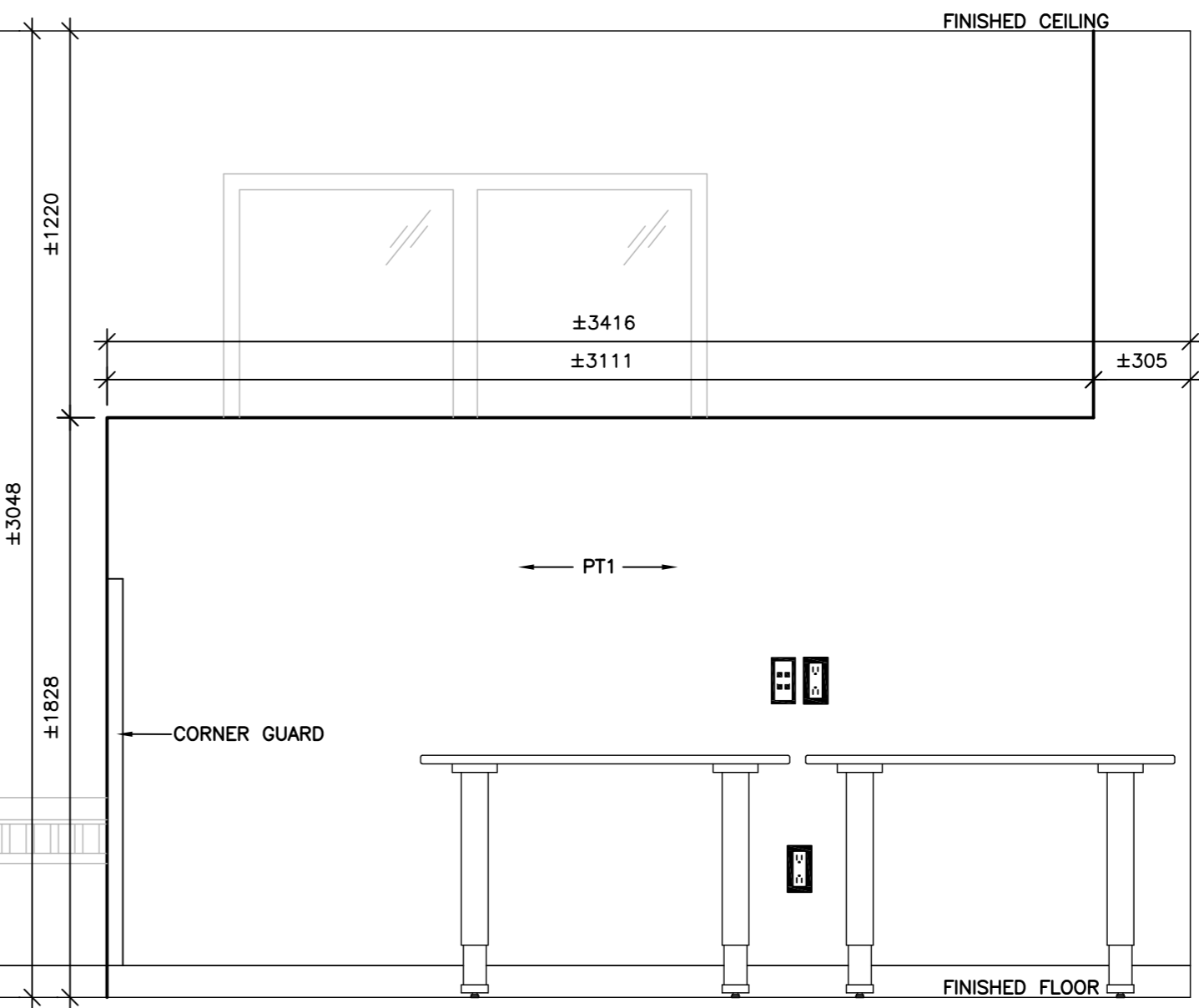
PARTITION WALL – KITCHENETTE – SOUTH ELEVATION
SCALE: 1:20 4
A-5.1



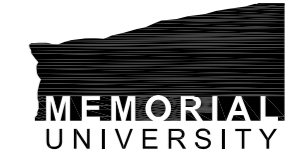
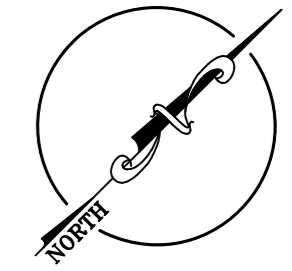
PARTITION WALL – KITCHENETTE – SOUTH ELEVATION
SCALE: 1:20 3
A-5.1



PARTITION WALL – PRINT AREA – SOUTH ELEVATION
SCALE: 1:20 2
A-5.1



PARTITION WALL – PRINT AREA – NORTH ELEVATION
SCALE: 1:20 1
A-5.1



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INTERIOR ELEVATIONS

REVIEWED: M.F. DRAWN: E.B.

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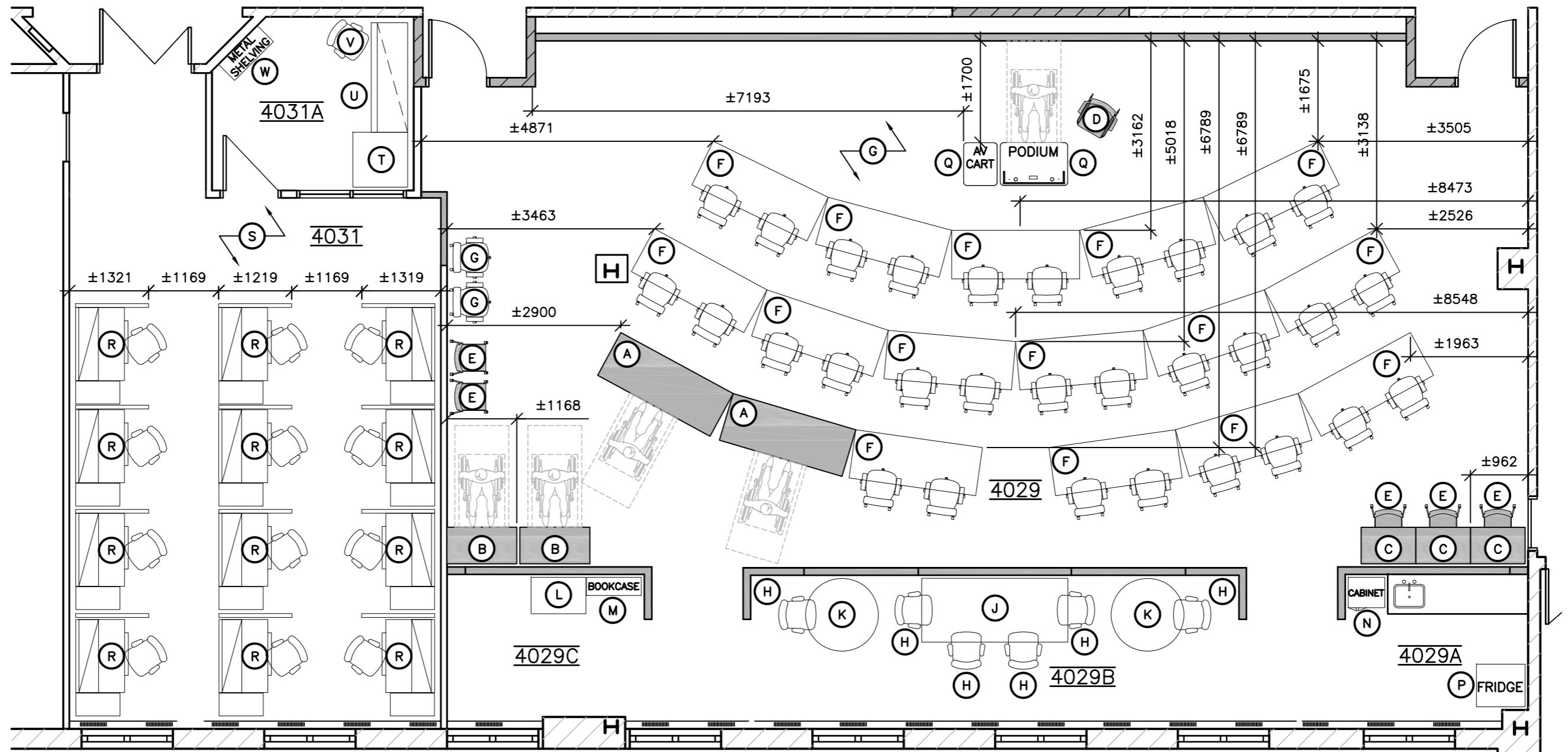
MUN PROJECT No. **EN-123-21** DRAWING No. **A-5.1**

FLOOR PLAN CONSTRUCTION NOTES: (#)

1. **NEW HEIGHT ADJUSTABLE TABLE (32x84"):** QUANTITY (X2) (A)
 - SUPPLY AND INSTALL NEW ELECTRIC HEIGHT ADJUSTABLE TABLE
 - TABLE TYPE AS NOTED BELOW, OR APPROVED ALTERNATE:
 - "HISPACE" BY TEKNION
 - "VICTORY LX 2-LEG" BY ESI
 - "ASCENT SIT-STAND DESK SERIES" BY WORKRITE
 - NEW TABLE TO HAVE THE FOLLOWING ITEMS:
 - HIGH PRESSURE LAMINATE TOP W/ MINIMUM 1-3/16" THICKNESS AND STRAIGHT EDGE TRIM
 - 48"Wx17"H LAMINATE MODESTY PANEL
 - EXTENDED RANGE ELECTRIC SWITCH FOR DESK HEIGHT POWER; RANGE BETWEEN 22.5-48.5" AFF
 - STANDARD FOOT WITH TWO (2) LOCKABLE CASTERS PER FOOT
 - ONE (1) LOCKABLE STOWAWAY DRAWER 5"Hx17"Wx17"D
 - BASE, TOP, AND MODESTY PANEL FINISH TO BE SELECTED FROM MANUFACTURER'S FULL COLOUR RANGE
 - NEW TABLE POWER TO HAVE THE FOLLOWING ITEMS:
 - MINIMUM 12" HORIZONTAL CABLE MANAGER MOUNTED TO UNDERSIDE OF TABLE TOP
 - MINIMUM 10' POWER CORD
 - VERTICAL MAGNETIC CABLE MANAGER MOUNTED AT UNDERSIDE OF TABLE TOP AND LEG ADJACENT TO POWER CONNECTION
 - VERTICAL CABLE MANAGER FINISH TO BE SELECTED FROM MANUFACTURER'S FULL COLOUR RANGE
2. **NEW HEIGHT ADJUSTABLE TABLE (24x46"):** QUANTITY (X2) (B)
 - SUPPLY AND INSTALL NEW ELECTRIC HEIGHT ADJUSTABLE TABLE
 - TABLE TYPE AS NOTED BELOW, OR APPROVED ALTERNATE:
 - "HISPACE" BY TEKNION
 - "VICTORY LX 2-LEG" BY ESI
 - "ASCENT SIT-STAND DESK SERIES" BY WORKRITE
 - NEW TABLE TO HAVE THE FOLLOWING ITEMS:
 - HIGH PRESSURE LAMINATE TOP W/ MINIMUM 1-3/16" THICKNESS AND STRAIGHT EDGE TRIM
 - EXTENDED RANGE ELECTRIC SWITCH FOR DESK HEIGHT POWER; RANGE BETWEEN 22.5-48.5" AFF
 - STANDARD FOOT WITH TWO (2) LEVELERS PER FOOT C/W FLOOR MOUNTED BRACKETS
 - BASE AND TOP FINISH TO BE SELECTED FROM MANUFACTURER'S FULL COLOUR RANGE
 - NEW TABLE POWER TO HAVE THE FOLLOWING ITEMS:
 - MINIMUM 12" HORIZONTAL CABLE MANAGER MOUNTED TO UNDERSIDE OF TABLE TOP
 - MINIMUM 10' POWER CORD
 - VERTICAL MAGNETIC CABLE MANAGER MOUNTED AT UNDERSIDE OF TABLE TOP AND LEG ADJACENT TO POWER CONNECTION
 - VERTICAL CABLE MANAGER FINISH TO BE SELECTED FROM MANUFACTURER'S FULL COLOUR RANGE
3. **NEW TABLE (24x36"):** QUANTITY (X3) (C)
 - SUPPLY AND INSTALL NEW TRAINING TABLE
 - TABLE TYPE AS NOTED BELOW, OR APPROVED ALTERNATE:
 - "EXPANSION TRAINING TABLE" BY TEKNION
 - "JIVE TRAINING TABLE" BY HAWORTH
 - NEW TABLE TO HAVE THE FOLLOWING ITEMS:
 - HIGH PRESSURE LAMINATE TOP W/ MINIMUM 1-3/16" THICKNESS AND STRAIGHT EDGE TRIM
 - STANDARD FIXED LEG WITH TWO (2) LEVELERS PER FOOT
 - CENTER GROMMET
 - LEG AND TOP FINISH TO BE SELECTED FROM MANUFACTURER'S FULL COLOUR RANGE
4. **NEW MEDIUM BACK HEIGHT ADJUSTABLE STOOL:** QUANTITY (X1) (D)
 - SUPPLY AND INSTALL NEW MEDIUM BACK HEIGHT ADJUSTABLE STOOL WITH ARMS
 - STOOL TYPE AS NOTED BELOW:
 - "PRESTO TASK STOOL" BY ALLSEATING
 - "GRANADA OPERATOR STOOL" BY GLOBAL
 - "IMPROV H.E. STOOL" BY HAWORTH
 - NEW STOOL TO HAVE THE FOLLOWING ITEMS:
 - UPHOLSTERED BACK AND SEAT
 - UPHOLSTERED SEAT SELECTION TO BE MINIMUM 100,000 DOUBLE RUBS, SUPPLIER MUST PRESENT MINIMUM OF SEVEN (7) SELECTIONS OF DIFFERENT PATTERNS
 - FRAME FINISH TO BE SELECTED FROM MANUFACTURER'S FULL FINISH RANGE
 - SYNCHRO-TILT
 - ADJUSTABLE T-ARM
 - DUEL SURFACE CASTERS
 - HIGH CYLINDER WITH 5.5" TRAVEL
 - ADJUSTABLE LUMBAR, BACK, AND SEAT SLIDER
 - EDGE GUARD VINYL BUMPER GUARD AT SEAMS
 - CHROME FOOT RING

5. **NEW STACKABLE GUEST CHAIR W/ CASTERS:** QUANTITY (X5) (E)
 - SUPPLY AND INSTALL NEW STACKABLE GUEST CHAIR W/ CASTERS
 - CHAIR TYPE AS NOTED BELOW, OR APPROVED ALTERNATE:
 - "TUCK GUEST" BY ALLSEATING
 - "STREAM" BY GLOBAL
 - "VERY SIDE AND SEMINAR" BY HAWORTH
 - NEW CHAIR TO HAVE THE FOLLOWING ITEMS:
 - UPHOLSTERED BACK AND SEAT
 - UPHOLSTERED SEAT SELECTION TO BE MINIMUM 100,000 DOUBLE RUBS, SUPPLIER MUST PRESENT MINIMUM OF SEVEN (7) SELECTIONS OF DIFFERENT PATTERNS
 - FRAME FINISH TO BE SELECTED FROM MANUFACTURER'S FULL FINISH RANGE
 - ARMS
 - DUEL SURFACE CASTERS
6. **EXISTING DRAFTING TABLES (32x84"):** QUANTITY (X15) (F)
 - EXISTING TABLES AS PER DWG 1/A-3.2
7. **EXISTING DRAFTING CHAIRS:** QUANTITY (X32) (G)
 - EXISTING CHAIRS AS PER DWG 1/A-3.2
8. **EXISTING COMPUTER CHAIRS:** QUANTITY (X6) (H)
 - EXISTING CHAIRS AS PER DWG 1/A-3.2
9. **EXISTING TABLE (42x96"):** QUANTITY (X1) (J)
 - EXISTING TABLE AS PER DWG 1/A-3.2
10. **EXISTING ROUND TABLE (48"Ø):** QUANTITY (X1) (K)
 - EXISTING TABLES AS PER DWG 1/A-3.2
11. **EXISTING TABLE (24x36"):** QUANTITY (X1) (L)
 - EXISTING TABLE AS PER DWG 1/A-3.2
12. **EXISTING BOOKCASE (12x36"):** QUANTITY (X1) (M)
 - EXISTING BOOKCASE AS PER DWG 1/A-3.2
13. **EXISTING CABINET (24x20"):** QUANTITY (X1) (N)
 - EXISTING CABINET AS PER DWG 1/A-3.2

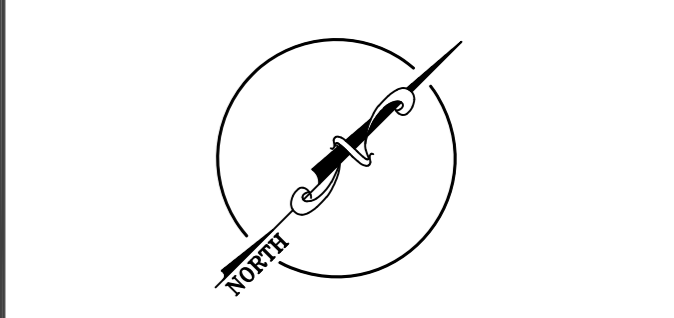
14. **EXISTING FRIDGE (28x32"):** QUANTITY (X1) (P)
 - EXISTING FRIDGE AS PER DWG 1/A-3.2
15. **INSTRUCTORS PODIUM AND AV CART:** (Q)
 - INSTRUCTORS PODIUM AND AV CART SHOWN FOR REFERENCE ONLY. NOT IN CONTRACT.
15. **EXISTING GRAD STUDENT WORKSTATIONS:** QUANTITY (X12) (R)
 - EXISTING GRAD STUDENT WORKSTATIONS AS PER DWG 1/A-3.2
16. **EXISTING COMPUTER CHAIRS:** QUANTITY (X12) (S)
 - EXISTING CHAIRS AS PER DWG 1/A-3.2
17. **EXISTING TABLE (24x36"):** QUANTITY (X1) (T)
 - EXISTING TABLE AS PER DWG 1/A-3.2
18. **EXISTING WORKSTATION:** QUANTITY (X1) (U)
 - EXISTING CHAIRS AS PER DWG 1/A-3.2
19. **EXISTING COMPUTER CHAIR:** QUANTITY (X1) (V)
 - EXISTING CHAIR AS PER DWG 1/A-3.2
20. **EXISTING METAL SHELVING (15x36"):** QUANTITY (X1) (W)
 - EXISTING METAL SHELVING AS PER DWG 1/A-3.2



NEW FURNITURE PLAN
SCALE: 1:75

No.	REVISION	DATE
R0	ISSUED FOR TENDER	MARCH 1, 2024

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PROJECT NAME:

ENGINEERING BUILDING RENOVATIONS TO EN-4029
Project #: EN-123-21

DRAWING TITLE:

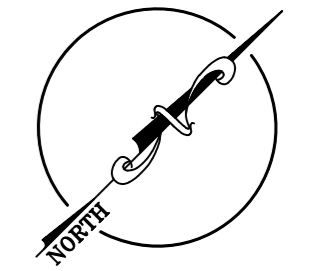
NEW FURNITURE PLAN

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. F-0

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

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 Project #: EN-123-21

DRAWING TITLE:
ELECTRICAL SYMBOL LEGEND

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. E-0

GENERAL ELECTRICAL NOTES (ALL SHEETS):

- ALL ELECTRICAL ISOLATIONS SHALL BE PERFORMED IN ACCORDANCE WITH MUN ZERO ENERGY ISOLATION PROGRAM (ZEIP). ELECTRICAL CONTRACTORS ARE REQUIRED TO HAVE COMPLETED MUN ZEIP TRAINING PRIOR TO PERFORMING ELECTRICAL WORK.
- CONTRACTORS SHALL PROVIDE ADVANCED NOTICE TO THE PROJECT COORDINATOR TO COORDINATE DE-ENERGIZING & RE-ENERGIZING OF ELECTRICAL EQUIPMENT WITH MUN ELECTRICAL SHOP. 48Hrs NOTICE FOR CIRCUIT BREAKERS. 72Hrs NOTICE FOR PANELS.
- BOTH THE ELECTRICAL CONTRACTOR AND MUN ELECTRICAL SHALL BE PRESENT TO PERFORM LOCK OUT / TAG OUT AND VERIFY ZERO ENERGY STATE BEFORE WORK BEGINS. ENERGIZED ELECTRICAL WORK IS STRICTLY PROHIBITED.
- PERFORM DEMOLITION WORK SHOWN AND/OR REQUIRED TO COMPLETE THE WORK. DO NOT ASSUME DEMOLITION DRAWINGS SHOW THE FULL EXTENT OF DEMOLITION WORK REQUIRED.
- ELECTRICAL CONTRACTOR MUST REFER TO ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR EXTENT OF WORK AND COORDINATE OTHER TRADES AND GENERAL CONTRACTOR PRIOR TO THE COMMENCEMENT OF ANY WORK.
- REVIEW DEMOLITION PLAN IN CONJUNCTION WITH ALL OTHER PLANS AND DETAILS. FURTHER DEMOLITION REQUIRED FOR NEW MECHANICAL AND ELECTRICAL CAN BE DETERMINED BASED ON NEW FLOOR PLAN LAYOUT AND SITE CONDITIONS. CHECK SITE DIMENSIONS AND CONDITIONS AND REPORT UNACCEPTABLE CONDITIONS TO PROJECT COORDINATOR FOR REMEDIAL INSTRUCTIONS PRIOR TO PROCEEDING WITH THE WORK.
- ALL CIRCUIT BREAKER/PANEL SHUTDOWNS WILL REQUIRE MUN ELECTRICIAN PRESENT TO PROVIDE LOCK OUT/TAG OUT. CONTRACTOR SHALL CONTACT PROJECT COORDINATOR 48hrs IN ADVANCE TO SCHEDULE MUN ELECTRICIAN. LIVE ELECTRICAL WORK IS NOT PERMITTED. CONTRACTOR TO VERIFY ELECTRICAL CIRCUITS PRIOR TO START OF WORK.
- ALL DATA DROPS NOTED TO BE REMOVED SHALL BE DISCONNECTED BY MUN FORCES PRIOR TO DEMOLITION WORK BY ELECTRICAL SUB-TRADE. CONTRACTOR SHALL CONTACT PROJECT COORDINATOR 48hrs IN ADVANCE TO NOTIFY/SCHEDULE DATA DROP DISCONNECTION. DO NOT CUT, OR DISCONNECT DATA CABLES.
- REMOVE ALL WIRING BACK AND CONDUIT BACK TO NEAREST JUNCTION BOXES FOR RECEPTACLES, SWITCHES, ETC. THAT ARE INDICATED TO BE REMOVED, OR RELOCATED.
- ELECTRICAL CONTRACTOR IS RESPONSIBLE TO VERIFY INDICATED CIRCUITS AND TRACE OUT ANY UNKNOWN POWER AND LIGHTING CIRCUITS PRIOR TO START OF WORK.
- REUSE EXISTING POWER AND LIGHTING CIRCUITS AS INDICATED. RE-ROUTE, EXTEND, OR MODIFY POWER FEEDS AS REQUIRED TO FACILITATE ALL NEW LOCATIONS OF LIGHT FIXTURES, ILLUMINATED EXIT SIGNS, LINE VOLTAGE DIMMER SWITCHES, AND LOW VOLTAGE SWITCHES.
- REUSE EXISTING POWER CIRCUITS AND RELAY CIRCUITS TO ENSURE SEPERATE LIGHT SWITCHING CONTROL IN INDIVIDUAL ROOMS, OR MULTIPLE SWITCHING CONTROL AS INDICATED.
- CONTRACTOR TO ENSURE THAT ALL EXISTING, OR NEW CONDUIT PENETRATIONS THROUGH THE FLOOR AND WALLS ARE APPROPRIATELY FIRE STOPPED.
- SUPPLY AND INSTALL NEW STAINLESS STEEL TYPE COVER PLATES THROUGHOUT FOR ALL NEW AND EXISTING RECEPTACLES, SWITCHES, AND JUNCTION BOXES.

VARIOUS ELECTRICAL SYMBOLS

	NEW TELEPHONE OUTLET
	EXISTING OBSOLETE DATA OUTLET
	NEW DATA OUTLET
	EXISTING DATA AND POWER RECESSED IN WIREMOLD
	GANGED SWITCH - LETTERS DENOTE FIXTURES CONTROLLED
	3-WAY TOGGLE SWITCH - LETTER DENOTES FIXTURE CONTROLLED
	SINGLE POLE TOGGLE SWITCH - LETTER DENOTES FIXTURE CONTROLLED
	347V SINGLE POLE TOGGLE SWITCH - LETTER DENOTES FIXTURE CONTROLLED
	15amp DUPLEX CONVENIENCE RECEPTACLE
	15amp ISOLATED GROUND RECEPTACLE
	DUPLEX RECEPTACLE MOUNTED 175mm ABOVE SPLASHBACK
	SPLIT DUPLEX RECEPTACLE @ 175mm ABOVE SPLASHBACK
	SPLIT DUPLEX RECEPTACLE MOUNTED IN COUNTER
	DUPLEX RECEPTACLE - TOP SWITCHED
	SIMPLEX RECEPTACLE, CSA CONFIG AS INDICATED
	FLOOR RECEPTACLE
	3-POLE RECEPTACLE
	2-POLE RECEPTACLE
	POWER POLE EQUAL TO WIREMOLD MODEL AMDTP TELE-POLE LENGTH AS REQUIRED C/W ALL REQ'D MOUNTING HARDWARE
	120V QUADPLEX RECEPTACLE MOUNTED IN CEILING SPACE
	120V DUPLEX RECEPTACLE MOUNTED IN CEILING SPACE
	15 AMP, 120V DUPLEX CONVENIENCE RECEPTACLE MOUNTED 152mm BELOW FINISHED CEILING.
	FIRE RATED 4" FLOOR BOX
	FIRE RATED 10" FLOOR BOX
	DIRECT CONNECTION TO ELECTRICAL EQUIPMENT
	TWIST LOCK RECEPTACLE
	DIRECT CONNECTION TO ARCHITECTURAL EQUIPMENT
	DIRECT CONNECTION TO OWNER SUPPLIED EQUIPMENT
	JUNCTION OR OUTLET BOX
	RECESSED MOUNTED POWER PANEL
	SURFACE MOUNTED POWER PANEL
	SINGLE FACE CLOCK
	DOUBLE FACED CLOCK
	WALL MOUNTED CLOCK
	CEILING MOUNTED CLOCK

LIGHTING

	TRACK LIGHTING LUMINAIRE TYPE 'f'		INCANDESCENT OR HID LUMINAIRE TYPE 'c', WALL MOUNTED		EMERGENCY LIGHTING BATTERY UNIT 2 HEADS C/W A/C & DC OUTLETS
	NEW FLUORESCENT LUMINAIRE, LETTERS DENOTES TYPE 'f' AS SCHEDULED CONNECTED TO PANEL 'a', CIRCUIT No. 1		INCANDESCENT OR FLUORESCENT LUMINAIRE TYPE 'd', RECESSED IN CEILING		EMERGENCY LIGHTING HARDWIRED UNIT 2 HEADS
	NEW FLUORESCENT LUMINAIRE, TYPE 'b' WALL MOUNTED AS SCHEDULED		EXIT LIGHTING LUMINAIRE, ARROW INDICATES DIRECTION OF EXIT		REMOTE EMERGENCY LUMINAIRE HEADS
			EXTERIOR POLE MOUNTED LUMINAIRE TYPE 'e' AS SCHEDULED		

LIST OF SUBSCRIPTS

a	LOWER CASE LETTERS INDICATE SWITCHING ARRANGEMENT
LV	INDICATES LOW VOLTAGE
3	INDICATES 3-WAY
4	INDICATES 4-WAY
D	INDICATES DIMMER
DF	INDICATES FLUORESCENT DIMMER
WP	INDICATES WEATHER PROOF
EM	INDICATES EMERGENCY POWER SUPPLY
W	INDICATES WALL MOUNTED
P	INDICATES PEDESTAL MOUNTED
N	INDICATES NEW DEVICE
C	INDICATES CEILING MOUNTED
E	INDICATES EXISTING TO REMAIN
ER	INDICATES EXISTING TO BE REMOVED
RL	INDICATES EXISTING TO BE RELOCATED
NL	INDICATES EXISTING IN NEW LOCATION
SM	INDICATES SURFACE MOUNTED

HEATING

	ELECTRIC HEATING UNIT TYPE 'a' 1000 WATTS CONNECTED TO PANEL 'b' CIRCUIT No. 2(4) - C/W BUILT IN THERMOSTAT
	BLANK HEATER SECTION OR FILLER PIECE TO MATCH HEATER AS SPECIFIED
	DUCT HEATING COIL WIRED BY DIV. 16 ONLY
	PNEUMATIC THERMOSTAT
	LOW VOLTAGE THERMOSTAT
	HEATING AND COOLING THERMOSTAT

SECURITY SYSTEM AND DOOR CONTROL

	ELECTRIC DOOR STRIKE
	CARD READER
	SECURITY SYSTEM MOTION DETECTOR
	SECURITY SYSTEM MOTION DETECTOR (WALL MOUNTED)
	SECURITY SYSTEM ALARM BELL
	SECURITY SYSTEM DOOR CONTACT
	SECURITY SYSTEM KEYPAD
	CCTV CAMERA
	ALARM HORN

FIRE ALARM

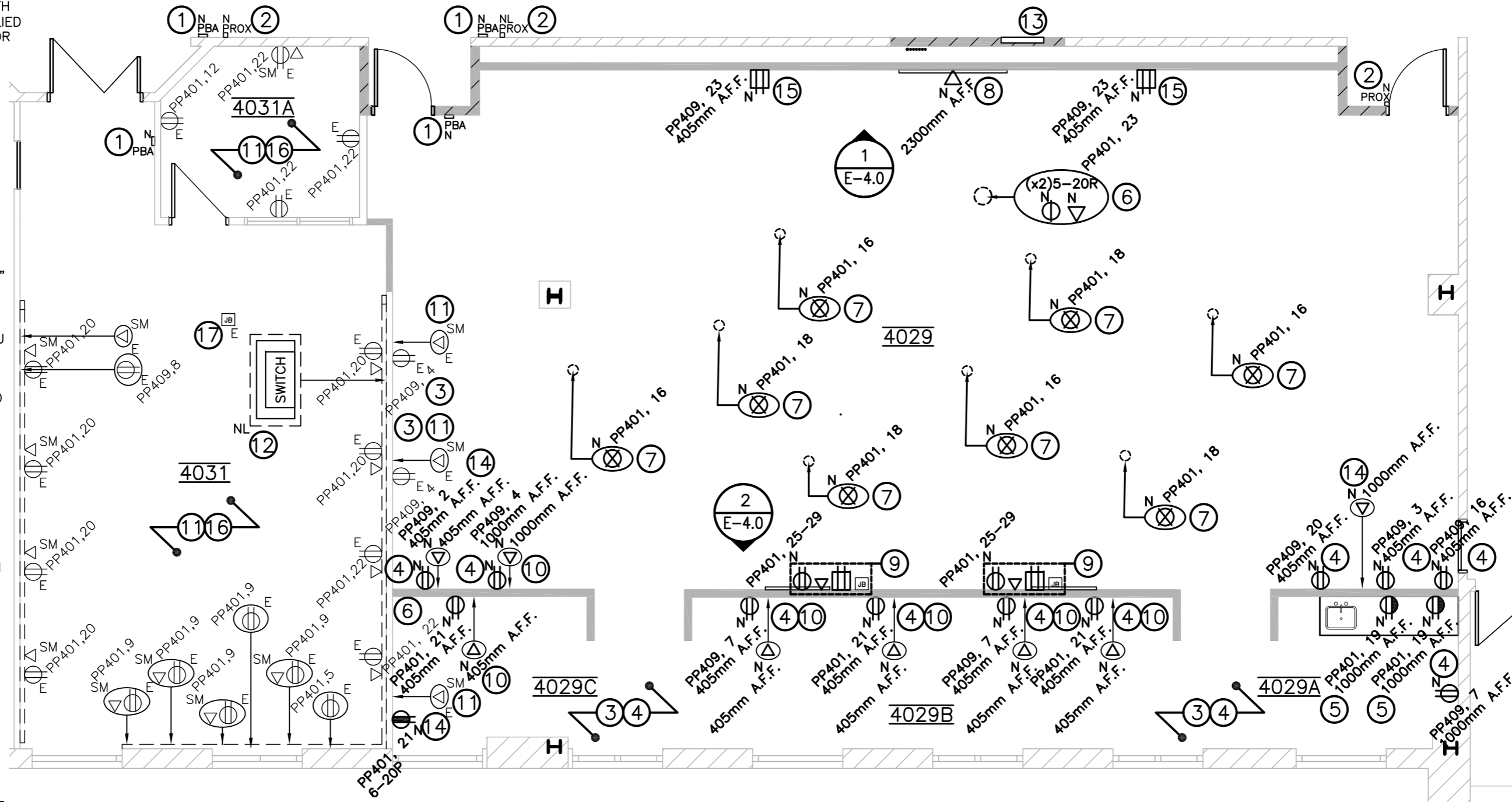
	MANUAL FIRE ALARM PULL STATION
	HEAT DETECTOR
	FIRE ALARM SIGNAL BELL
	FIRE ALARM SIGNAL HORN
	FIRE ALARM SIGNAL CHIME
	END OF LINE RESISTOR
	SMOKE DETECTOR
	DUCT TYPE SMOKE DETECTOR
	SMOKE ALARM
	CONNECTION TO SPRINKLER SYSTEM WET ALARM VALVE
	STROBE LIGHT WALL MOUNTED
	STROBE LIGHT CEILING MOUNTED
	CONNECTION TO MAGNETIC DOOR LOCK
	CONNECTION TO MAGNETIC DOOR HOLDER
	FIRE EXTINGUISHER

ELECTRICAL NEW NOTES: [#]

- SUPPLY AND INSTALL PUSH BUTTON ACTUATORS FOR AUTOMATIC DOOR CONTROL. SEE DWG 2/E-4.1 AND SPECIFICATIONS. COORDINATE PUSH BUTTON ACTUATOR INSTALLATION WITH GENERAL CONTRACTOR. HARDWARE SUPPLIED BY GENERAL CONTRACTOR, WIRING SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR. HARDWARE AND LOW VOLTAGE WIRING FOR ACTUATORS SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR.
- INSTALL 800 SERIES WIREMOLD FROM DOOR FRAME, OR MOUNTING BOX TO SITE CONTROLLER FOR PROX ROUGH-IN. CORE MOUNTING BOX AS REQUIRED. WIRING BY MUN FORCES.
- INSTALL NEW DUPLEX RECEPTACLE AT EXISTING DEVICE BOX.
- INSTALL NEW DUPLEX RECEPTACLE W/ NEW RECESSED DEVICE BOX. PROVIDE 19mmØ POWER CONDUIT IN WALL AND RUN BACK TO PANEL.
- INSTALL NEW GFCI RECEPTACLE W/ NEW RECESSED DEVICE BOX. PROVIDE 19mmØ POWER CONDUIT IN WALL AND RUN BACK TO PANEL.
- INSTALL NEW FIRE RATED FLOOR BOX TO PROVIDE POWER TO HEIGHT ADJUSTABLE INSTRUCTOR'S PODIUM AND MEDIA RACK. NEW DEVICE TO BE 'LEGRAND EVOLUTION 10" POKE-THRU DEVICE'. MODEL 10ATCP5N AS SHOWN IN DWG 3/E-4.1. NO SUBSTITUTIONS WILL BE ACCEPTED FOR THIS DEVICE. PROVIDE ALL ACCESSORIES AND CONDUIT FEEDS REQUIRED FOR FLOOR BOX INSTALLATION. INSTALL NEW 2-20AMP SINGLE POLE TANDEM BREAKER IN PANEL TO FACILITATE INSTALLATION OF POKE-THRU DEVICE. INSTALL NEW WIRING AS REQUIRED BACK TO PANEL. WESTINGHOUSE TYPE PANEL. INSTALL NEW CONDUIT AND JUNCTION BOX AS REQUIRED.
- INSTALL NEW FIRE RATED FLOOR BOX TO PROVIDE POWER TO TABLES. NEW DEVICE TO BE 'LEGRAND EVOLUTION 4" POKE-THRU DEVICE', OR APPROVED ALTERNATE. MODEL 4ATCP4RGY AS SHOWN ON DWG 1/E-4.1. PROVIDE ALL ACCESSORIES AND CONDUIT FEEDS REQUIRED FOR FLOOR BOX INSTALLATION. INSTALL NEW 20AMP BREAKER IN BLANK CIRCUIT LOCATION #38 IN PANEL EN-PP-409 TO FACILITATE INSTALLATION OF POKE-THRU DEVICE. INSTALL NEW WIRING AS REQUIRED BACK TO PANEL. WESTINGHOUSE TYPE PANEL. INSTALL NEW CONDUIT AND JUNCTION BOX AS REQUIRED.
- INSTALL NEW 25mmØ CONDUIT TO NEW HUBBELL CAMERA MOUNT AS SHOWN ON DWG 1/E-4.0.
- NEW POWER AND DATA FOR FOR SCREEN DISPLAY. DATA TO BE STUBBED TO COMMON JUNCTION BOX LOCATED IN CEILING ABOVE.
- NEW FOUR PORT MUN DATA DROP (CAT 6 CABLE). BOXES, CONDUIT, AND ROUGH IN BY CONTRACTOR. CABLING BY MUN FORCES. ALL DATA CONDUIT TO BE STUBBED 150mm ABOVE ACCESSIBLE CEILING SPACE.
- EXISTING DATA TO REMAIN.
- POWER AND DATA FOR EXISTING SERVER SWITCH TO BE DISCONNECTED AND RELOCATED BY MUN FORCES.
- RELOCATE ELECTRICAL PANEL EN-PP-409 TO NEW LOCATION AS INDICATED. PROVIDE ALL REQUIRED JUNCTION BOXES, CONDUIT, AND WIRING TO FACILITATE RELOCATION OF PANEL.
- INSTALL NEW 19mmØ POWER CONDUIT W/ NEW RECESSED DEVICE BOX AND FISH LINE RUN BACK TO PANEL. BLANK PLATE DEVICE BOX.
- INSTALL NEW SPLIT QUADPLEX RECEPTACLE W/ NEW RECESSED DEVICE BOX. PROVIDE NEW 19mmØ POWER CONDUIT IN WALL AND RUN BACK TO PANEL.
- EXISTING POWER TO REMAIN.
- REINSTATE POWER TO GRAD STUDENT WORK STATIONS.
- SEE DWG 2/A-0.1 FOR PANEL LOCATIONS.
- COORDINATE EXACT LOCATIONS ON SITE WITH GENERAL CONTRACTOR, FURNITURE SUPPLIER AND PROJECT COORDINATOR.

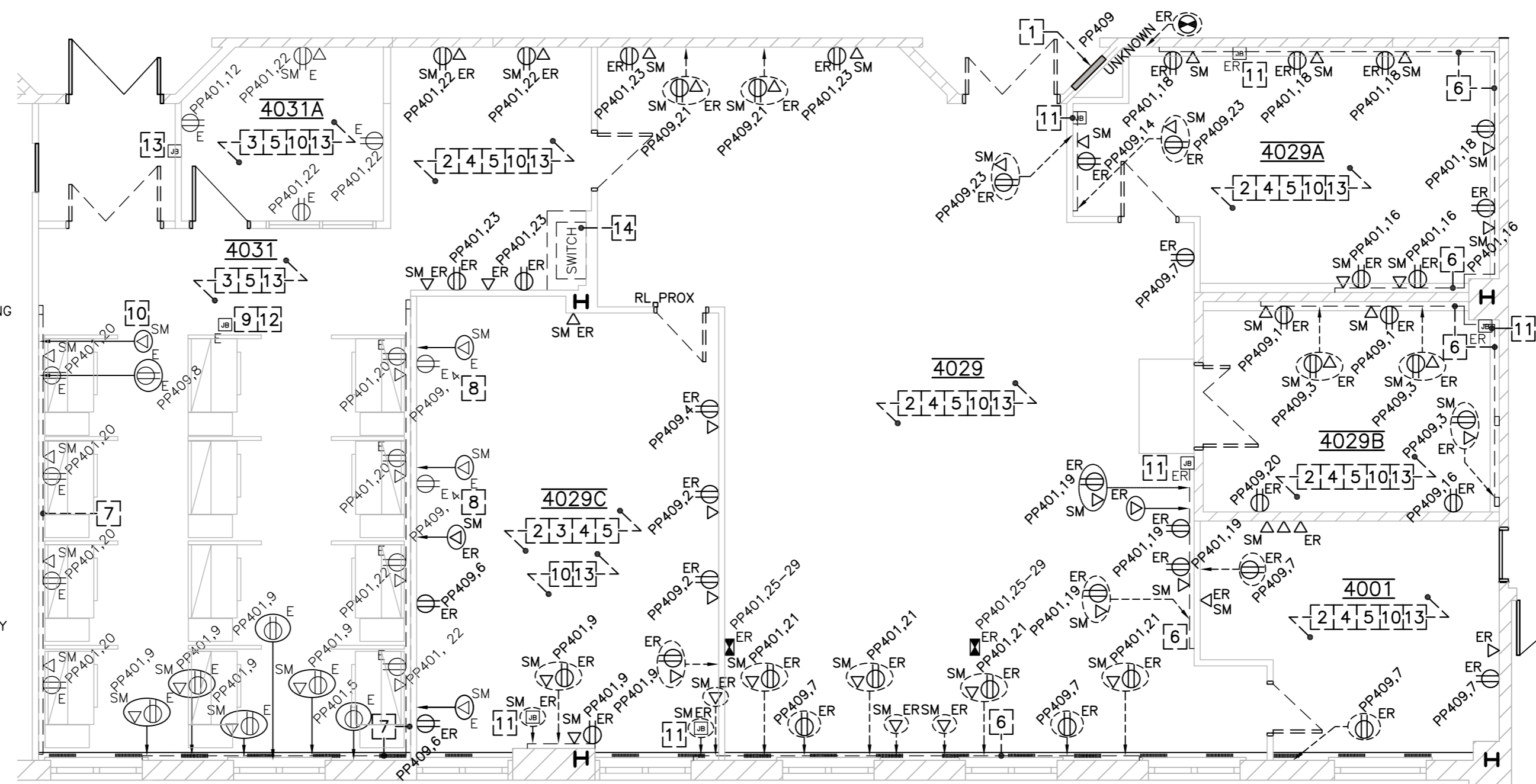
ELECTRICAL DEMOLITION NOTES: [#]

- DISCONNECT ALL POWER FED FROM ELECTRICAL PANEL EN-PP-409. PULL BACK WIRING TO NEAREST JUNCTION BOX ABOVE CEILING.
- DISCONNECT EXISTING POWER THROUGHOUT AS INDICATED. PULL BACK WIRING TO NEAREST JUNCTION BOX ABOVE CEILING.
- EXISTING POWER TO REMAIN AS INDICATED.
- DATA CABLING TO BE DISCONNECTED AND REMOVED BY MUN FORCES AS INDICATED.
- EXISTING DATA TO REMAIN AS INDICATED.
- REMOVE AND DISPOSE OF EXISTING WIREMOLD.
- EXISTING WIREMOLD TO REMAIN AS INDICATED.
- REMOVE EXISTING RECEPTACLES AND FACE PLATES. WIRING TO REMAIN.
- DISCONNECT EXISTING POWER TO GRAD STUDENT WORK STATIONS. PULL BACK WIRING TO NEAREST JUNCTION BOX.
- REMOVE OBSOLETE DATA DROP. DATA CABLING TO BE DISCONNECTED AND REMOVED BY MUN FORCES.
- REMOVE JUNCTION BOX, BX CABLING AS INDICATED. PULL BACK WIRING TO NEAREST JUNCTION BOX ABOVE CEILING.
- EXISTING JUNCTION BOX TO REMAIN.
- INSTALL BLANK PLATE TO EXPOSED JUNCTION BOX, DEVICE BOX, OR DATA DROP.
- POWER AND DATA FOR EXISTING SERVER SWITCH TO BE DISCONNECTED AND RELOCATED BY MUN FORCES.
- ELECTRICAL CONTRACTOR IS RESPONSIBLE TO TRACE ALL UNKNOWN CIRCUITS PRIOR TO DISCONNECTION.



NEW ELECTRICAL FLOOR PLAN

SCALE: 1:75



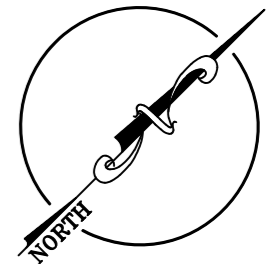
DEMOLITION ELECTRICAL FLOOR PLAN

SCALE: 1:75

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

GENERAL NOTES

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- ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF FACILITIES MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.



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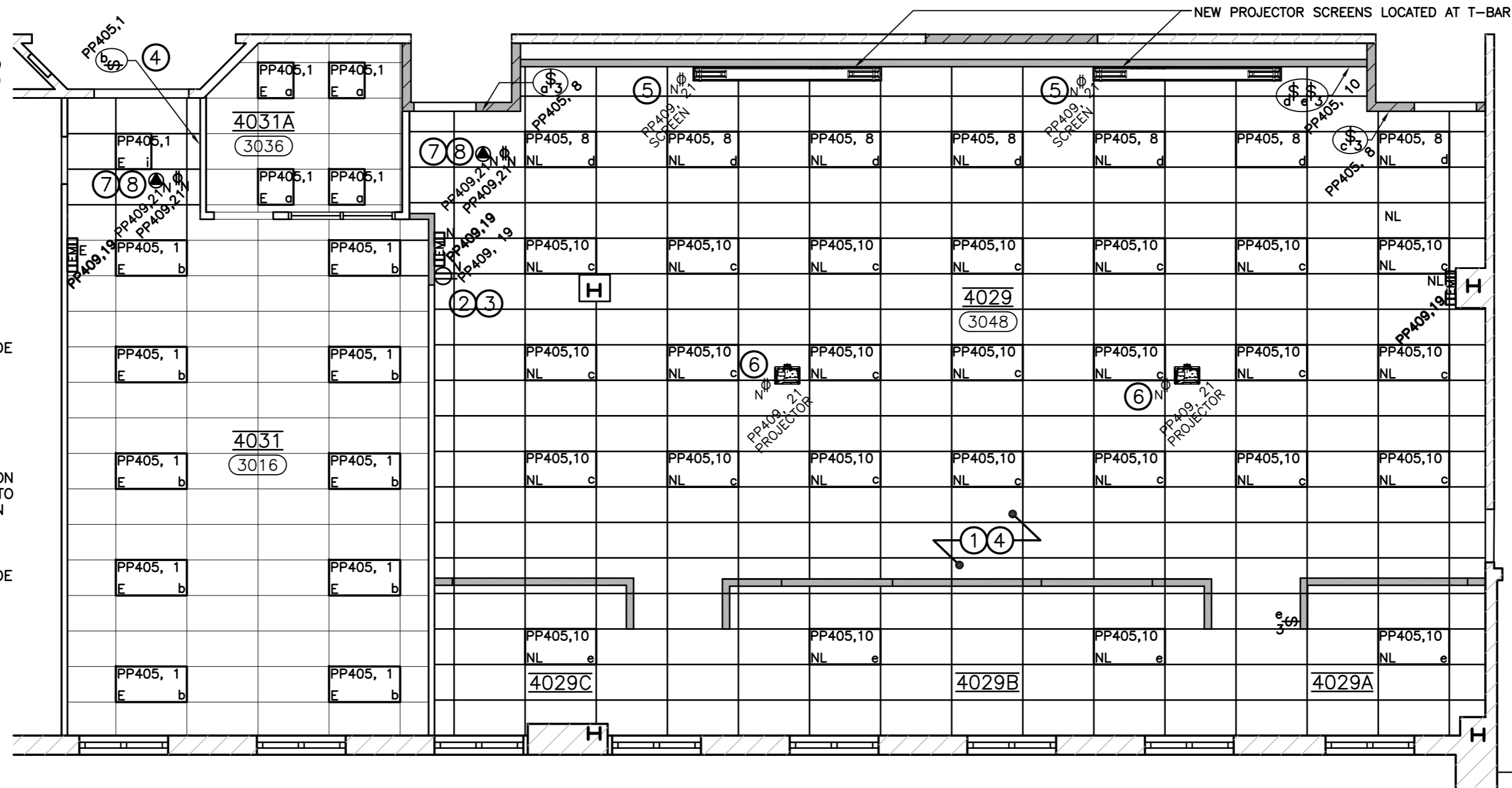
PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
DEMOLITION & NEW ELECTRICAL PLAN POWER & COMMUNICATIONS

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. E-1.0

CEILING PLAN NEW NOTES: #

- RELOCATE LIGHT FIXTURES AS INDICATED.
- SUPPLY AND INSTALL NEW DUPLEX RECEPTACLE FOR EMERGENCY LIGHTING UNIT. INSTALL JUST BELOW T-BAR CEILING. CONNECT TO EXISTING LIGHTING CIRCUIT. PROVIDE 19mm CONDUIT IN WALL AND RUN BACK TO PANEL.
- SUPPLY AND INSTALL NEW EMERGENCY LIGHTING BATTERY UNIT, 'LDXC SERIES - LDXC1244', OR APPROVED ALTERNATE, C/W TWO (2) MR16 LED, 12V-6W LAMP HEADS, MAINTENANCE FREE SEALED LEAD ACID BATTERY W/ 120 MINUTES RUNTIME, STEEL HOUSING W/ ANTI-CORROSION UNDERCOATING, 120/347 VAC WITHOUT LINE CORD, FACTORY WHITE. CONNECT TO EXISTING LIGHTING CIRCUIT.
- SUPPLY AND INSTALL NEW SWITCHES W/ DEVICE BOX RECESSED INTO GYPSUM BOARD WALL. EXACT LOCATION TO BE DETERMINED ON SITE. PROVIDE 19mm CONDUIT IN WALL AND RUN BACK TO PANEL. SWITCHES TO BE LOCATED 1000mm A.F.F.
- SUPPLY AND INSTALL NEW DUPLEX RECEPTACLE W/ DEVICE BOX ABOVE CEILING FOR OWNER SUPPLIED PROJECTOR SCREEN. PROVIDE 19mm CONDUIT RUN BACK TO PANEL.
- SUPPLY AND INSTALL NEW DUPLEX RECEPTACLE W/ DEVICE BOX ABOVE CEILING FOR OWNER SUPPLIED PROJECTOR. PROVIDE 19mm CONDUIT RUN BACK TO PANEL.
- SUPPLY AND INSTALL NEW DIRECT POWER CONNECTION FOR NEW AUTOMATIC DOOR OPERATOR. INSTALL SURFACE MOUNTED JUNCTION BOX ABOVE CEILING. EXTEND SURFACE MOUNTED CONDUIT DOWN TO DOOR OPERATOR AND BACK TO PANEL. COORDINATE INSTALLATION WITH GENERAL CONTRACTOR.
- SUPPLY AND INSTALL NEW DUPLEX RECEPTACLE W/ DEVICE BOX MOUNTED ABOVE CEILING SPACE FOR PROX CARD SYSTEM. PROVIDE 19mm CONDUIT RUN BACK TO PANEL.
- ALL LIGHT FIXTURES CONNECTED TO 347V POWER LIGHTING CIRCUITS.

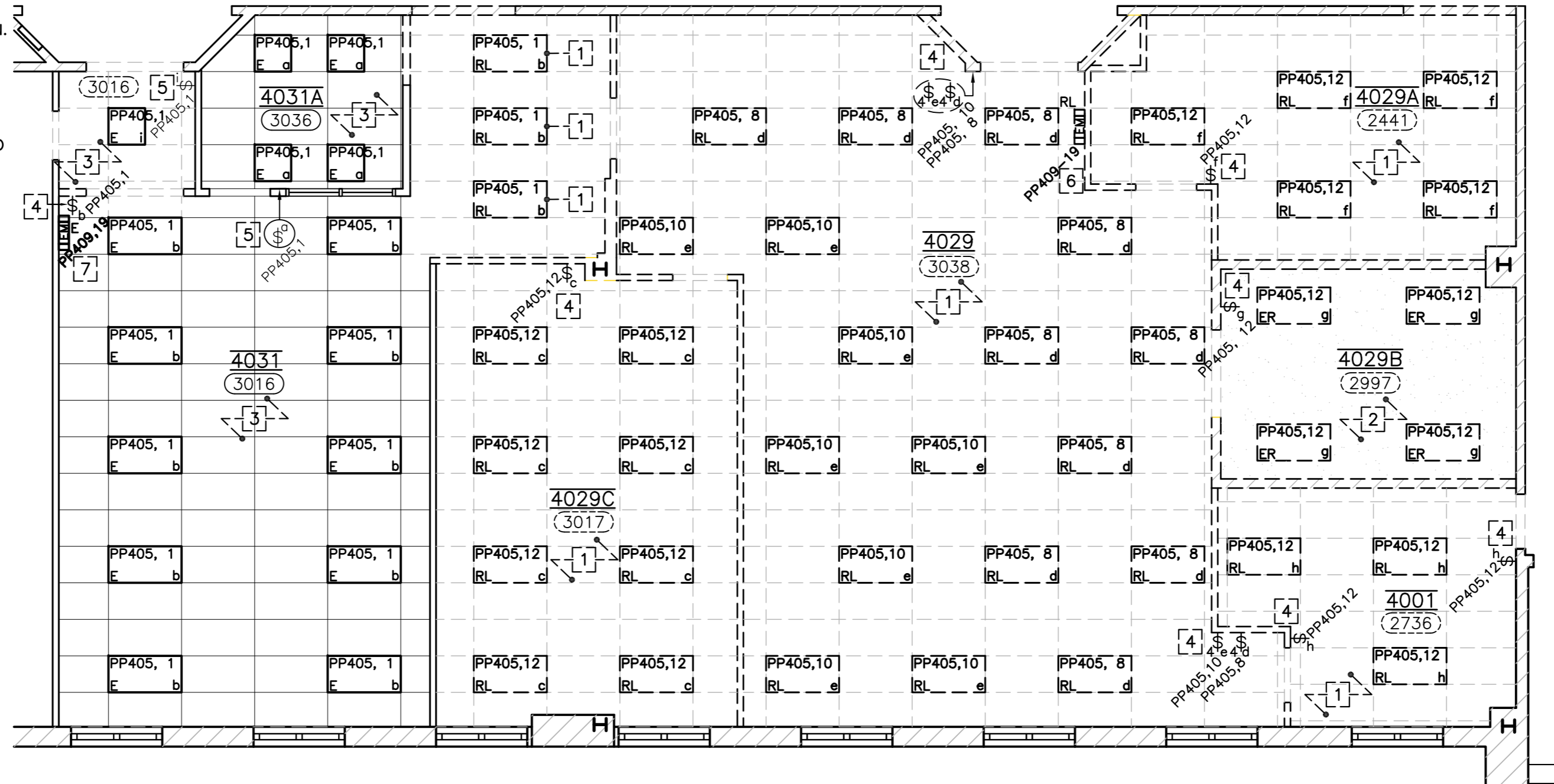


NEW ELECTRICAL CEILING PLAN

SCALE: 1:75

CEILING PLAN DEMOLITION NOTES: #

- DISCONNECT POWER TO EXISTING LIGHT FIXTURES FOR RELOCATION.
- REMOVE AND DISPOSE OF EXISTING LIGHT FIXTURES. PULL BACK WIRING TO NEAREST JUNCTION BOX ABOVE CEILING.
- EXISTING LIGHT FIXTURES TO REMAIN.
- REMOVE AND DISPOSE OF EXISTING SWITCH. PULL BACK WIRING TO NEAREST JUNCTION BOX ABOVE CEILING.
- EXISTING SWITCH TO REMAIN.
- DISCONNECT POWER TO EXISTING EMERGENCY LIGHTING FOR RELOCATION.
- EXISTING EMERGENCY LIGHTING TO REMAIN.



DEMOLITION ELECTRICAL CEILING PLAN

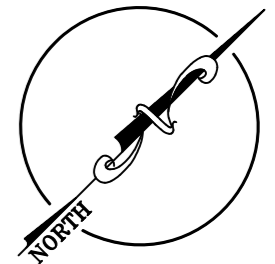
SCALE: 1:75

No.	REVISION	DATE

R0 ISSUED FOR TENDER MARCH 1, 2024

GENERAL NOTES

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PROJECT NAME:

**ENGINEERING BUILDING
RENOVATIONS TO EN-4029**
Project #: EN-123-21

DRAWING TITLE:

**DEMOLITION & NEW
ELECTRICAL CEILING
PLANS**

REVIEWED:

M.F.

DRAWN:

E.B.

SCALE:

AS SHOWN

DATE:

MARCH, 2024

MUN PROJECT No.

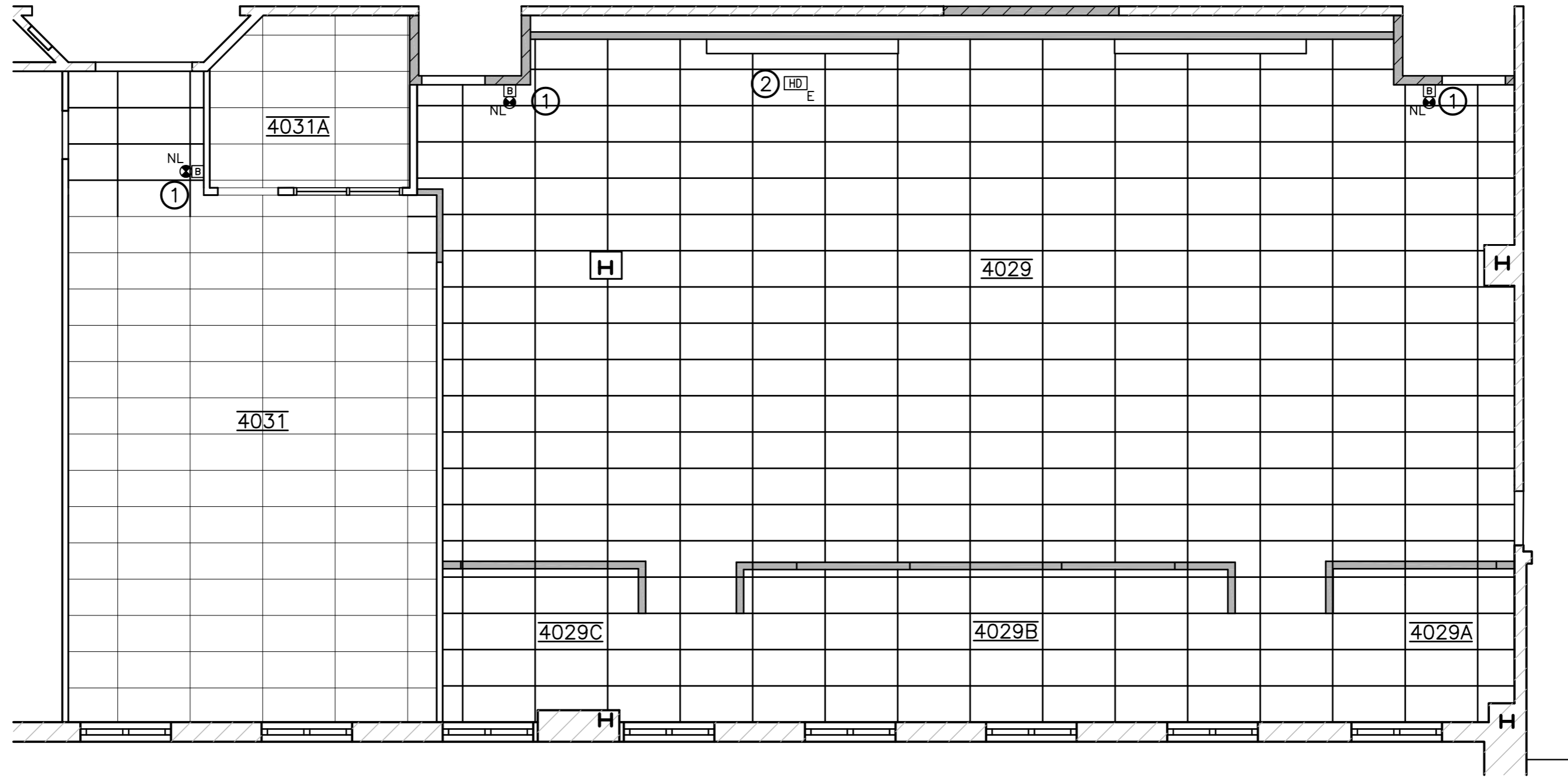
EN-123-21

DRAWING No.

E-2.0

CEILING PLAN NEW NOTES: #

1. RELOCATE FIRE EXTINGUISHERS AS INDICATED.
2. EXISTING HEAT DETECTOR DEVICE TO REMAIN.



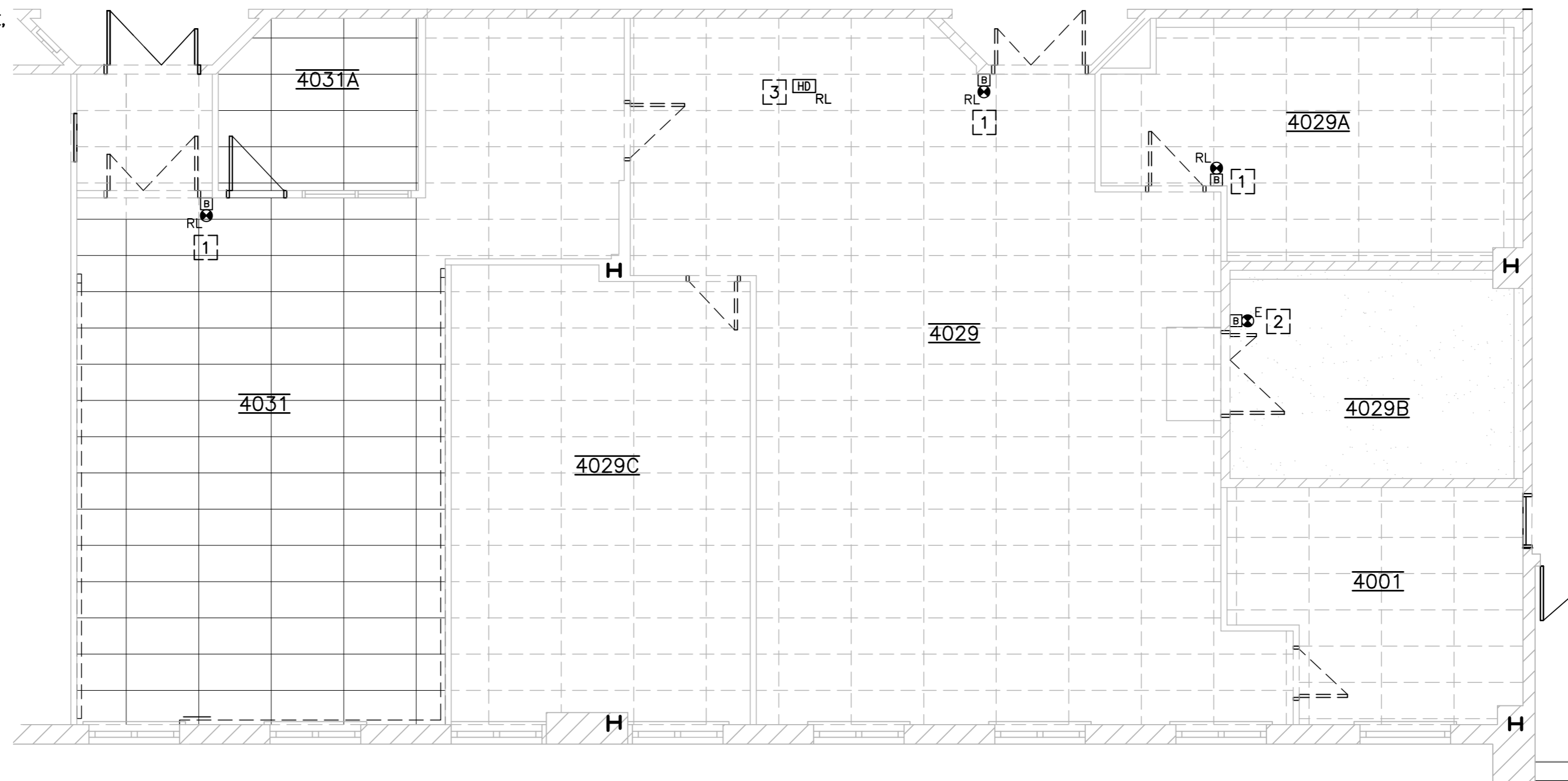
NEW FIRE ALARM SYSTEM PLAN

SCALE: 1:75

2
E-3.0

FIRE ALARM SYSTEM DEMOLITION NOTES: #

1. REMOVE AND RELOCATE FIRE EXTINGUISHER, MOUNTING HARDWARE, AND FASTENERS AS PER 2/E-3.0.
2. REMOVE FIRE EXTINGUISHER AND TURN OVER TO OWNER.
3. EXISTING HEAT DETECTOR DEVICE TO REMAIN.



DEMOLITION FIRE ALARM SYSTEM PLAN

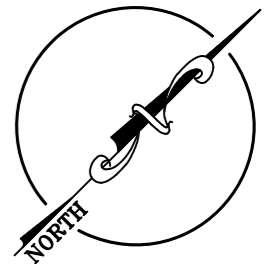
SCALE: 1:75

1
E-3.0

No.	REVISION	DATE
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PROJECT NAME:

**ENGINEERING BUILDING
RENOVATIONS TO EN-4029**
Project #: EN-123-21

DRAWING TITLE:

**DEMOLITION & NEW
FIRE ALARM SYSTEMS**

REVIEWED:

M.F.

DRAWN:

E.B.

SCALE:

AS SHOWN

DATE:

MARCH, 2024

MUN PROJECT No.

EN-123-21

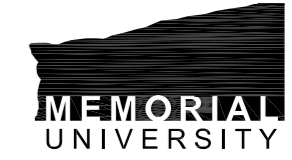
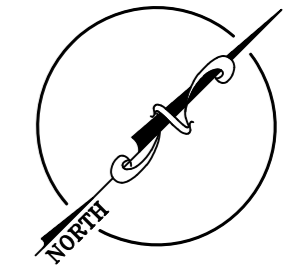
DRAWING No.

E-3.0

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

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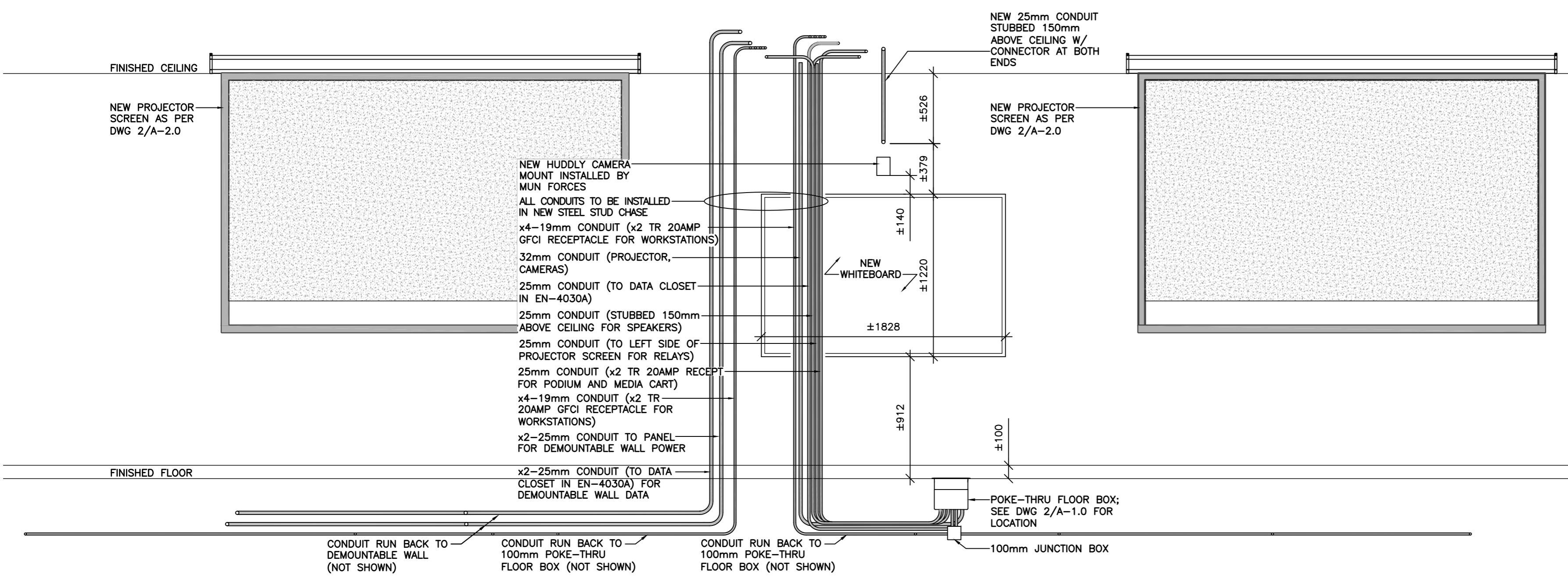


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PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
ELECTRICAL DETAILS

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. E-4.0



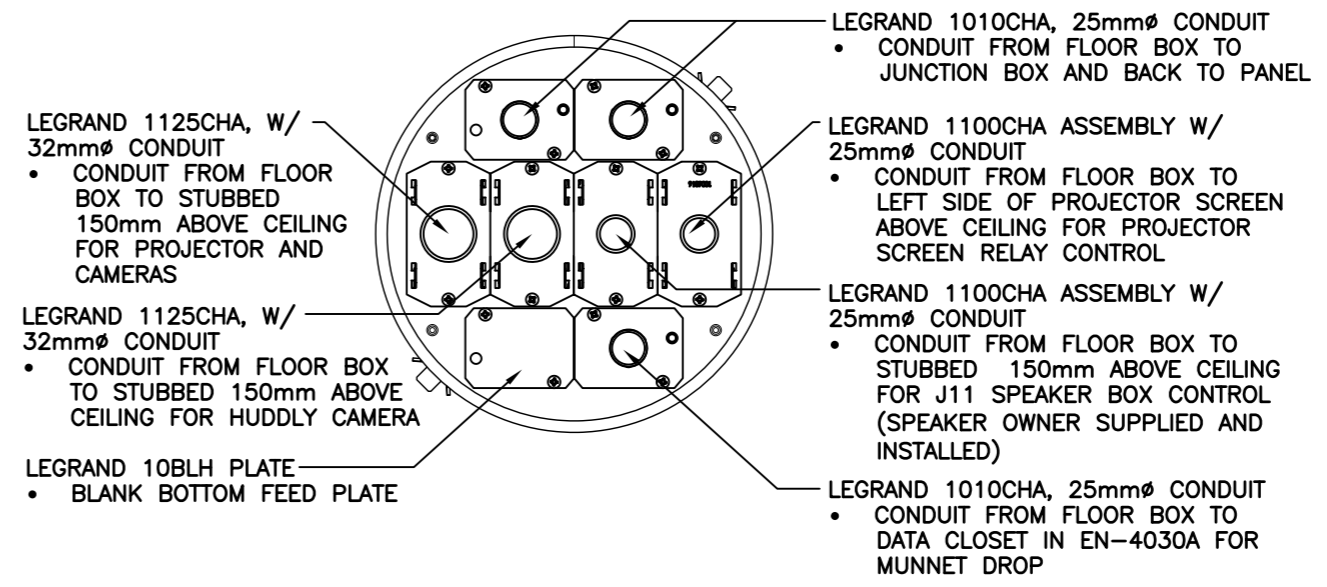
CONDUIT ELEVATION
 SCALE: 1:25

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

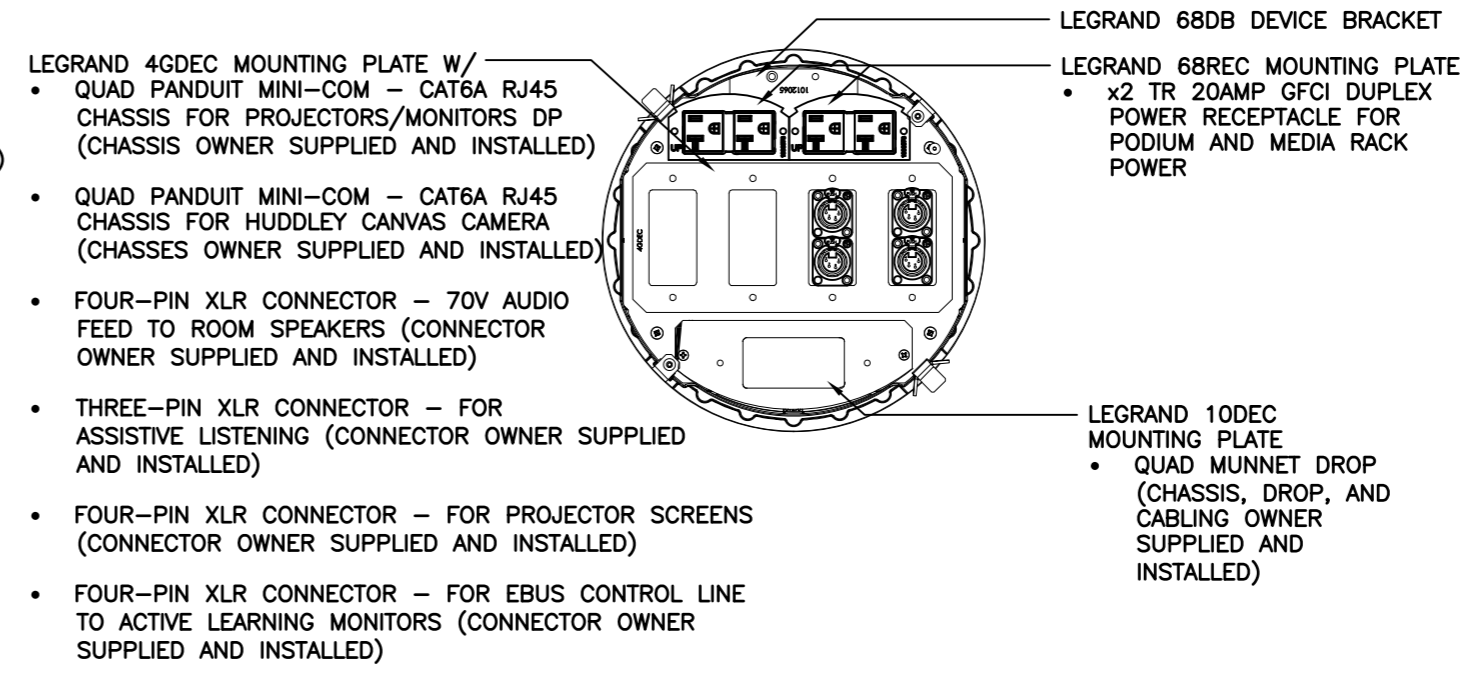
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BOTTOM FEED PLATES AND HOUSING ASSEMBLIES



TOP FEED PLATES AND HOUSING ASSEMBLIES



CONTRACTOR TO SUPPLY AND INSTALL 'LEGRAND EVOLUTION SERIES 10" POKE-THRU DEVICE'; MODEL NUMER 10ATCPSN. NO SUBSTITUTIONS WILL BE ACCEPTED FOR THIS DEVICE. SUBMIT SHOP DRAWINGS FOR APPROVAL.

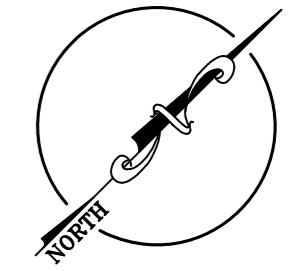
DEVICE TO COME COMPLETE WITH THE COVER AND STEM PRE-ASSEMBLED TOGETHER. CONTRACTOR TO SUPPLY AND INSTALL ALL MOUNTING PLATES, HOUSING ASSEMBLIES, RECEPTACLES, CONDUIT, FASTENERS, AND HARDWARE UNLESS NOTED OTHERWISE.

DEVICE TO BE UL FIRE RATED FOR UP TO 2HR RATED FLOORS.

PODIUM POKE-THRU DEVICE

SCALE: NTS

3
E-4.1



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ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
ELECTRICAL DETAILS

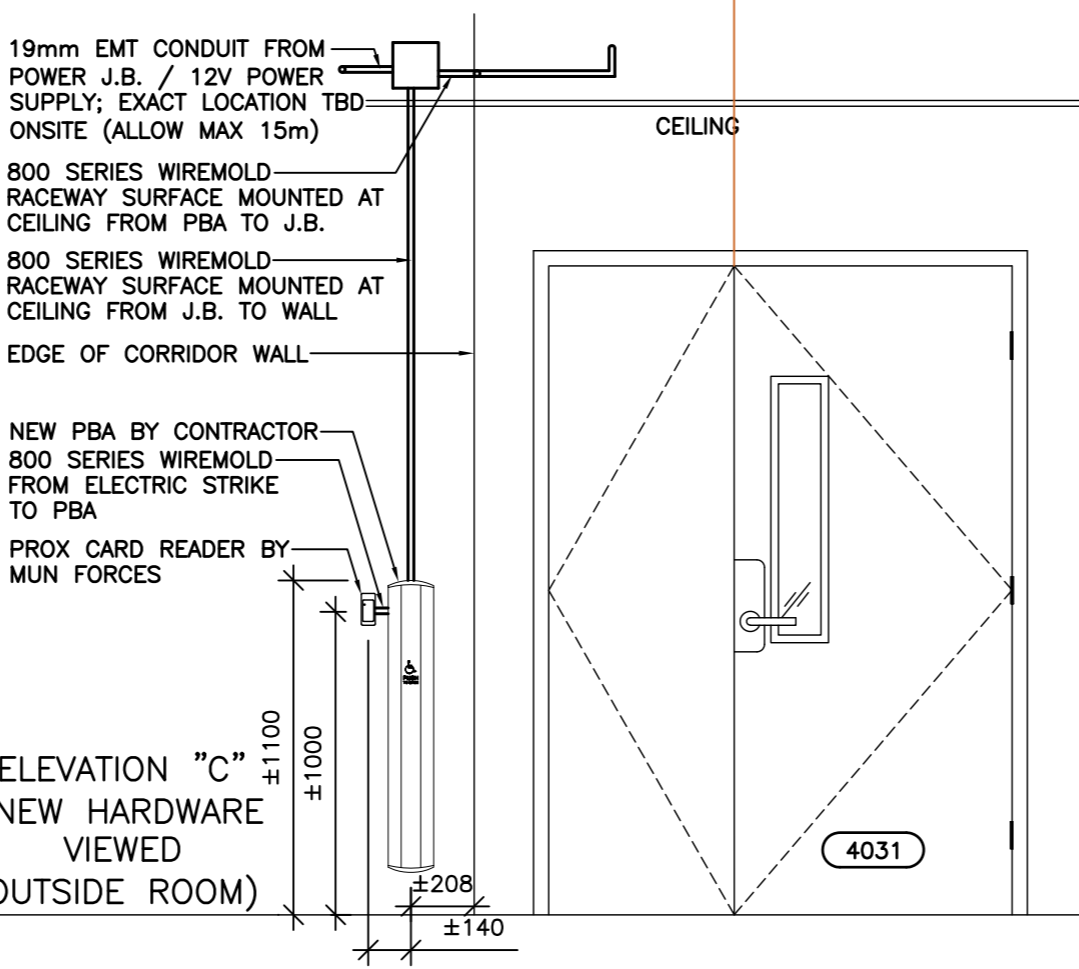
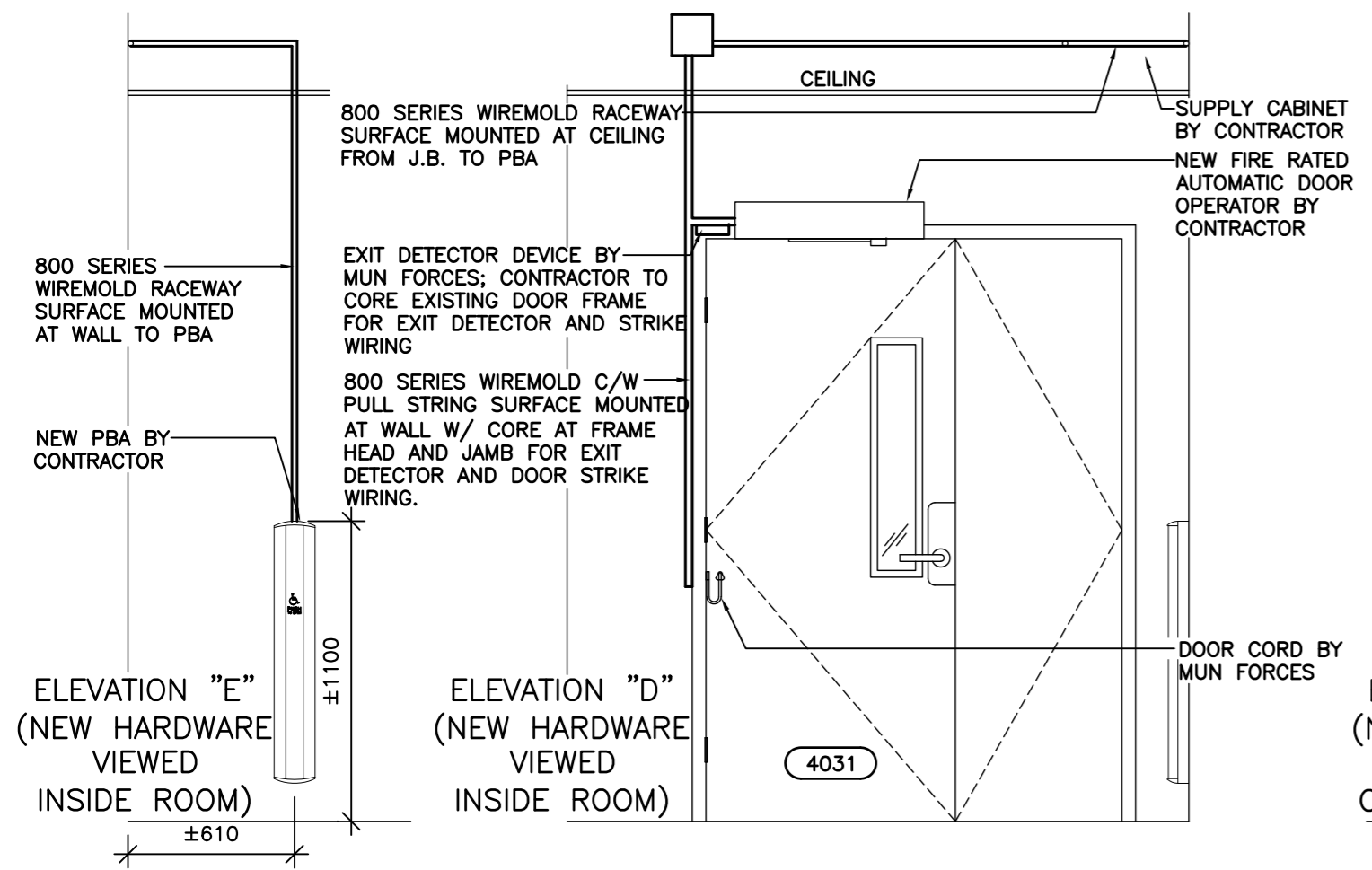
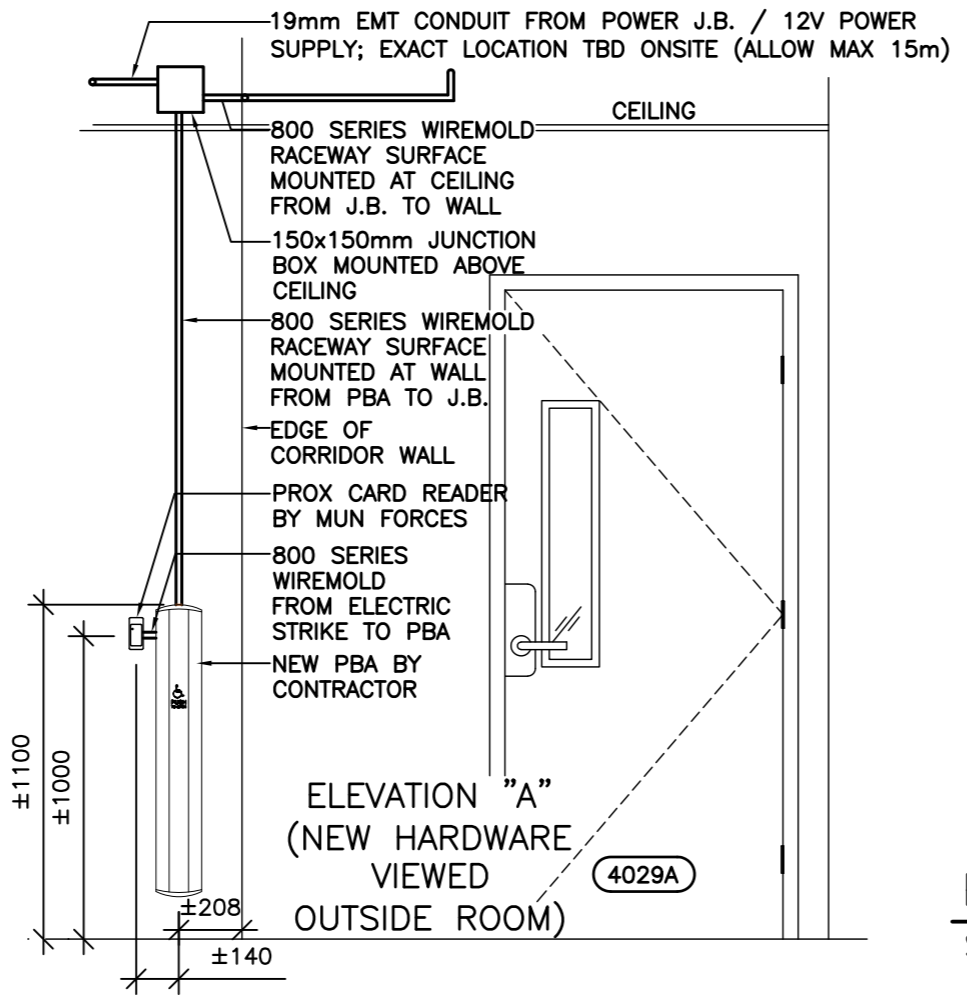
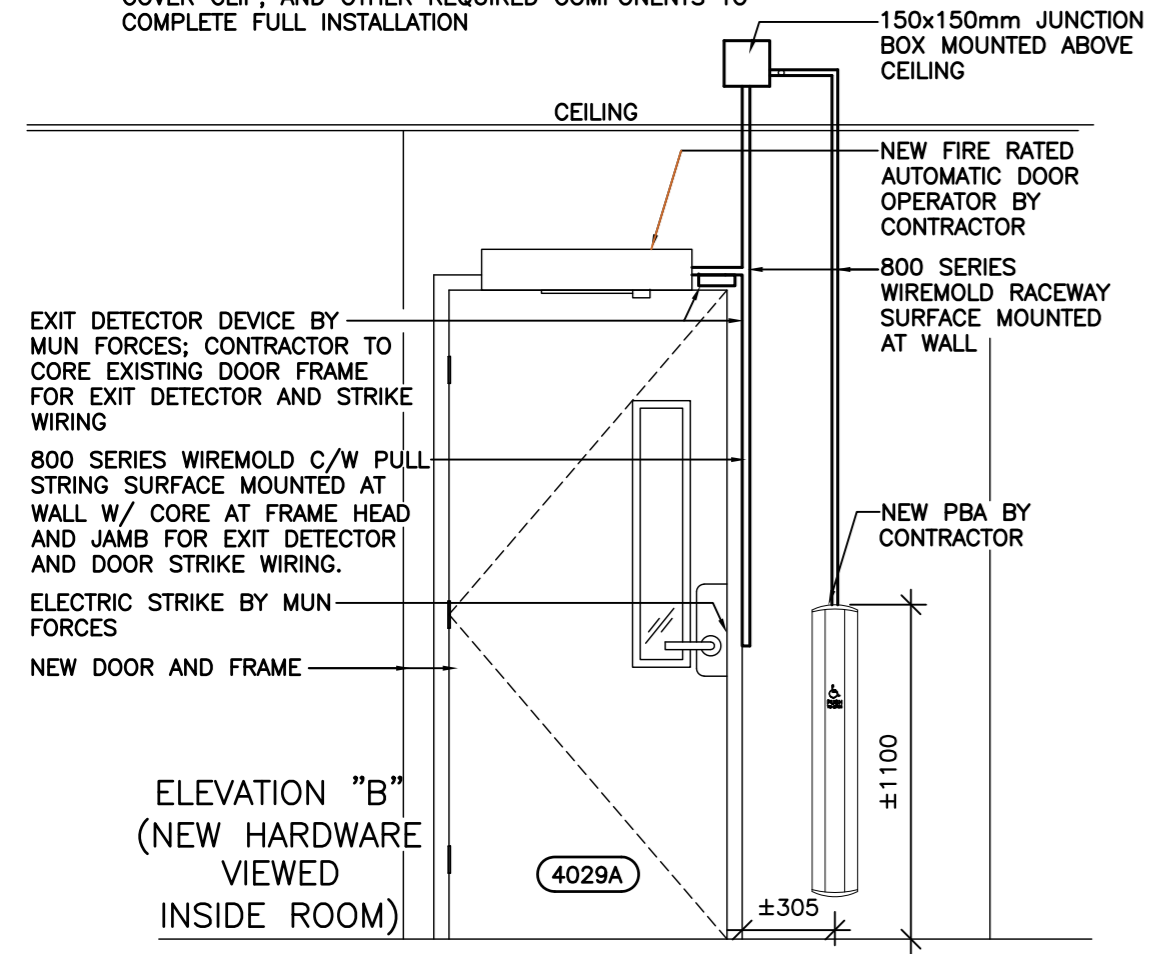
REVIEWED: M.F. DRAWN: E.B.

SCALE: AS SHOWN DATE: MARCH, 2024

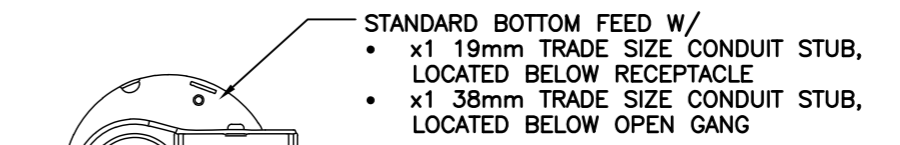
MUN PROJECT No. EN-123-21 DRAWING No. E-4.1

HARDWARE NOTES:

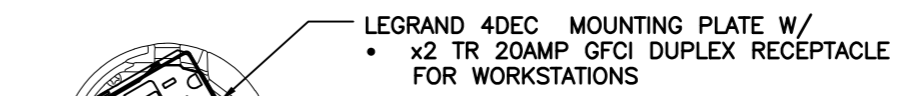
1. PROVIDE NEW 800 SERIES WIREMOLD RACEWAY (BY LEGRAND, OR APPROVED ALTERNATE):
 - 1.1. EXTEND RACEWAY FROM ABOVE FINISHED CEILING TO DOOR OPERATORS AND FROM OPERATORS TO SURFACE MOUNT BOXES FOR ACTUATORS
 - 1.2. 800BAC RACEWAY
 - 1.3. INCLUDE BLANK END FITTING, ENTRANCE END FITTING, COVER CLIP, AND OTHER REQUIRED COMPONENTS TO COMPLETE FULL INSTALLATION



BOTTOM FEED PLATES AND HOUSING ASSEMBLIES



TOP FEED PLATES AND HOUSING ASSEMBLIES



CONTRACTOR TO SUPPLY AND INSTALL 'LEGRAND EVOLUTION SERIES 4" POKE-THRU DEVICE'; MODEL NUMER 4ATCP4RGY. SUBMIT SHOP DRAWINGS FOR APPROVAL.

DEVICE TO COME COMPLETE WITH THE COVER AND STEM PRE-ASSEMBLED TOGETHER. CONTRACTOR TO SUPPLY AND INSTALL ALL MOUNTING PLATES, HOUSING ASSEMBLIES, RECEPTACLES, CONDUIT, FASTENERS, AND HARDWARE UNLESS NOTED OTHERWISE.

DEVICE TO BE UL FIRE RATED FOR UP TO 2HR RATED FLOORS.

2
E-4.1

WORKSTATION POKE-THRU DEVICE

SCALE: NTS

1
E-4.1

PUSH BUTTON ACTUATOR EQUIPMENT & CONDUIT ELEVATION

SCALE: 1:25

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

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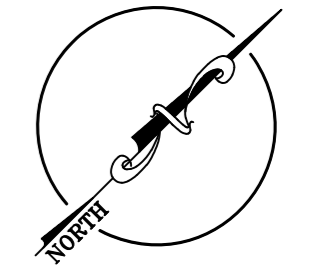
LIGHTING SCHEDULE

EXISTING SYMBOL	NEW SYMBOL	LIGHT SOURCE	COLOR TEMP	VOLT	WATT	MANUFACTURER	CATALOGUE NUMBER	EXISTING	NEW	QTY
a	a	LED	-	347	-	-	-	●		4
b	b	LED	-	347	-	-	-	●		13
c	c	LED	-	347	-	-	-	●		8
d	c,d	LED	-	347	-	-	-	●		10
e	c	LED	-	347	-	-	-	●		8
f	e	LED	-	347	-	-	-	●		5
g	-	LED	-	347	-	-	-	●		4
h	c	LED	-	347	-	-	-	●		3
i	i	LED	-	347	-	-	-	●		1
EM	EM	LED	-	347	-	-	-	●		2

PANEL FM-PP-409 PANEL SCHEDULE				
TYPE <u>CIRCUIT BREAKER</u>				
RATING <u>120/208V, 3Ø, 4W, 225A</u>				
STANDARD OF ACCEPTANCE <u>EATON/WESTINGHOUSE</u>				
MINIMUM INTERRUPTING CAPACITY _____ R.M.S. SYMM AMPERES				
NOTES * LOCK ON DEVICE _____ FLUSH MOUNT _____				
CIRCUIT DESCRIPTION	BRKR. SIZE	CIRCUIT NO.	BRKR. SIZE	CIRCUIT DESCRIPTION
WALL TRACK REC. RM 4029	15	1 2	20	OUTLETS SE WALL RM 4029C
WALL TRACK REC. RM 4029	15	3 4	20	OUTLETS NE & W WALL RM 4029C
UNAVAILABLE	15 MINS	5 6	20	OUTLETS SW WALL RM 4029C
REC. RM 4001 & 4029	15	7 8	15	REC. RM 4029, 4029B, & 4031
REC. RM 4029C	15	9 10	20	REC. RM 4029B
REC. RM 4029C	15	11 12	20	UNAVAILABLE
REC. RM 4029B	15	13 14	15	TV REC. IN CORR. & 4029
REC. RM 4029C	15	15 16	15	REC. RM 4029B
REC. RM 4029B	15	17 18	15	UNAVAILABLE
EMERG. LTS RM 4029 & 4031	15	19 20	15	REC. RM 4029B
DISC. RM 4029A	15	21 22	15	WORKSTATIONS 4029
TRACK REC. RM 4029A	15	23 24	15	WORKSTATIONS 4029
208 VOLT REC. 4029B		25 26	15	WORKSTATIONS 4029
208 VOLT REC. 4029B	30	27 28	15	WORKSTATIONS 4029
208 VOLT REC. 4029B		29 30		
UNAVAILABLE	15	31 32		
	15	33 34		
		35 36		
		37 38		
UNAVAILABLE	15 MINS	39 40	15 MINS	UNAVAILABLE
UNAVAILABLE	15 MINS	41 42	15 MINS	UNAVAILABLE
CONNECTED LOAD: DEMAND LOAD:				

PANEL FM-PP-405 PANEL SCHEDULE				
TYPE <u>CIRCUIT BREAKER</u>				
RATING <u>347/600V, 3Ø, 4W, 100A</u>				
STANDARD OF ACCEPTANCE <u>EATON/WESTINGHOUSE</u>				
MINIMUM INTERRUPTING CAPACITY _____ R.M.S. SYMM AMPERES				
NOTES * LOCK ON DEVICE _____ FLUSH MOUNT _____				
CIRCUIT DESCRIPTION	BRKR. SIZE	CIRCUIT NO.	BRKR. SIZE	CIRCUIT DESCRIPTION
LTS RM 4031 & 4031A	XX	1 2	XX	UNAVAILABLE
UNAVAILABLE	XX	3 4	XX	UNAVAILABLE
UNAVAILABLE	XX	5 6	XX	UNAVAILABLE
UNAVAILABLE	XX	7 8	XX	LTS RM 4029 & 4029A
UNAVAILABLE	XX	9 10	XX	LTS RM 4029
UNAVAILABLE	XX	11 12	XX	LTS RM 4001, 4029B, & 4029C
		13 14	XX	UNAVAILABLE
		15 16	XX	UNAVAILABLE
		17 18	XX	UNAVAILABLE
UNAVAILABLE	XX	19 20	XX	UNAVAILABLE
UNAVAILABLE	XX	21 22	XX	UNAVAILABLE
UNAVAILABLE	XX	23 24	XX	UNAVAILABLE
		25 26		
		27 28		
		29 30		
		31 32		
		33 34		
		35 36		
		37 38		
		39 40		
		41 42		
CONNECTED LOAD: DEMAND LOAD:				

PANEL FM-PP-401 PANEL SCHEDULE				
TYPE <u>CIRCUIT BREAKER</u>				
RATING <u>120/208V, 3Ø, 4W, 225A</u>				
STANDARD OF ACCEPTANCE <u>EATON/WESTINGHOUSE</u>				
MINIMUM INTERRUPTING CAPACITY _____ R.M.S. SYMM AMPERES				
NOTES * LOCK ON DEVICE _____ FLUSH MOUNT _____				
CIRCUIT DESCRIPTION	BRKR. SIZE	CIRCUIT NO.	BRKR. SIZE	CIRCUIT DESCRIPTION
UNAVAILABLE	15	1 2	15	DROP CORD 4031
UNAVAILABLE	15	3 4	20	DROP CORD 4031
REC. RM 4031, 4034, & 4035	15	5 6	20	DROP CORD 4031
DROP CORDS 4031	15	7 8	15	UNAVAILABLE
DROP CORDS 4031	15	9 10	15	UNAVAILABLE
UNAVAILABLE	15	11 12	15	REC. RM 4029 & 4031A
CLOCKS RM 4031, 4032, 4034, & 4035	15	13 14	15	UNAVAILABLE
UNAVAILABLE	30	15 16	15	TRACK REC. RM 4029
UNAVAILABLE	15	17 18	15	TRACK REC. RM 4029A
UNAVAILABLE	15	19 20	15	REC. RM 4031
UNAVAILABLE	15	21 22	15	REC. RM 4031
WALL REC. RM 4031	15	23 24	15	REC. RM 4031
POWER POLE	15	25 26	20	UNAVAILABLE
POWER POLE	15	27 28	20	UNAVAILABLE
POWER POLE	15	29 30	15	REC. RM 4031
		31 32		
		33 34		
		35 36		
		37 38		
		39 40		
		41 42		
CONNECTED LOAD: DEMAND LOAD:				



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PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
PANEL SCHEDULES

REVIEWED: M.F. DRAWN: E.B.

SCALE: AS SHOWN DATE: MARCH, 2024

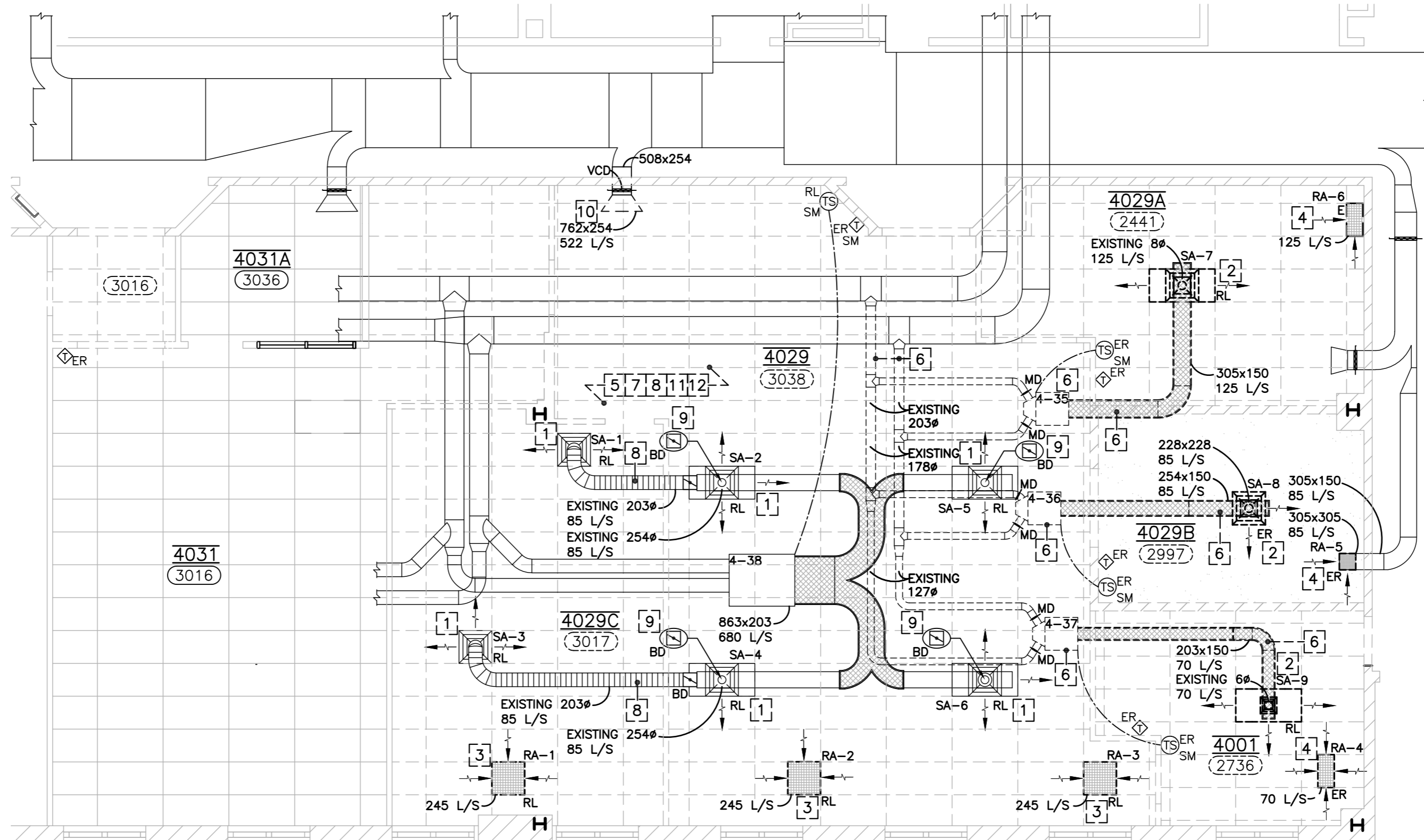
MUN PROJECT No. **EN-123-21** DRAWING No. **E-5.0**

GENERAL VENTILATION NOTES:

1. THE COMPLETE VENTILATION SYSTEM SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL BUILDING CODE, CANADIAN PLUMBING CODE, NFPA, ASHRAE AND SMACNA STANDARDS, THE DEPT. OF FACILITIES MANAGEMENT STANDARDS AND LOCAL BY-LAWS CURRENTLY IN FORCE IN THE PROVINCE AND MUNICIPALITY.
2. BEFORE COMMENCING ANY DEMOLITION OR NEW WORK, THE CONTRACTOR SHALL THOROUGHLY INSPECT THE SITE SO AS TO BECOME FAMILIAR WITH ALL EXISTING CONDITIONS. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING ON SITE THE ACTUAL SIZE, LOCATION, AND ROUTING OF ALL EXISTING DEVICES, EQUIPMENT AND SYSTEMS.
3. TRACE OUT ALL LINES AND SYSTEMS BEFORE INITIATING WORK. COORDINATE SHUTDOWNS AND SERVICE INTERRUPTIONS WITH THE PROJECT COORDINATOR, AND PROVIDE WRITTEN DESCRIPTION OF WORK FOR REVIEW BY OWNER. THE OWNER RESERVES THE RIGHT TO CHANGE SCHEDULES TO PROTECT ONGOING OPERATIONS.
4. PROVIDE ALL OFFSETS, OR ELBOWS THAT MAY BE REQUIRED TO AVOID EXISTING DUCTING, CONDUIT, ETC. IN THIS RENOVATION.
5. MAKE GOOD ANY DAMAGE AS A RESULT OF THE CONSTRUCTION WORK.
6. DUCTWORK: NEW GALVANIZED STEEL OF LOCK FORMING QUALITY TO ASTM 525 M-80 ZINC COATING WITH GAUGES AND FABRICATION DETAILS TO SMACNA STANDARDS.
7. HANGERS & SUPPORTS: TO SMACNA & ASHRAE RECOMMENDATIONS & STANDARDS.
8. SEAMS, JOINTS & CONNECTIONS TO BE MADE AIRTIGHT WITH SEALING COMPOUND & TAPE.
9. DUCT SEALER: OIL RESISTANT, POLYMER TYPE FLAME RESISTANT HIGH VELOCITY DUCT SEALING COMPOUND.
10. NEW AND RELOCATED REGISTERS TO BE CENTERED IN CEILING TILES.

GENERAL DEMOLITION NOTES: #

1. REMOVE AND STORE EXISTING SUPPLY DIFFUSERS TO REINSTATE.
2. REMOVE AND DISPOSE OF EXISTING SUPPLY DIFFUSERS.
3. REMOVE AND STORE EXISTING RETURN DIFFUSERS TO REINSTATE.
4. REMOVE AND DISPOSE OF EXISTING RETURN DIFFUSERS.
5. DUCTING TO REMAIN UNLESS OTHERWISE NOTED.
6. REMOVE AND DISPOSE OF EXISTING DUCTING, BOXES, AND ASSOCIATED COMPONENTS FOR SUPPLY AIR TO EN-4001, 4029A, AND 4029B.
7. REMOVE AND/OR MODIFY EXISTING DUCT TO FACILITATE NEW BRANCH INSTALLATION.
8. EXISTING BALANCING DAMPERS TO REMAIN UNLESS OTHERWISE NOTED.
9. REMOVE AND STORE EXISTING BALANCING DAMPERS TO REINSTATE.
10. REMOVE DUCTWORK AND VCD FOR EXTENSION.
11. CLEAN ALL EXISTING AND REINSTATED SUPPLY AND RETURN DIFFUSERS.
12. SEE DWG ME-1.0 FOR ALL CONTROLS IN RELATION TO MECHANICAL EQUIPMENT.

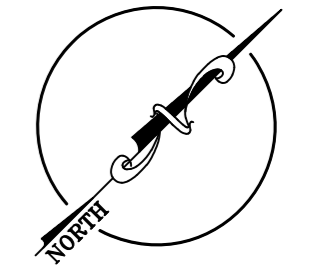


DEMOLITION VENTILATION PLAN
SCALE: 1:75

No.	REVISION	DATE
R0	ISSUED FOR TENDER	MARCH 1, 2024

GENERAL NOTES

1. DRAWINGS TO BE READ AS A SET.
2. DO NOT SCALE FROM DRAWINGS.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND SITE CONDITIONS. PRIOR TO SUBMISSION OF TENDERS.
4. ALL DISCREPANCIES FOUND IN THESE DRAWINGS TO BE BROUGHT TO THE ATTENTION OF FACILITIES MANAGEMENT PRIOR TO SUBMISSION OF TENDERS.



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PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
DEMOLITION VENTILATION PLAN

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. MV-1.0

GENERAL VENTILATION NOTES:

1. THE COMPLETE VENTILATION SYSTEM SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL BUILDING CODE, CANADIAN PLUMBING CODE, NFPA, ASHRAE AND SMACNA STANDARDS, THE DEPT. OF FACILITIES MANAGEMENT STANDARDS AND LOCAL BY-LAWS CURRENTLY IN FORCE IN THE PROVINCE AND MUNICIPALITY.
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3. TRACE OUT ALL LINES AND SYSTEMS BEFORE INITIATING WORK. COORDINATE SHUTDOWNS AND SERVICE INTERRUPTIONS WITH THE PROJECT COORDINATOR, AND PROVIDE WRITTEN DESCRIPTION OF WORK FOR REVIEW BY OWNER. THE OWNER RESERVES THE RIGHT TO CHANGE SCHEDULES TO PROTECT ONGOING OPERATIONS.
4. PROVIDE ALL OFFSETS, OR ELBOWS THAT MAY BE REQUIRED TO AVOID EXISTING DUCTING, CONDUIT, ETC. IN THIS RENOVATION.
5. MAKE GOOD ANY DAMAGE AS A RESULT OF THE CONSTRUCTION WORK.
6. DUCTWORK: NEW GALVANIZED STEEL OF LOCK FORMING QUALITY TO ASTM 525 M-80 ZINC COATING WITH GAUGES AND FABRICATION DETAILS TO SMACNA STANDARDS.
7. HANGERS & SUPPORTS: TO SMACNA & ASHRAE RECOMMENDATIONS & STANDARDS.
8. SEAMS, JOINTS & CONNECTIONS TO BE MADE AIRTIGHT WITH SEALING COMPOUND & TAPE.
9. DUCT SEALER: OIL RESISTANT, POLYMER TYPE FLAME RESISTANT HIGH VELOCITY DUCT SEALING COMPOUND.
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NEW CONSTRUCTION NOTES: (#)

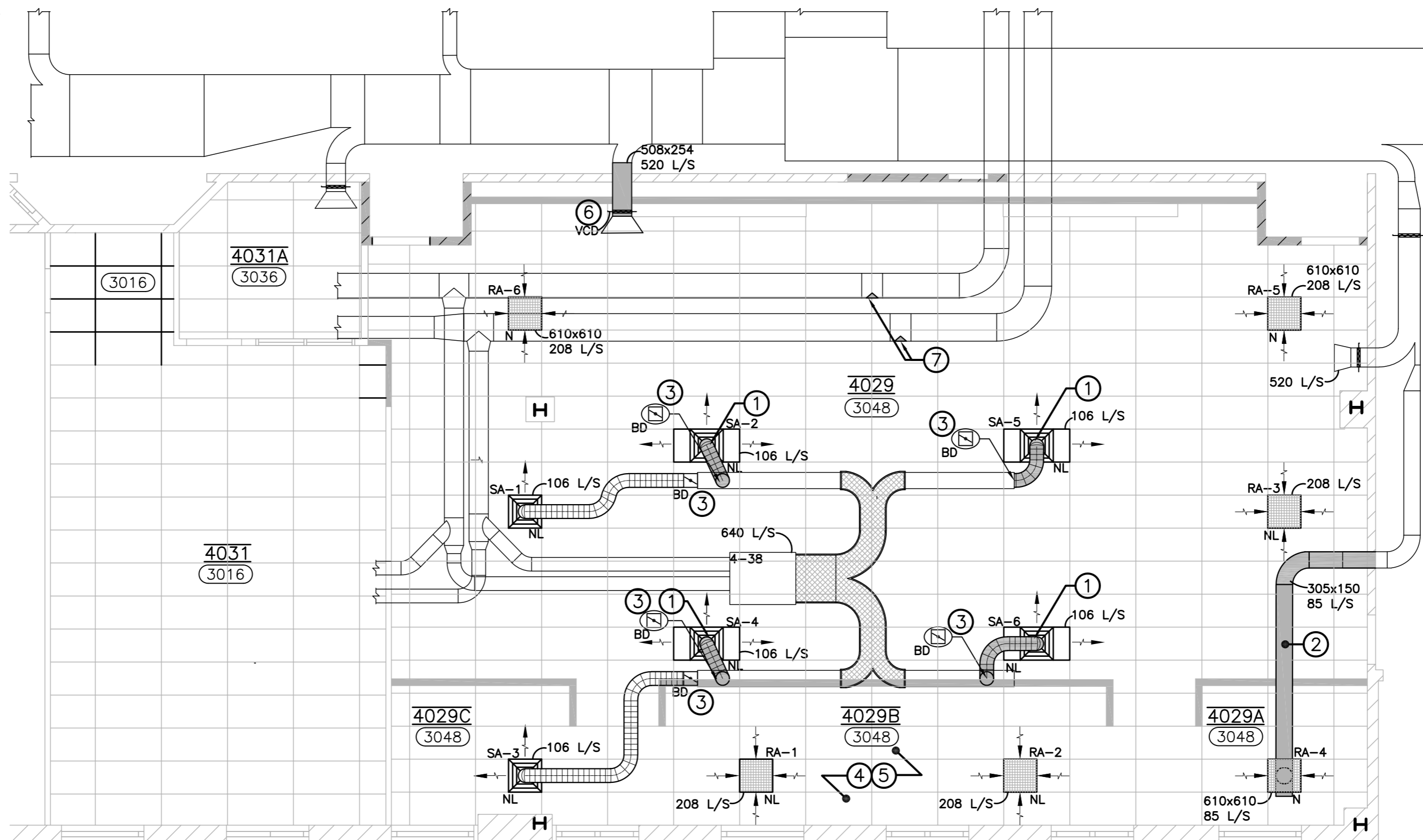
1. NEW SUPPLY DUCTING AS INDICATED.
2. NEW EXHAUST DUCTING AS INDICATED.
3. NEW BALANCING DAMPERS AS INDICATED.
4. RELOCATE EXISTING DIFFUSERS AND SUPPLY/INSTALL NEW AS PER SCHEDULE.
5. EXTEND EXISTING BRANCH PIPING AS REQUIRED TO ACCOMMODATE NEW DIFFUSER LOCATIONS AND CEILING HEIGHTS.
6. EXTEND RETURN DUCT TO FACILITATE INSTALLATION OF NEW CHASE. REINSTATE VCD AND DUCT BOOT.
7. PATCH DUCT WHERE EXISTING BRANCHES REMOVED WITH SHEET METAL.
8. GRILLES/REGISTERS MAY REQUIRE DIFFERENT FRAME MOUNTING OTHER THAN SHOWN ABOVE, CONTRACTOR TO VERIFY CEILING TYPES WITH ARCHITECTURAL REFLECTED CEILING PLAN.
9. ALTERNATE MANUFACTURERS FOR DIFFUSERS/REGISTERS: TITUS, NAILOR.
10. SEE DWG ME-1.0 FOR ALL CONTROLS IN RELATION TO MECHANICAL EQUIPMENT.

GRILLE & REGISTER SCHEDULE							
NUMBER	MANUFACTURER	MODEL	NOMINAL SIZE	AIR FLOW	FRAME MOUNTING	CONSTRUCTION	NOTES
SA-1-6	EXISTING	EXISTING	EXISTING	SUPPLY	FLUSH	ALUMINUM	EXISTING TO REMAIN
RA-1-3	EXISTING	EXISTING	EXISTING	EXHAUST	FLUSH	ALUMINUM	REINSTATE EXISTING DIFFUSER
RA-4-6	PRICE	80 EGG CRATE	610x610	EXHAUST	FLUSH	ALUMINUM	WHITE POWDER COAT FINISH

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

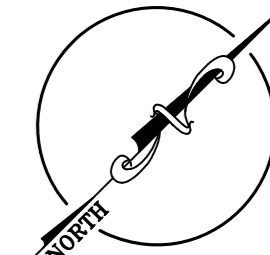
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NEW VENTILATION PLAN
SCALE: 1:75

1
MV-1.1



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PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
Project #: EN-123-21

DRAWING TITLE:
NEW VENTILATION PLAN

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. MV-1.1

GENERAL PLUMBING NOTES:

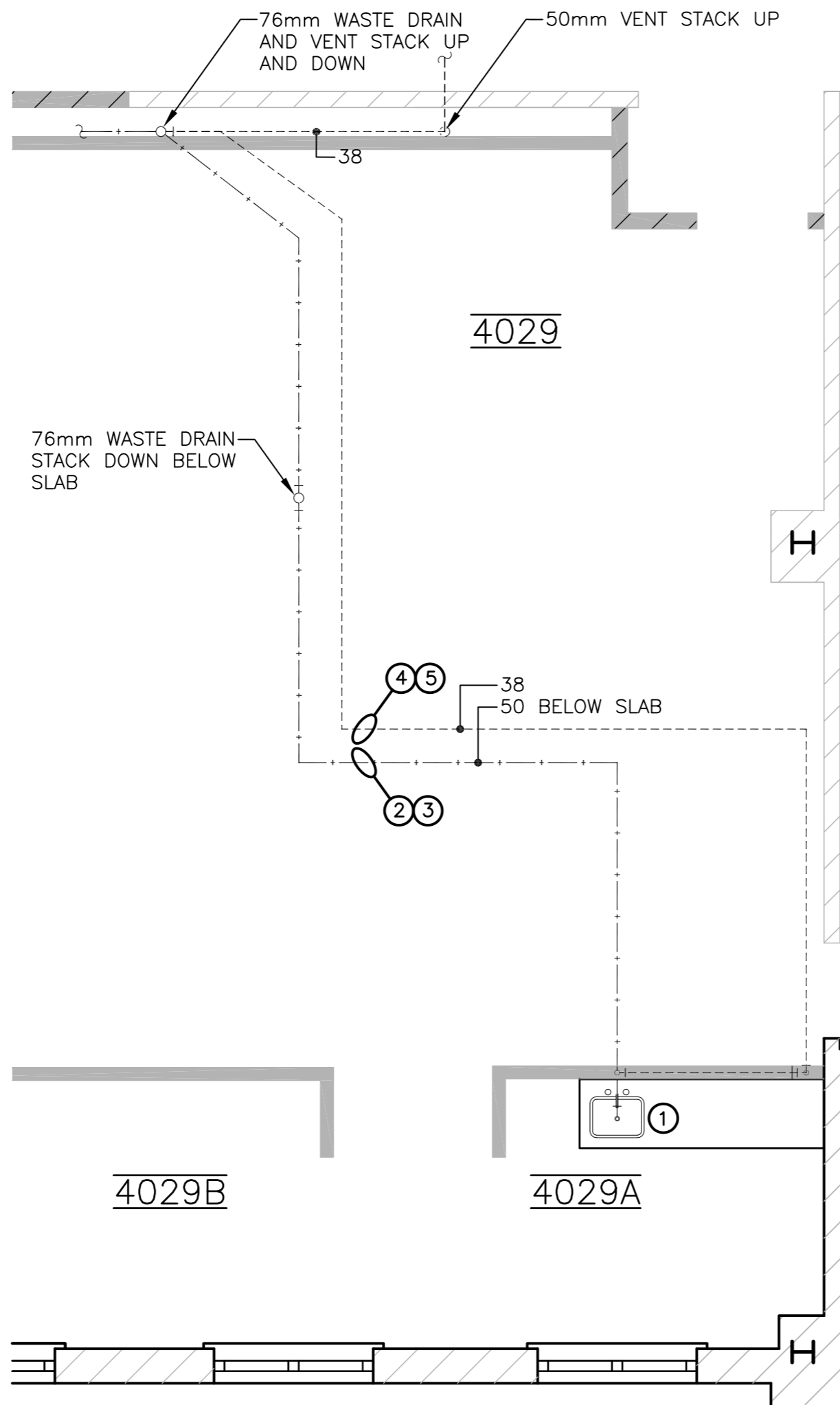
1. ALL CUTTING AND PATCHING SHALL BE COORDINATED WITH THE ARCHITECTURAL DIVISION.
2. FIRE RATING OF PENETRATIONS:
 - 2.1. MAINTAIN FIRE RATINGS AROUND PIPING PASSING THROUGH FLOORS AND CEILINGS.
 - 2.2. FILL AND PATCH HOLES IN FLOOR ASSEMBLIES.
3. ALLOW FOR EXTRA PIPE, OFFSETS, FITTINGS, ETC. AS REQUIRED TO AVOID ANY INTERFERENCE AND COMPLETE INSTALLATION.
4. PROVIDE P-TRAPS, WASTE, S.S. BRAIDED WATER LINES, VALVES, CARRIERS, ETC. FOR ALL PLUMBING FIXTURES AS REQUIRED.
5. PROVIDE ACCESS DOORS AT ALL CONCEALED VALVES AND CLEANOUTS. ACCESS DOORS TO BE MAINTAIN FIRE RATING OF ASSEMBLIES IN WHICH THEY ARE INSTALLED. ACCESS DOORS TO BE MINIMUM 610x610mm UNLESS OTHERWISE NOTED.
6. ALL CUTTING AND PATCHING SHALL BE COORDINATED WITH THE GENERAL CONTRACTOR.
7. ACCESS TO PLUMBING VIA LEVELS 3 TO BE SCHEDULED WITH PROJECT COORDINATOR PRIOR TO MOBILIZATION.
8. COORDINATE ROUTING OF ALL NEW PIPING TO AVOID INTERFERENCE WITH EQUIPMENT PRIOR TO INSTALLATION. IF INTERFERENCE FOUND RELOCATE PIPING TO SUIT.
9. ALL NEW WASTE PIPING TO RUN IN CEILING SPACE OF LEVEL 3.
10. ALL NEW VENT PIPING TO RUN IN CEILING SPACE OF LEVEL 4.

NEW NOTES: #

1. NEW SINK - SINGLE COMPARTMENT, SELF RIMMING SINK, WITH CENTER BACK WASTE LOCATION, CRUMB CUP STRAINER, THREE FAUCET HOLES, STAINLESS STEEL TAILPIECE, AND FASTENERS.
 - 1.1. COLOUR: 18 GAUGE SATIN-FINISHED STAINLESS STEEL
 - 1.2. DIMENSIONS: 18-13/16" x 18-1/8" OVERALL DIMENSIONS
 - 1.3. ACCEPTABLE PRODUCT: FRANKE COMMERCIAL SYSTEMS MODEL LBS4607/316P-1/3, OR APPROVED EQUAL.
2. SUPPLY AND INSTALL NEW WASTE DRAIN PIPING AS SHOWN. PROVIDE ALL WYE'S, VALVES, AND ASSOCIATED COMPONENTS AS REQUIRED.
3. ALL NEW WASTE DRAIN PIPING TO BE FED BACK TO 76mm WASTE STACK.
4. SUPPLY AND INSTALL NEW VENT PIPING AS SHOWN. PROVIDE ALL WYE'S, VALVES, AND ASSOCIATED COMPONENTS AS REQUIRED.
5. ALL NEW VENT PIPING TO BE FED BACK TO 76mm WASTE DRAIN AND VENT STACK.

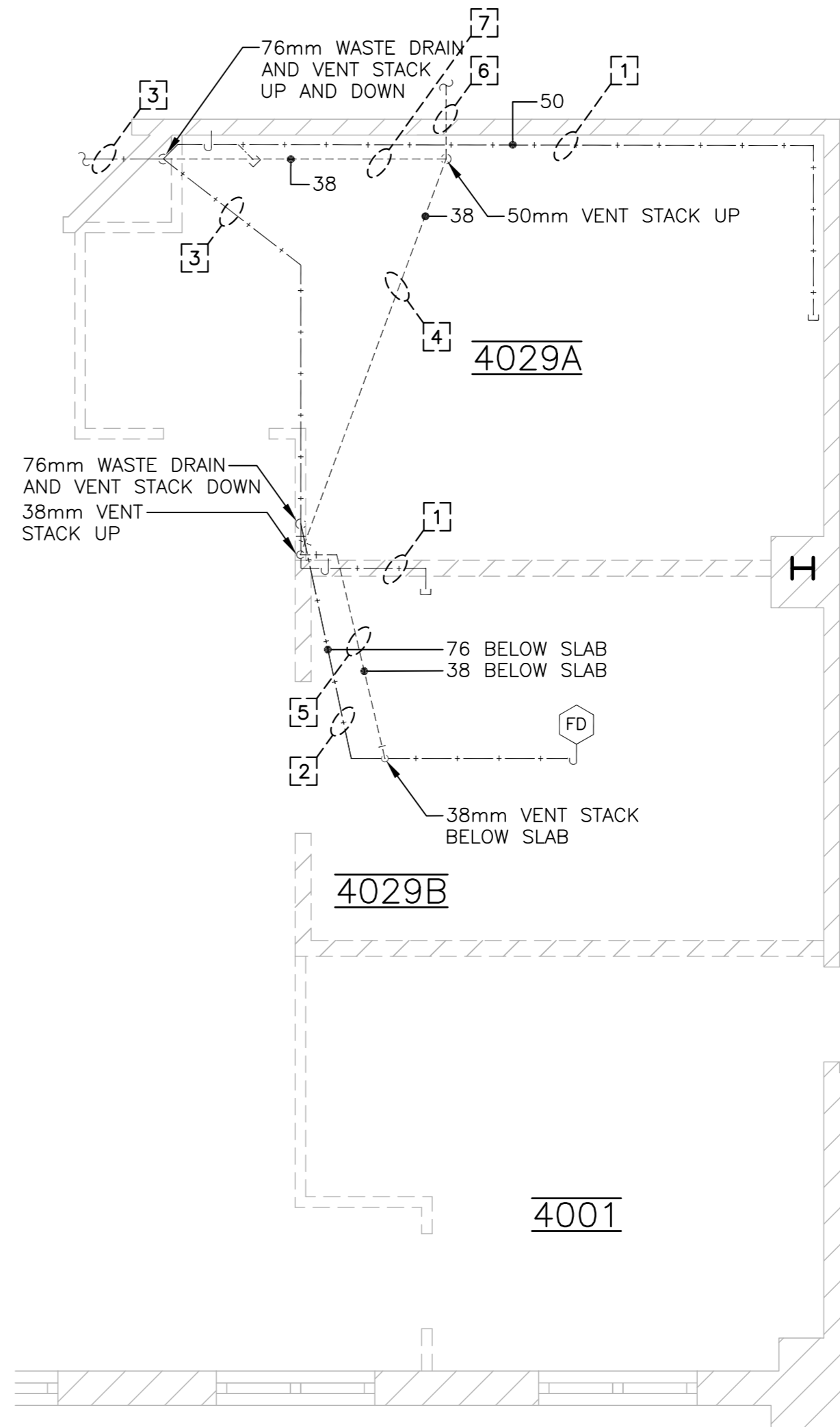
DEMOLITION NOTES: #

1. REMOVE AND DISPOSE OF EXISTING WASTE DRAIN PIPING BACK TO EXISTING 76mm WASTE STACK. EXISTING WYE'S TO BE CAPPED.
2. REMOVE AND DISPOSE OF EXISTING FLOOR DRAIN AND WASTE DRAIN PIPING.
3. EXISTING WASTE DRAIN PIPING TO REMAIN.
4. REMOVE AND DISPOSE OF EXISTING VENT PIPING BACK TO EXISTING 50mm VENT STACK. EXISTING WYE'S TO BE CAPPED.
5. REMOVE AND DISPOSE OF EXISTING VENT PIPING AND STACK AS INDICATED.
6. REMOVE AND REPLACE PORTION OF DAMAGED VENT PIPING AS SHOWN.
7. EXISTING VENT PIPING TO REMAIN.
8. PLUMBING LOCATED ABOVE SLAB UNLESS OTHERWISE NOTED.



NEW WASTE AND VENT PLUMBING PLAN
SCALE: 1:50

2
MP-1.0



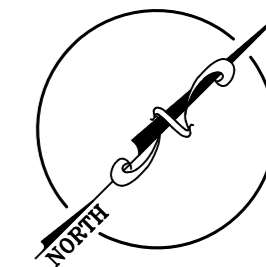
DEMOLITION WASTE AND VENT PLUMBING PLAN
SCALE: 1:50

1
MP-1.0

No.	REVISION	DATE
RO	ISSUED FOR TENDER	MARCH 1, 2024

GENERAL NOTES

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PROJECT NAME:
ENGINEERING BUILDING RENOVATIONS TO EN-4029
 Project #: EN-123-21

DRAWING TITLE:
DEMOLITION & NEW WASTE & VENT PLUMBING PLANS

REVIEWED: M.F.	DRAWN: E.B.
SCALE: AS SHOWN	DATE: MARCH, 2024
MUN PROJECT No. EN-123-21	DRAWING No. MP-1.0

